Nursing Home Staffing Study

Comprehensive Report

June, 2023

About This Report

This comprehensive report summarizes results from the Nursing Home Staffing Study activities between May and December of 2022 and presents options for minimum nurse staffing requirements for consideration by the Centers for Medicare & Medicaid Services.

Prepared For:

Centers for Medicare & Medicaid Services
7500 Security Blvd. Baltimore, MD 21244

Prepared By:

Primary Authors

Alan J. White, Principal Investigator
Lauren E.W. Olsho

Section Lead Authors

Allison J. Muma, Project Director
Nora Connor
Sara Galantowicz
Meghan Hendricksen
Catherine Hersey
Matthew T. Knowles
Qing Zheng

Supporting Authors

Sameer Desale
Marschall Furman
Isaiah Gerber
Morris Hamilton
Jenna Harder
Charles Harpole
Kristin Heck
Eric Hedberg
Jared Hite
Charlotte Lloyd
Sarah Miner
Farnaz Nojavan
Christianna Williams
Li Zhang
Pearl Zheng

This project was funded by the Centers for Medicare & Medicaid Services under contract GS-00F-252CA, Task Order 75FCMC18F0064. The statements contained in this report are solely those of the authors and do not necessarily reflect the views or policies of the Centers for Medicare & Medicaid Services. Abt Associates assumes responsibility for the accuracy and completeness of the information contained in this report.

Acknowledgements

The Staffing Study team is grateful to the more than 360 nursing home staff, residents, and family members interviewed and the 684 stakeholder listening session attendees for sharing their experiences and insights. The Staffing Study team also appreciates the licensed nurse staff and nursing homes that allowed observation of more than 8,000 instances of clinical care. Collectively, their participation informed key themes around the benefits of full staffing, impacts of understaffing, and staffing challenges/constraints, and it allowed assessment of the time needed to provide common clinical care. This rich evidence provides critical context for the quantitative work and for a comprehensive understanding of feasibility and quality implications of potential minimum staffing requirements.

Abt Associates | 6130 Executive Boulevard | Rockville, MD 20852

CONTENTS

List of Exhibits

Executive Summary

Key Takeaways

- The predicted percentage of nursing homes exceeding minimally acceptable quality and safety thresholds would increase between 1 percentage point and nearly 8 percentage points across four potential minimum staffing requirement options ranging from low (below the current median) to high total nurse staffing.
- Simulation modeling results show that the percentage of delayed or omitted clinical care decreases appreciably with increased licensed nurse (RN, LPN) staffing levels.
- While a recent minimum staffing requirement implemented in one state demonstrated increased staffing in response to the requirement, nursing home staff reported multiple potential challenges, including workforce shortages, to implementing a federal requirement.
- Study findings indicate that total costs of additional staffing to meet a minimum staffing requirement range from $1.5 to $6.8 billion depending on the structure and option.

In February 2022, the Biden Administration announced a set of nursing home initiatives intended to "improve the safety and quality of nursing home care, hold nursing homes accountable for the care they provide, and make the quality of care and facility ownership more transparent so that potential residents and their loved ones can make informed decisions about care" [1].

Historically, quality and safety vary appreciably across U.S. nursing homes, as reflected in publicly reported Centers for Medicare & Medicaid Services (CMS) quality measures [2]. The landmark report of the Institute of Medicine's Committee on the Adequacy of Nurse Staffing in Hospitals and Nursing Homes in 1996 found that nurse staffing levels are a "critical factor" in determining nursing home quality of care [3]. Subsequent research continues to demonstrate that nursing homes with higher staff-to-resident ratios provide better care [4-10]. Nursing homes with higher staffing levels have also had greater success in addressing the COVID-19 pandemic [11-12]. Among President Biden's initiatives is establishing minimum staffing requirements for nursing homes, to ensure that "every nursing home provides a sufficient number of staff who are adequately trained to provide high-quality care" [1]. A minimum staffing requirement also aims to provide staff the support they need to care for residents.

Staffing Study

In response to the White House call for action, CMS contracted with Abt Associates to conduct a mixed-methods Nursing Home Staffing Study as part of CMS's multi-faceted approach to identify a minimum staffing requirement. The Staffing Study's focus is on the level and type of staffing needed to promote acceptable quality and safety, so that residents are not at substantially increased risk of not receiving the safe and quality care they deserve. The study also explores potential implications for feasibility of increased staffing and costs to nursing homes. The Staffing Study was primarily conducted between May and December 2022, with some additional analytic work completed in 2023.

Methods and Data

The goal of the Staffing Study is to identify a range of options to inform the development of CMS's minimum staffing requirements, to promote quality and safe care for more than 1.1 million nursing home residents nationwide. The Nursing Home Staffing Study components illustrated in **Exhibit ES.1** comprise a mixed-methods approach that characterized expected quality and safety outcomes as well as feasibility and costs across a range of minimum nurse staffing (registered nurse [RN], licensed practical/vocational nurse [LPN], and nurse aide) requirement options.

Exhibit ES.1: Nursing Home Staffing Study Components

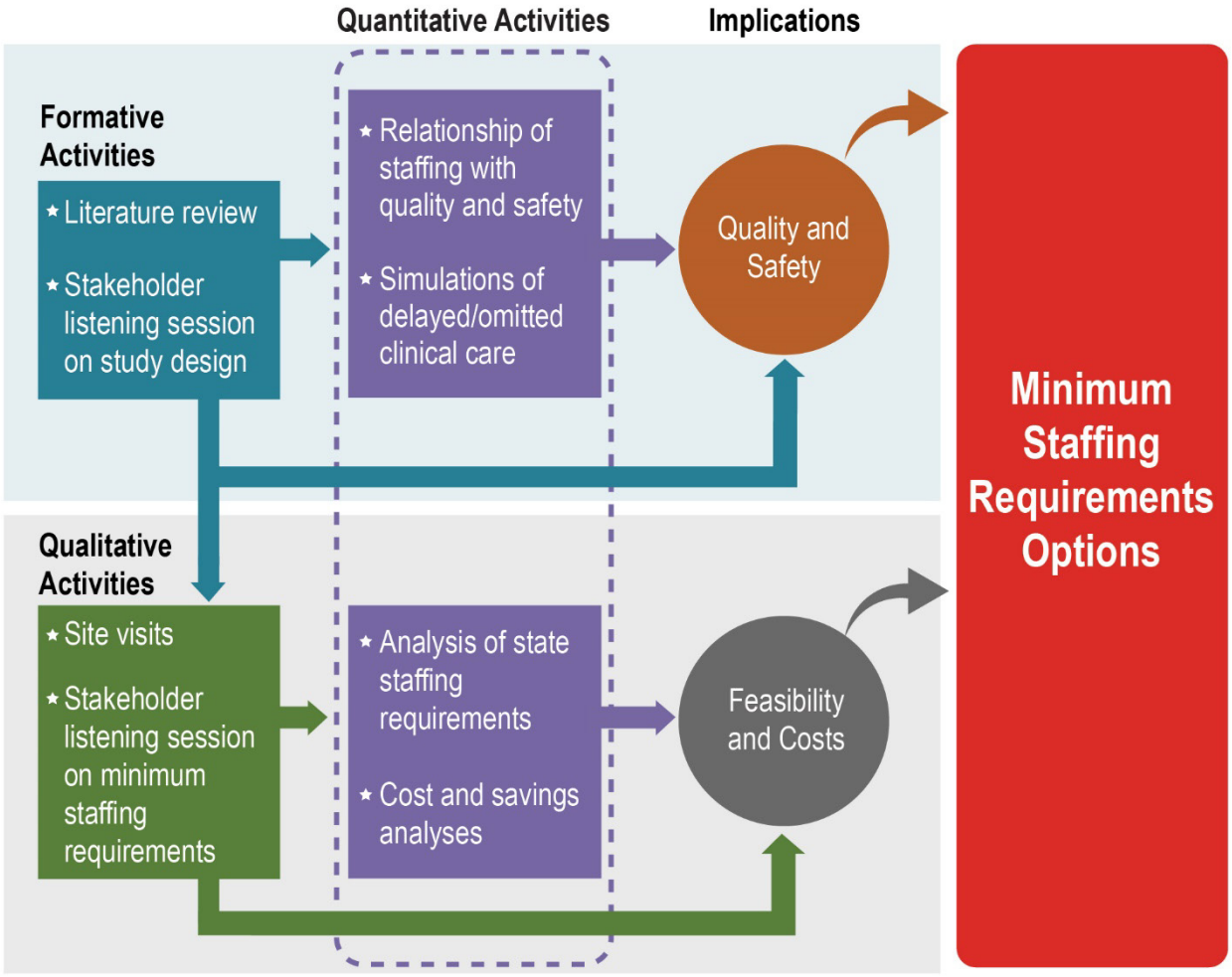


Exhibit ES.2 provides additional detail on data sources and purpose for each study component.

Exhibit ES.2: Staffing Study Data Sources and Purpose, by Study Component

Study Component	Data Sources	Purpose
Formative Activities		
Literature review	• Peer-reviewed articles and informally published ("gray") literature	Summarize evidence on the relationship between staffing and quality, current state and federal standards for nurse staffing, the role of different nurse types (i.e., RNs, LPNs, nurse aides) in nursing home safety and quality, and the costs associated with nurse staffing in nursing homes and with implementing minimum nurse staffing requirements.
Stakeholder listening session on study design (June 2022)	• Listening session attended by 16 invited stakeholders	Gather feedback from professionals with expertise in nursing home staffing and policies on the Staffing Study design.
Qualitative Activities		
Site visits (September–November 2022)	• Interviews with >360 nursing home staff, residents, and family members in 31 nursing homes • Missed Nursing Care (MISSCARE) surveys completed by ~170 nursing home staff	Provide qualitative, contextual information through primary data collected on the importance of adequate staffing, potential barriers to increased staffing levels, ways that nursing home staffing relates to quality, recommended staffing ratios, and potential unintended consequences associated with a minimum staffing requirement.
Stakeholder listening session on minimum staffing requirement (August 2022)	• Listening session attended by 668 individual stakeholders	Gather feedback from providers, advocates, associations, and others about benefits and challenges of a minimum staffing requirement.
Quantitative Activities		
Relationship of staffing with quality and safety	• Payroll Based Journal (PBJ) system • Nursing Home Care Compare quality and safety measures	Develop staffing measures (nurse hours per resident day) and measures of nursing home quality and patient safety; estimate relationships between nurse staffing levels and probability of exceeding different thresholds of acceptable care quality and safety for different staffing levels. Also, to model predicted improvements in quality and safety associated with potential federal minimum staffing requirement options.
Simulations of delayed/omitted clinical care	• >8,000 timed observations of common clinical tasks in 20 nursing homes • Minimum Data Set (MDS) • PBJ system • Regulatory analysis • Expert consultation on simulation approaches	Simulate the impact of different licensed nurse staffing levels on delayed and omitted clinical care at different resident acuity levels. Also, to model predicted reductions in delayed and omitted clinical care associated with potential federal minimum staffing requirement options.
Analysis of state staffing requirements	• PBJ system • Certification and Survey Provider Enhanced Reports (CASPER) system • Nursing Home Care Compare quality and safety measures	Identify states with recent changes in minimum nurse staffing requirements; use synthetic control[1] methods to estimate the impact of a new state-level minimum nurse staffing requirement in Massachusetts on staffing levels and quality and safety.

[1] Synthetic control is a statistical method for estimating the causal effect of an intervention on a single entity or group of entities compared to those not part of the intervention. It combines outcomes for all those not part of the intervention to represent the expected experience if there were no intervention.

Study Component	Data Sources	Purpose
Cost and savings analyses	• Medicare's Skilled Nursing Facility Cost Report data set • Nursing Home Care Compare nursing home-level characteristics and claims-based quality measures	Estimate the costs to nursing homes associated with increases in staffing levels or changes to the mix of staff under potential minimum staffing requirement options; estimate potential savings to Medicare from reduced hospitalizations and emergency department visits and increased numbers of discharges into the community.

Key Findings

Below are key findings from the Staffing Study.

- Nurse staffing levels vary considerably across nursing homes nationwide, and by nursing home characteristics such as location, size, and profit status. Federal regulations require nurse staff availability 24 hours a day, but do not specify a minimum staffing level. Thirty-eight states and the District of Columbia have a minimum staffing requirement.
- Recent literature underscores the relationship between nursing home staffing and quality outcomes, such as reduced pressure ulcers, emergency department visits, rehospitalizations, and outbreaks and deaths related to COVID-19. However, it does not provide a clear evidence basis for setting a minimum staffing level.
- Nursing home staff, residents, and family members report that quality of life, quality of care, and resident safety are adversely affected when nursing homes are short staffed. Personal hygiene, especially bathing, and mealtimes are often affected. Short staffing also affects staff physical and mental health.
- Multivariate models show that quality and safety, as measured using claims, resident assessments, and health inspection data, increase with staffing levels, with no obvious plateau at which quality and safety are maximized or "cliff" below which quality and safety steeply decline.
- The relationship of staffing with quality and safety varies by staff type. Quality and safety consistently increase with RN staffing levels but only at the highest levels of nurse aide staffing. There is no consistent relationship of quality and safety with LPN staffing. There is a negative correlation between LPN and RN staffing, indicating that nursing homes with higher LPN staffing levels tend to have lower RN staffing levels.
- Multivariate models examined how the probability of exceeding quality and safety thresholds varied with nurse staffing levels, after accounting for differences in other nursing home characteristics. The Study Team established thresholds based on performance measures from the October 2022 Nursing Home Care Compare update. Quality thresholds were based on total quality measure performance (50th and 25th percentiles), and safety thresholds were based on within-state health inspection performance (50th and 25th percentiles). Based on observed associations from these models, the predicted percentage of nursing homes exceeding the current 25th (lowest quartile) or 50th (median) quality and safety performance percentiles would increase between 1 percentage point (~ 100 nursing homes) and nearly 8 percentage points (~1,200 nursing homes) across four potential minimum staffing requirement options ranging from low (below the current median) to high total nurse staffing.
- Simulation models indicate the percentage of clinical care either delayed or omitted decreases with greater licensed nurse (RN and LPN) staffing levels, falling below 10 percent at approximately 1.0 hour per resident day (HPRD) and approaching zero at approximately 1.4 HPRD. In combination with previous findings from the literature [13], this implies that a total nurse (RN, LPN, nurse aide) staffing level between 3.8 HPRD and 4.6 HPRD would be adequate to keep rates of both omitted activities of daily living care and omitted clinical care below 10 percent.

- A state-level minimum staffing requirement introduced in Massachusetts in 2020 penalizes its nursing homes with total nurse staffing below 3.58 HPRD with a 2 percent reduction in their quarterly Medicaid payments. This requirement increased staffing levels among low-staffed nursing homes with high Medicaid resident shares, with the effect most pronounced for nurse aides. However, the impacts of the requirement on quality and safety were not statistically significant. This may be related to findings in previous literature suggesting that modest increases in nurse aide staffing do not affect quality and safety. For safety outcomes, the lack of significant findings could also be related to data issues in health inspection measures. Specifically, as of December 2021, more than one-third of nursing homes did not have updated health inspection data since the beginning of the COVID-19 public health emergency (PHE) and the policy change.
- The estimated minimum savings to the Medicare program specific to decreased use of acute care services and increased community discharges range from $187 to $465 million. There are many additional potential benefits that cannot be easily costed out because of data and time limitations, including those related to other clinical outcomes, out-of-pocket savings for residents, and improved resident quality of life.
- Nursing home staff and leadership report that nursing homes are currently very challenged in hiring and retaining direct care workers, because of workforce shortages and competition from higher-paying agency positions.
- Some stakeholders noted concerns about the lack of adequate current staffing to meet resident needs, while others raised workforce and cost considerations that could affect the feasibility of increased staffing. Many suggested considering resident acuity in setting a minimum requirement. Some stakeholders specifically highlighted the importance of staff training and skills.
- The total costs of additional staffing to meet a minimum staffing requirement range from $1.5 to $6.8 billion for the four potential minimum staffing requirement options presented in this report, and vary with the structure of the minimum requirement. Requirements structured to allow nursing homes flexibility to substitute across staff types to meet the requirement are generally less costly than requirements that do not allow for such substitution.

Minimum Staffing Requirement Options

Exhibit ES.3 presents four options: *Low, Medium, Higher, Highest*, based on collective Staffing Study findings, for CMS consideration as minimum staffing requirements to help ensure nursing home residents experience acceptable levels of care quality and safety.

Minimum staffing requirement options are expressed in terms of HPRD for RNs, licensed nurses (RNs, LPNs), and total nurse staff (RNs, LPNs, nurse aides). Including a total licensed nurse staffing threshold in a requirement would ensure adequate levels of licensed nurse staffing for timely completion of key clinical care tasks while allowing nursing homes flexibility to substitute RNs for LPNs. Similarly, a total nurse staff requirement would ensure adequate overall staffing levels to meet clinical and activities of daily living (ADL) tasks while allowing nursing homes discretion in determining the staffing mix most appropriate for their population. The options were informed by a set of regression models that examined relationships between staffing deciles and nursing home quality and safety. Instead of continuous or more granular staffing levels, the study used staffing deciles in these models to ensure adequate sample size in each staffing category and to facilitate interpretation.

For each minimum staffing requirement option, the exhibit presents associated implications in feasibility, cost, and potential improvements in quality and safety based on Staffing Study findings. The options presented are specific HPRD levels based on the decile start point for total nurse and RN staffing, rather than the full decile ranges that were used in the regression models, to show the *minimum* staffing levels associated with potential quality and safety improvements. As a point of comparison, the table also

includes metrics associated with the *status quo* (no federal minimum staffing requirement). Staffing Study findings imply that anticipated benefits of a minimum staffing requirement threshold lower than the options presented in **Exhibit ES.3** would be minimal.

As shown in **Exhibit ES.3**, as minimum required nurse staff HPRD increase, there is a corresponding increase in potential quality and safety improvements, and a decrease in expected delayed and omitted care. Projected savings also increase with higher nursing staff HPRD, as do additional staffing costs. For example, moving from the *Low* (3.30 total nurse staff HPRD) to *Highest* (3.88 nurse staff HPRD) nurse staff HPRD is associated with a 6-percentage point increase in the percentage of nursing homes predicted to exceed median quality levels. With an increase in licensed nurse (RN and LPN) staffing from 1.15 to 1.43 HPRD, omitted and delayed care is predicted to drop from over 3 percent to less than 1 percent. Moving from the *Low* to *Highest* minimum staffing requirement option there is an increase of at least $278 million in projected Medicare savings, and an estimated $3.8 billion increase in staffing costs.

Exhibit ES.3: Cost, Quality, and Safety Implications of Four Minimum Nurse Staffing Requirement Options

Minimum Staffing Requirement Scenario	Metrics						
	% NHs Needing To Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]	Minimum Projected Quantifiable Medicare Savings[6]	Predicted Delayed/ Omitted Care[7]	
Four Minimum Staffing Hours per Resident Day (HPRD) Requirement Threshold Options							**Contextual Evidence**
Low: • 3.30 total nurse staff HPRD[8] • 1.15 licensed nurse HPRD,[9] including at least 0.45 RN HPRD	43%	$1.5 billion/ year	Above lowest quartile: 76% Above median: 50%	Above lowest quartile: 77% Above median: 51%	$187 million/year from ~5,800 fewer hospitalizations ~4,500 fewer ED visits ~4,000 more community discharges	3.3% delayed care 0.04% omitted care	• Past literature has established strong evidence for a relationship between staffing and quality but has not identified a minimum staffing level to ensure safe and quality care. • Nurse staff types play different roles within nursing homes and so can influence different dimensions of quality and safety. • Analysis of a minimum total staffing requirement that Massachusetts introduced in 2020 found that staffing levels increased, driven by an increase in nurse aides. However, the impact on quality and safety was not significant. • Nursing home staff, residents, and family members reported many benefits to increased staffing, including better resident clinical and ADL care, improved resident quality of life, and decreased physical and mental burden on staff. • Not all Medicare savings can be readily quantified, including those related to better clinical care and improved quality of life. • Nursing staff reported they could provide more person-centered care when they supported fewer residents. • Resident personal hygiene including showers, meals, and timely response to call lights are adversely affected by low staffing. • Nursing homes face many barriers to hiring, primarily workforce shortages and competition from staffing agencies. • Stakeholders recommended CMS consider resident acuity when setting requirements; they also noted the importance of adequate training and workforce and reimbursement barriers to meeting a requirement.
Medium: • 3.48 total nurse staff HPRD[8] • 1.23 licensed nurse HPRD,[9] including at least 0.52 RN HPRD	55%	$2.4 billion/ year	Above lowest quartile: 76% Above median: 49%	Above lowest quartile: 76% Above median: 51%	$318 million/year from ~10,400 fewer hospitalizations ~7,500 fewer ED visits ~5,800 more community discharges	2.3% delayed care 0.02% omitted care	
Higher: • 3.67 total nurse staff HPRD[8] • 1.32 licensed nurse HPRD,[9] including at least 0.60 RN HPRD	66%	$3.6 billion/ year	Above lowest quartile: 80% Above median: 54%	Above lowest quartile: 77% Above median: 53%	$410 million/year from ~11,000 fewer hospitalizations ~13,800 fewer ED visits ~10,000 more community discharges	1.4% delayed care 0.01% omitted care	
Highest: • 3.88 total nurse staff HPRD[8] • 1.43 licensed nurse HPRD,[9] including at least 0.70 RN HPRD	76%	$5.3 billion/ year	Above lowest quartile: 80% Above median: 56%	Above lowest quartile: 78% Above median: 53%	$465 million/year from ~12,100 fewer hospitalizations ~14,800 fewer ED visits ~12,000 more community discharges	0.6% delayed care 0.002% omitted care	

Minimum Staffing Requirement Scenario	Metrics						
	% NHs Needing To Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]	Minimum Projected Quantifiable Medicare Savings[6]	Predicted Delayed/ Omitted Care[7]	
Status Quo							**Current State**
No federal minimum staffing requirement[10]	0%	$0	Above lowest quartile:[11] 74% Above median:[11] 49%	Above lowest quartile: 75% Above median: 50%	$0	5.6% delayed care 0.4% omitted care	• There was support for a minimum staffing requirement in qualitative interviews and stakeholder listening sessions. • Nursing home staff, residents, and family members reported quality and safety risks when nursing homes are understaffed. • Nursing homes are experiencing challenges to filling existing staffing vacancies. • 38 states already have some type of minimum staffing requirement.

Abbreviations: ADL = activities of daily living, CMS = Centers for Medicare & Medicaid Services, ED = emergency department, HPRD = hours per 24-hour resident day, LPN = licensed practical nurse/licensed vocational nurse, NH = nursing home, QM = quality measure, RN = registered nurse

Notes:

[1] Calculated as the percentage of nursing homes below specified staffing levels in the second quarter of 2021 as reported on the October 2021 Nursing Home Care Compare update.

[2] Staffing costs include estimated wage and benefit costs for increasing staffing to the required levels and assume nursing homes currently above required staffing levels will not change staffing.

[3] Percentages indicate adjusted percentage of nursing homes above the current lowest quartile and median thresholds based on predicted probabilities from logistic regression models with nurse staffing deciles as the key predictors. Models are adjusted for measures of facility characteristics including ownership type (non-profit, government, or for-profit); size (number of certified beds); whether the nursing home is hospital-based; Medicaid quartile; whether the nursing home is in a rural location; whether the nursing home is part of a continuing care retirement community; and for nursing home quality outcomes, whether the nursing home is a Special Focus Facility or a Special Focus Facility candidate.

[4] Quality measure median and lowest quartile thresholds are based on total QM scores (50^{th} and 25^{th} percentiles) from the October 2022 Nursing Home Care Compare update.

[5] Safety median and lowest quartile thresholds are based on within-state health inspection scores (50^{th} and 25^{th} percentiles) from the October 2022 Nursing Home Care Compare update.

[6] Savings include estimated cost savings to Medicare from prevented hospitalizations and emergency department visits and increased community discharges, and are based on savings from the RN staffing requirement for the decile just above the RN requirement threshold.

[7] Predicted percentages are the percentage of resident care events that are delayed or omitted based on interpolated values from simulations of licensed nurses (RNs, LPNs) in an average-sized facility providing core clinical tasks to a resident population with acuity mix similar to the national median in the Minimum Data Set. Care is considered delayed if it occurs within 2 hours of need and omitted if it occurs more than 2 hours from the need.

[8] Total minimum staffing requirement includes combined HPRD for RNs, LPNs, and nurse aides.

[9] Licensed nurse minimum staffing requirement includes combined HPRD for RNs and LPNs.

[10] Median staffing levels in U.S. nursing homes based on CMS Payroll Based Journal system (2022Q2) data are currently 3.61 total nurse staff HPRD, 1.45 licensed nurse HPRD, and 0.56 RN HPRD.

[11] The estimated percentages of nursing homes above lowest quartile and median under the status quo scenario (no federal minimum staffing requirement) deviate from expected values of 75% and 50% because of inclusion of predicted values for nursing homes with complete data on covariates but missing values for the outcome measure (total QM score or within-state health inspection score).

The Study Team also examined the cost, quality, and safety implications of minimum staffing requirements at equivalent staffing levels as for requirements presented in **Exhibit ES.3**, but not allowing substitution across staff types. Specifically, the Study Team considered separate requirements including RNs and nurse aides only (two-requirement structure), as well as separate requirements for RNs, LPNs, nurse aides, and total nurse staff (four-requirement structure). **Exhibit ES.4** shows predicted quality and safety and the estimated additional staffing costs for these two alternative staffing requirement structures.

Predicted quality and safety for these two alternatives is slightly higher than for the three-requirement structure described in **Exhibit ES.3** above. However, predicted quality and safety are similar across the two- and four-requirement structures, since LPN staffing levels were not statistically associated with the probability of exceeding minimum quality and safety thresholds in Staffing Study multivariate models.

The cost of the four-requirement structure is higher than for the two-requirement structure, since more nursing homes would need to add staff to comply. Under the two-requirement structure the implied total nurse staffing required level would be low (e.g., 2.77 HPRD for the *Medium* option, which is below the 3rd decile of total nurse staffing) if nursing homes only staffed to the specified requirements.

Exhibit ES.4: Cost, Quality, and Safety Implications: Two- vs. Four-Nurse Staffing Requirement Structures

Option	Two Requirements (RNs, Nurse Aides)					Four Requirements (Total Nurse Staff, RNs, LPNs, Nurse Aides)				
	Minimum Staffing Requirement (HPRD)	% NHs Needing to Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]	Minimum Staffing Requirement (HPRD)	% NHs Needing to Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]
Low	• 0.45 RN • 2.15 nurse aide	59%	$2.2 billion/year	Above lowest quartile: 78% Above median: 52%	Above lowest quartile: 77% Above median: 52%	• 3.30 total nurse staff • 0.45 RN • 0.70 LPN[6] • 2.15 nurse aide	73%	$2.9 billion/ year	Above lowest quartile: 78% Above median: 52%	Above lowest quartile: 77% Above median: 52%
Medium	• 0.52 RN • 2.25 nurse aide	68%	$3.1 billion/year	Above lowest quartile: 78% Above median: 52%	Above lowest quartile: 77% Above median: 52%	• 3.48 total nurse staff • 0.52 RN • 0.71 LPN[6] • 2.25 nurse aide	80%	$3.9 billion/ year	Above lowest quartile: 79% Above median: 52%	Above lowest quartile: 78% Above median: 52%
Higher	• 0.60 RN • 2.35 nurse aide	75%	$4.3 billion/year	Above lowest quartile: 79% Above median: 56%	Above lowest quartile: 79% Above median: 54%	• 3.67 total nurse staff • 0.60 RN • 0.72 LPN[6] • 2.35 nurse aide	85%	$5.1 billion/ year	Above lowest quartile: 80% Above median: 56%	Above lowest quartile: 79% Above median: 54%
Highest	• 0.70 RN • 2.45 nurse aide	82%	$6.0 billion/year	Above lowest quartile: 81% Above median: 57%	Above lowest quartile: 77% Above median: 53%	• 3.88 total nurse staff • 0.70 RN • 0.73 LPN[6] • 2.45 nurse aide	90%	$6.8 billion/ year	Above lowest quartile: 82% Above median: 57%	Above lowest quartile: 78% Above median: 53%

Abbreviations: HPRD = hours per 24-hour resident day, LPN = licensed practical nurse/licensed vocational nurse, NH = nursing home, QM = quality measure, RN = registered nurse

[1] Calculated as the percentage of nursing homes below specified staffing levels in the second quarter of 2021 as reported on the October 2021 Nursing Home Care Compare update.

[2] Staffing costs include estimated wage and benefit costs for increasing staffing to the required levels and assume nursing homes currently above required staffing levels will not change staffing.

[3] Percentages indicate adjusted percentage of nursing homes above the current lowest quartile and median thresholds based on predicted probabilities from logistic regression models with nurse staffing deciles as the key predictors. Models are adjusted for measures of facility characteristics including ownership type (non-profit, government, or for-profit); size (number of certified beds); whether the nursing home is hospital-based; Medicaid quartile; whether the nursing home is in a rural location; whether the nursing home is part of a continuing care retirement community; and for nursing home quality outcomes, whether the nursing home is a Special Focus Facility or a Special Focus Facility candidate.

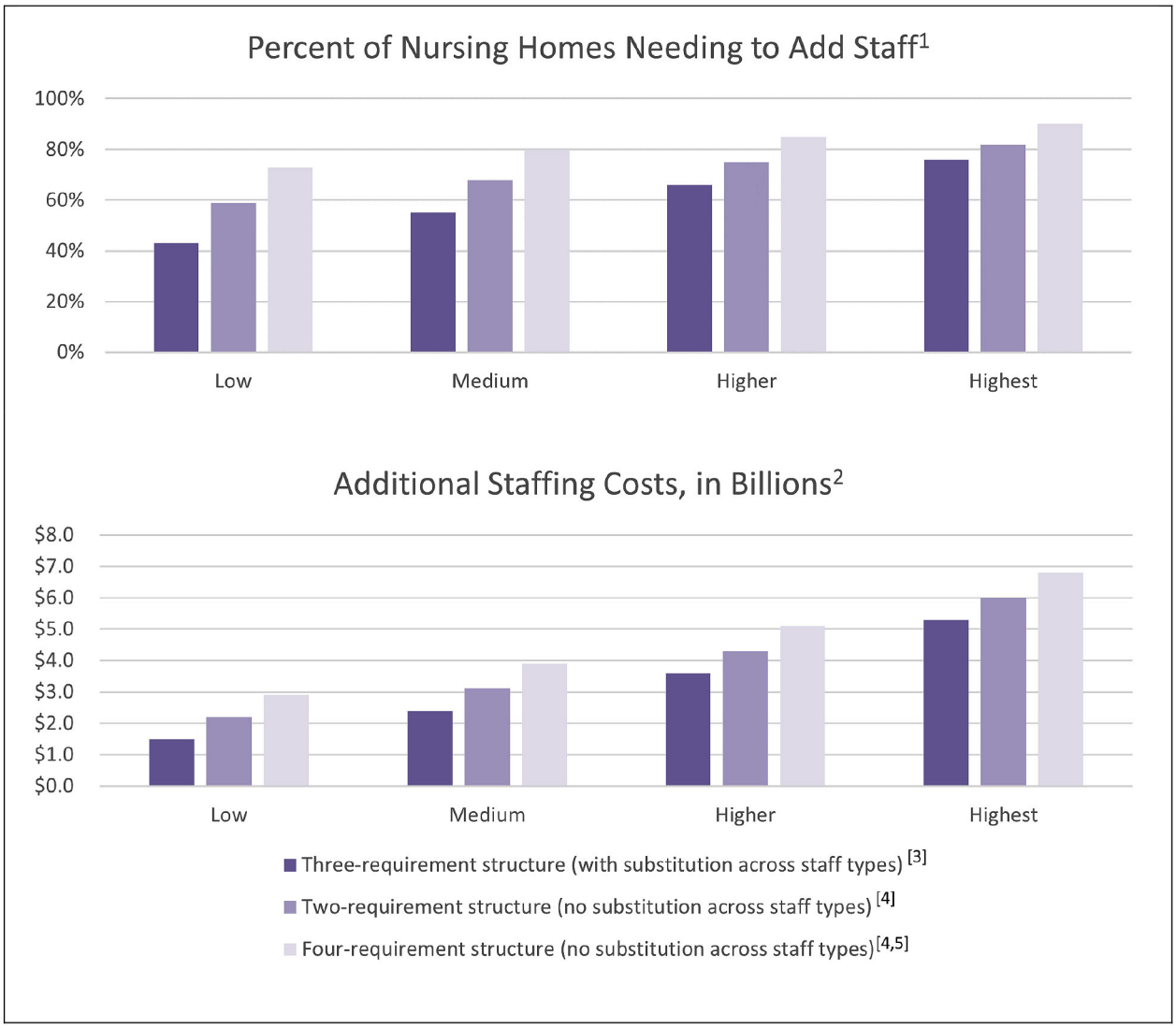
[4] Quality measure median and lowest quartile thresholds are based on total QM scores (50^{th} and 25^{th} percentiles) from the October 2022 Nursing Home Care Compare update.

[5] Safety median and lowest quartile thresholds are based on within-state health inspection scores (50th and 25th percentiles) from the October 2022 Nursing Home Care Compare update.

[6] Analyses found no significant relationship between LPN staffing levels and the probability of exceeding quality and safety thresholds after adjusting for RN and nurse aide staffing deciles.

Exhibit ES.5 compares the estimated costs to nursing homes and the percentage of nursing homes that would need to increase staffing across the three potential requirement structures considered above. This includes the three-requirement structure allowing substitution across staff types (RNs, licensed nurses, total nurse staff) and the two structures with identical RN and nurse aide HPRD requirements but not allowing substitution across staff types: a two-requirement structure (RNs and nurse aides only) and a four-requirement structure (total nurse staff, RNs, LPNs, nurse aides).

Exhibit ES.5: Estimated Percentage of Nursing Homes Needing To Add Staff and Estimated Additional Staffing Costs per Year to Meet Minimum Staffing Requirements



[1] Calculated as the percentage of nursing homes below specified staffing levels in the second quarter of 2021 as reported on the October 2021 Nursing Home Care Compare update.
[2] Staffing costs include estimated wage and benefit costs for increasing staffing to the required levels, and assume nursing homes currently above required staffing levels will not change staffing.
[3] Under three-requirement structure, nursing homes may substitute across RNs, LPNs, and nurse aides to meet aggregate requirements for licensed nursing and total nurse staffing.
[4] Nurse aide staffing levels under the two- and four-requirement structures are derived from the difference between the total nurse and licensed nurse minimums under the three-requirement structure (e.g., 3.30–1.15 for the *Low* option).
[5] LPN staffing levels under the four-requirement structure are derived from the difference between the licensed nurse and RN HPRD minimums under the three-requirement structure (e.g., 1.15–0.45 for the *Low* option).

Costs are higher under requirement structures not allowing substitution across staff types compared to among structures allowing substitution, because more nursing homes would need to increase staffing to meet separate requirements. By design, implicit licensed and total nurse staffing thresholds are the same under the two-, three-, and four-requirement structures, but costs differ. For example, a nursing home with 3.30 total nurse HPRD including 0.65 RN HPRD, 0.60 LPN HPRD, and 2.05 nurse aide HPRD would be compliant with the *Low* three-requirement structure, but would need to increase nurse aide staffing to meet the *Low* two-requirement structure, and would need to increase both LPN and nurse aide staffing to meet the *Low* four-requirement structure. Unless this nursing home concurrently reduced RN staffing levels, the needed increase in LPN and nurse aide staffing to meet the four-requirement structure would cause the nursing home to exceed total nurse staffing minimum requirements of 3.30 HPRD.

Successes and Challenges

The Staffing Study team successfully completed multiple data analytic tasks and collected large volumes of primary data over an active study period of approximately six months. Several challenges prevented the study team from completing site visits with 50 nursing homes by the first week of November 2022, as initially planned. These challenges include staffing shortages in sampled nursing homes, Hurricane Ian in Florida, and COVID-19 outbreaks affecting nursing homes that had site visits scheduled. However, there was strong consistency in themes in the interview data from the 31 nursing home visits the team was able to complete. The Staffing Study team continued to reach out to and recruit additional sites as a part of ongoing validation activities, and completed a total of 47 site visits by the end of December 2022.

Limitations

Several important study limitations should be acknowledged.

Data Limitations

The Payroll Based Journal (PBJ) system does not include staffing information by shift, which precluded examining the relationship of shift staffing levels with quality and safety. The majority of the PBJ data used in the Staffing Study were collected during the COVID-19 PHE. Quality measures used in this analysis were calculated at the nursing home level, such that the Staffing Study team was not able to examine within-facility differences for subgroups of nursing home residents. The study did not use an experimental or quasi-experimental design, so the study team was not able to establish a *causal* relationship of staffing with quality, safety, or Medicare cost savings at the national level.

However, the study team was able to analyze the impact of Massachusetts's new minimum staffing requirement using a quasi-experimental design with a synthetic control approach for constructing the comparison group. This allowed the estimation of plausible causal effects of this policy on staffing, quality of care, and safety outcomes. The Medicare cost reports for skilled nursing facilities are not audited, and not all nursing homes have cost reports. Potential Medicare and other cost savings analyses were limited to acute care utilization and community discharges, which may not represent all potential savings to Medicare. The simulation study did not collect data on resident characteristics; observational data collected to inform the simulation modeling were limited to high-quality nursing homes, such that findings might not generalize to lower-quality settings.

Time Limitations

This study was conducted on a compressed timeframe, with data collection and analysis included in this report primarily completed between June and December 2022. The short duration reflects the time-sensitive nature of the study and CMS's timeline for proposing a minimum staffing requirement in support of the Presidential initiative. The mixed-methods approach was intended to compensate for the limited timeframe, by offering a wide range of evidence for consideration in policy making.

Discussion

In the second quarter of 2022, the average nurse staffing level in U.S. nursing homes was 3.76 total nurse—RN, LPN, and nurse aide—hours per resident day. However, staffing levels vary considerably across nursing homes, with 10 percent of nursing homes with staffing levels at or below 2.79 nurse HPRD and 10 percent with levels above 4.88 HPRD. Lower-staffed nursing homes are more likely to be for-profit, larger, rural, and have a higher share of Medicaid residents. Nursing home residents and their care needs also vary within and across nursing homes. While the majority of states have implemented some type of minimum staffing requirement, state-level standards range widely [14-16]. This variation creates an opportunity for standardization through a new federal minimum requirement for nurse staffing HPRD.

Nursing homes currently staffing below levels specified by a new federal requirement would need to hire additional staff, and/or increase hours of existing staff, to comply with a minimum staffing requirement—and it is in these nursing homes that quality of care is expected to improve. The higher the minimum staffing requirement, the more nursing homes would need to increase staffing in response and, therefore, the larger the potential improvement in quality and safety [17]. However, if the minimum staffing requirement is set too high, nursing homes would face substantial cost and feasibility barriers in adding staff, particularly given the role of the COVID-19 public health emergency in amplifying existing nursing home workforce shortages [18-19]. Collectively, Staffing Study activities provide evidence both on potential minimum staffing requirement benefits and on potential barriers to and unintended consequences of implementation.

Both qualitative and quantitative findings from the Staffing Study indicated potential quality and safety benefits associated with increased nurse staffing. Nearly half of nurse staff interview respondents reported that their current assignment was not reasonable to provide quality and safe care now. Multivariate models indicate higher staffing is associated with a higher probability of meeting acceptable quality and safety thresholds. Predicted quality improvements would generate Medicare savings through reduced hospitalizations and emergency department visits and increased community discharges. Staffing Study simulation models indicate higher nurse staffing is associated with substantial reductions in delayed and omitted clinical care. The finding complements existing simulation evidence indicating that higher nurse aide staffing is associated with reductions in delayed and omitted activities of daily living care [13].

The different roles filled by staff can inform the design of a minimum requirement. Simulation findings in conjunction with analyses on the relationship of staffing with quality and safety suggest that a minimum staffing requirement should include a licensed nurse staffing requirement. The regression model results suggest that RN staffing among staff types has the strongest relationship with care quality and safety metrics. However, simulations imply that licensed nurse staffing needs exceed current RN staffing even among many higher-staffed nursing homes. Similarly, nurse aides provide more-direct support to residents, and respondents reported this activities of daily living support is often delayed or missed when staffing is short.

The Staffing Study team acknowledges that *quality* is a multi-dimensional construct; what is considered "high quality" can vary across observers and care recipients. The Staffing Study's quantitative analyses were limited to quality metrics for which there are extant secondary data or where it was possible to collect primary data within the brief study time period via direct observation. Staffing Study interviews with nursing home staff, residents, and families indicated perceived improvements in resident-centered care and resident quality of life associated with higher staffing levels, capturing dimensions of quality beyond what can be captured in existing quantitative data. Nurse staff could also benefit from increased staffing levels, as many staff interview respondents noted the adverse impact of short staffing on their physical and mental well-being. However, there are likely additional benefits to quality of care and life that cannot be fully identified through Staffing Study activities.

Staffing Study findings additionally provide evidence on the feasibility, potential barriers, and unintended consequences of implementing a minimum staffing requirement. For example, the impact analysis of the nursing home staffing policy in Massachusetts demonstrates that it is feasible to implement a new minimum staffing requirement, and, when this is coupled with a financial penalty, be successful in increasing staffing levels. However, stakeholders participating in listening sessions and nursing home staff interviewees emphasized that workforce shortages and current hiring challenges could present barriers to nursing home compliance with a new federal staffing requirement.

Moreover, the study team estimated that between 43 and 90 percent of nursing homes would need to increase staffing, relative to current levels, across the potential minimum staffing requirements considered in the study. However, the Staffing Study was not a workforce study, and so did not comprehensively address the feasibility of implementing a minimum staffing requirement and did not review national health care staffing shortages, health care workforce distribution, or access to health care training and education programs. Interview respondents shared several potential unintended consequences of a national minimum staffing requirement, such as that nursing homes might i) not be able to meet the required staffing levels; ii) reduce resident admissions to meet requirements; or iii) close down entirely, thus potentially reducing access to care.

Additional staffing costs, estimated to be billions of dollars, could be a parallel barrier to implementation. The structure of a potential federal minimum staffing requirement has important cost implications, with costs ranging from $1.5 billion to $5.3 billion for the four potential minimum staffing requirement thresholds under a three-requirement structure allowing substitution across staff types to meet aggregate requirements (requirements for RN, total licensed nurse, and total nurse staffing). Costs under a four-requirement structure not allowing substitution (separate requirements for RN, LPN, nurse aide, and total nurse staffing), for the same implicit minimum staffing requirement levels, range from $2.9 billion to $6.8 billion. A two-requirement structure not allowing substitution across staff types (separate requirements for RNs and nurse aides) is estimated to cost from $2.2 to $6.0 billion across the four options.

The Staffing Study findings provide CMS with options for setting a minimum staffing requirement, and illustrate the trade-offs of these policy options, balancing cost and feasibility with implications for quality and safety. Some of the benefits of increased staffing are hard to quantify, such as improved resident quality of life or decreased staff burnout. Selecting a lower requirement would likely achieve smaller gains in the quality and safety of resident care but would require fewer nursing homes to increase staffing levels. Conversely, selecting a higher requirement would be associated with larger potential gains in quality and safety and a greater reduction in direct care staff burden, if the requirement is successfully implemented, but implementation would be more costly and challenging, particularly in the face of nursing workforce shortages. Ultimately, the realized improvements in quality and safety will depend on nursing home success in increasing staffing levels to comply with minimum staffing requirements.

Notes

1. FACT SHEET: Protecting Seniors by Improving Safety and Quality of Care in the Nation's Nursing Homes. https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/28/fact-sheet-protecting-seniors-and-people-with-disabilities-by-improving-safety-and-quality-of-care-in-the-nations-nursing-homes/
2. See: https://www.medicare.gov/care-compare/?providerType=NursingHome&redirect=true
3. Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century.* The National Academies Press. https://doi.org/10.17226/10027
4. Harrington, C., Dellefield, M. E., Halifax, E., Fleming, M. L., & Bakerjian, D. (2020). Appropriate nurse staffing levels for US nursing homes. *Health Services Insights, 13,* 1–14. https://doi.org/10.1177/1178632920934785

5. Shin, J. H., & Bae, S.-H. (2012). Nurse staffing, quality of care, and quality of life in US nursing homes, 1996-2011: An integrative review. *Journal of Gerontological Nursing, 38*(12), 46–53.

6. Bostick, J. E., Rantz, M. J., Flesner, M. K., & Riggs, C. J. (2006). Systematic review of studies of staffing and quality in nursing homes. *Journal of the American Medical Directors Association, 7*(6), 366–376.

7. Spector, W. D., Limcangco, R., Williams, C. S., Rhodes, W., & Hurd, D. (2013). Potentially avoidable hospitalizations for elderly long-stay residents in nursing homes. *Medical Care, 51*(8), 673–681.

8. Grabowski, D. C., Stewart, K. A., Broderick, S. M., & Coots, L. A. (2008). Predictors of nursing home hospitalization: A review of the literature. *Medical Care Research and Review, 65*(1), 3–39.

9. Castle, N. G., Wagner L. M., Ferguson, J. C., & Handler, S. M. (2011). Nursing home deficiency citations for safety. *Journal of Aging & Social Policy, 23*(1), 34–57.

10. Harrington, C., Zimmerman, D., Karon, S. L., Robinson, J., & Beutel, P. (2000). Nursing home staffing and its relationship to deficiencies. *Journal of Gerontology Series B: Psychological Science and Social Science, 55*(5), S278–S287.

11. Williams, C. S., Zheng, Q., White, A. J., Bengtsson, A. I., Shulman, E. T., Herzer, K. R., & Fleisher, L. A. (2021). The association of nursing home quality ratings and spread of COVID-19. *Journal of the American Geriatrics Society, 69*(8), 2070–2078.

12. Gorges, R. J., & Konetzka, R. T. (2020). Staffing levels and COVID-19 cases and outbreaks in US nursing homes. *Journal of the American Geriatrics Society, 68*(11), 2462–2466. https://doi.org/10.1111/jgs.16787

13. Schnelle, J. F., Schroyer, L. D., Saraf, A. A., & Simmons, S. F. (2016). Determining nurse aide staffing requirements to provide care based on resident workload: A discrete event simulation model. *Journal of the American Medical Directors Association, 17*(11), 970–977. https://doi.org/10.1016/j.jamda.2016.08.006

14. Medicaid and CHIP Payment and Access Commission (MACPAC). (2022). Compendium: State policies related to nursing facility staffing. https://www.macpac.gov/publication/state-policies-related-to-nursing-facility-staffing/

15. Medicaid and CHIP Payment and Access Commission (MACPAC). (2022). *State policy levers to address nursing facility staffing issues.* https://www.macpac.gov/wp-content/uploads/2022/03/State-Policy-Levers-to-Address-Nursing-Facility-Staffing-Issues.pdf

16. Consumer Voice (The National Consumer Voice for Quality Long-Term Care). (2021). State nursing home staffing standards: Summary report. https://theconsumervoice.org/issues/other-issues-and-resources/staffing

17. Chen, M. M., & Grabowski, D. C. (2014). Intended and unintended consequences of minimum staffing standards for nursing homes. *Health Economics, 24*(7), 822–839.

18. Gasdaska, A., Segelman, M., Porter, K. A., Huber, B., Feng, Z., Barch, D., Squillace, M., Dey, J., & Oliveira, I. (2022). *Nursing home staffing disparities were exacerbated during the COVID-19 pandemic in 2020.* Research Brief. Office of Behavioral Health, Disability, and Aging Policy, Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services. https://aspe.hhs.gov/sites/default/files/documents/e37945b7d88efb005839a876660a59fb/nh-staffing-disparities-brief.pdf

19. AHCA/NCAL (American Health Care Association / National Center for Assisted Living). (2022). *BLS March 2022 jobs report.* https://www.ahcancal.org/News-and-Communications/Fact-Sheets/FactSheets/BLS-MARCH2022-JOBS-REPORT.pdf

1. Overview

In February 2022, the White House announced a set of nursing home initiatives intended to "improve the safety and quality of nursing home care, hold nursing homes accountable for the care they provide, and make the quality of care and facility ownership more transparent so that potential residents and their loved ones can make informed decisions about care." Among the initiatives are minimum staffing requirements for nursing homes to ensure that "every nursing home provides a sufficient number of staff who are adequately trained to provide high-quality care" (The White House, 2022).

In response to the White House call for action, the Centers for Medicare & Medicaid Services (CMS) contracted with Abt Associates to conduct a Nursing Home Staffing Study using a mixed-methods approach. The Staffing Study's focus is on the level and type of staffing needed to promote acceptable quality and safety, and potential implications for cost and feasibility. The Staffing Study was primarily conducted between May and December 2022, with some additional analytic work completed in 2023.

1.1 Nurse Staffing and Quality in Nursing Homes

The Institute of Medicine conceptualizes quality of care as a multi-dimensional construct encompassing patient safety, care effectiveness, patient-centeredness, timeliness, care efficiency, and equity (Institute of Medicine, 2001). The landmark report of its Committee on the Adequacy of Nurse Staffing in Hospitals and Nursing Homes in 1996 found that nurse staffing levels are a "critical factor" in determining the quality of care in nursing homes (Institute of Medicine, 1996).

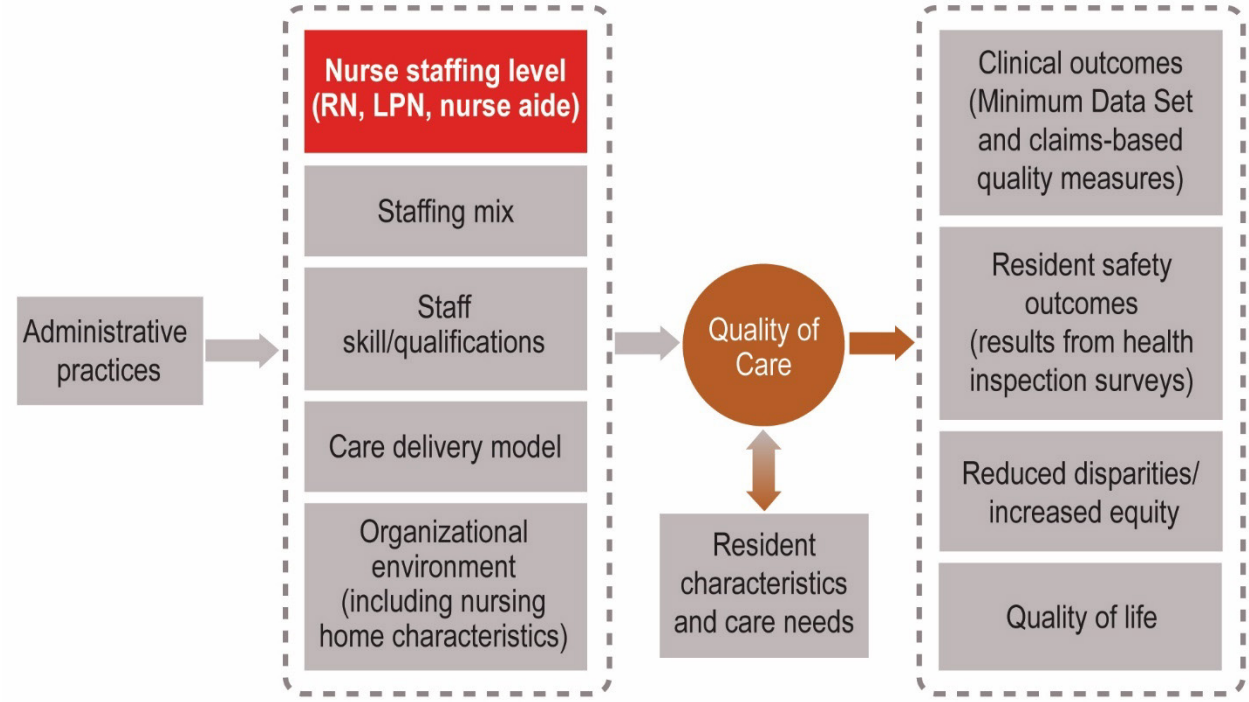
The 2001 Report to Congress *Appropriateness of Minimum Nurse Staffing Ratios in Nursing Homes* (Abt Associates, 2001), commonly referred to as the 2001 CMS Staffing Study, identified a set of evidence-based nursing home staffing levels that maximized quality of care. These thresholds, expressed in hours per resident day (HPRD), varied by type of nursing home residents (i.e., short-stay or long-stay) and by type of nurse staffing, ranging from 0.55 to 0.75 HPRD for registered nurses (RN), from 1.15 to 1.30 HPRD for licensed nurses (RNs and licensed practical/vocational nurses [LPNs]), and from 2.4 to 2.8 HPRD for nurse aides. These thresholds were not intended to reflect minimum staffing levels required for adequate care; rather, they were staffing levels above which no further improvements in quality of care were observed. However, these levels are commonly misinterpreted, applied, and emphasized as staffing minimums by researchers and industry. The current Staffing Study findings are intended to provide CMS options for setting a minimum staffing requirement, and illustrate the trade-offs of these policy options, balancing cost and feasibility with implications for quality and safety.

Ongoing research continues to demonstrate that nursing homes with higher staff-to-resident ratios provide better care, as indicated by quality measures such as lower prevalence of pressure ulcers, less use of physical and chemical restraints (Harrington et al., 2020; Shin & Bae, 2012; Bostick et al., 2006), and lower rates of acute care transfers (Spector et al., 2013; Grabowski et al., 2008). Better-staffed nursing homes also perform better on federally mandated annual health inspections, meaning that they are cited for fewer deficiencies or violations of federal regulations (Castle et al., 2011; Harrington et al., 2000). Nursing homes with higher staffing levels have also had greater success in addressing the COVID-19 public health emergency (Williams et al., 2021; Gorges & Konetzka, 2020). Even before the COVID-19 public health emergency, nursing homes with higher staffing levels had lower rates of facility-acquired infections (Shin & Bae, 2012). RN staffing in particular has shown an especially strong relationship with quality (Dellefield et al., 2015).

Building on the existing literature, the Staffing Study adopted a conceptual framework (**Exhibit 1.1**) that identifies staffing levels as one component of administrative practices influencing nursing home quality of care, along with staffing mix, staff skill/qualifications, care delivery model, and organizational environment (including characteristics of the nursing home). All else being equal, higher nurse staffing levels are expected to increase quality of care. Increased quality of care in turn manifests in improved

nursing home resident outcomes, including improved clinical outcomes, increased patient safety, reduced disparities, and improved quality of life. Resident care needs, which vary depending on acuity, clinical complexity, and other resident characteristics, also could directly influence quality of care. Nursing homes with higher-acuity or more clinically complex residents can require a higher level of staffing to meet resident needs.

Exhibit 1.1: Conceptual Framework: Nursing Home Staffing, Quality of Care, and Resident Outcomes



Adapted from Clarke & Donaldson (2008).

1.2 Current Nursing Home Staffing and Federal Requirements

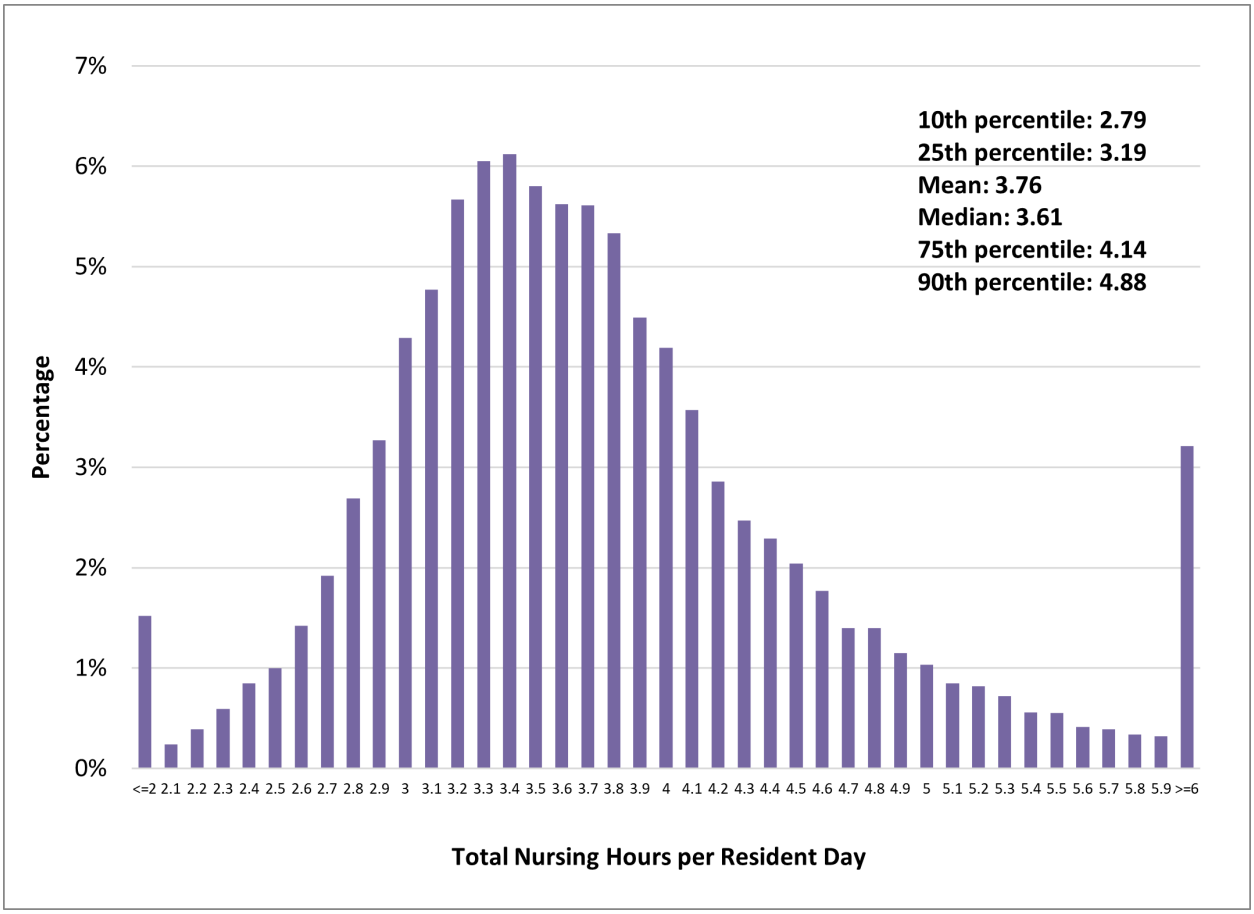
Staffing levels currently vary considerably across nursing homes (**Exhibit 1.2**). For example, 10 percent of nursing homes have staffing levels at or below 2.79 total nurse HPRD and 10 percent have levels above 4.88 HPRD. Lower-staffed nursing homes are more likely to be for-profit, larger, rural, and have a higher share of Medicaid residents (**Section 4.1**). While the expectation is that, on average, nursing homes with higher staffing levels provide a higher quality of care, it is important to note that some level of variation in staffing is expected based on differences in resident needs and other factors.

Federal requirements do not currently specify the types of staff that must be employed or staffing levels required per resident (Nursing Services, 1989), but they do require that an RN be on site eight consecutive hours a day, for seven days a week (42 C.F.R. § 483.35(b)(1)), and that nursing homes have licensed nurses and other nursing personnel (e.g., nurse aides) available 24 hours a day (42 C.F.R. § 483.35(a)(1)(i)).

To comply with a potential new federal requirement specifying minimum nurse staffing thresholds, nursing homes currently staffing below those thresholds would need to hire additional staff or increase hours of existing staff. For example, a minimum staffing requirement set at 3.61 total nurse HPRD, equivalent to the current median staffing level, would require half of nursing homes to increase staffing. A requirement near the top of the current staffing distribution at 6.0 total nurse HPRD would require virtually all nursing homes (97 percent) to add staffing. Even a very low requirement of 2.0 total nurse

HPRD, near the bottom of the current staffing distribution, would necessitate increased staffing in more than 200 nursing homes (<2 percent). Consistent with the **Exhibit 1.1** conceptual framework described in the previous section, increased staffing in nursing homes affected by a new federal minimum staffing requirement is expected to be associated with improved quality of care concentrated within those nursing homes.

Exhibit 1.2: Distribution of Total Nursing Hours per Resident Day, 2022Q2

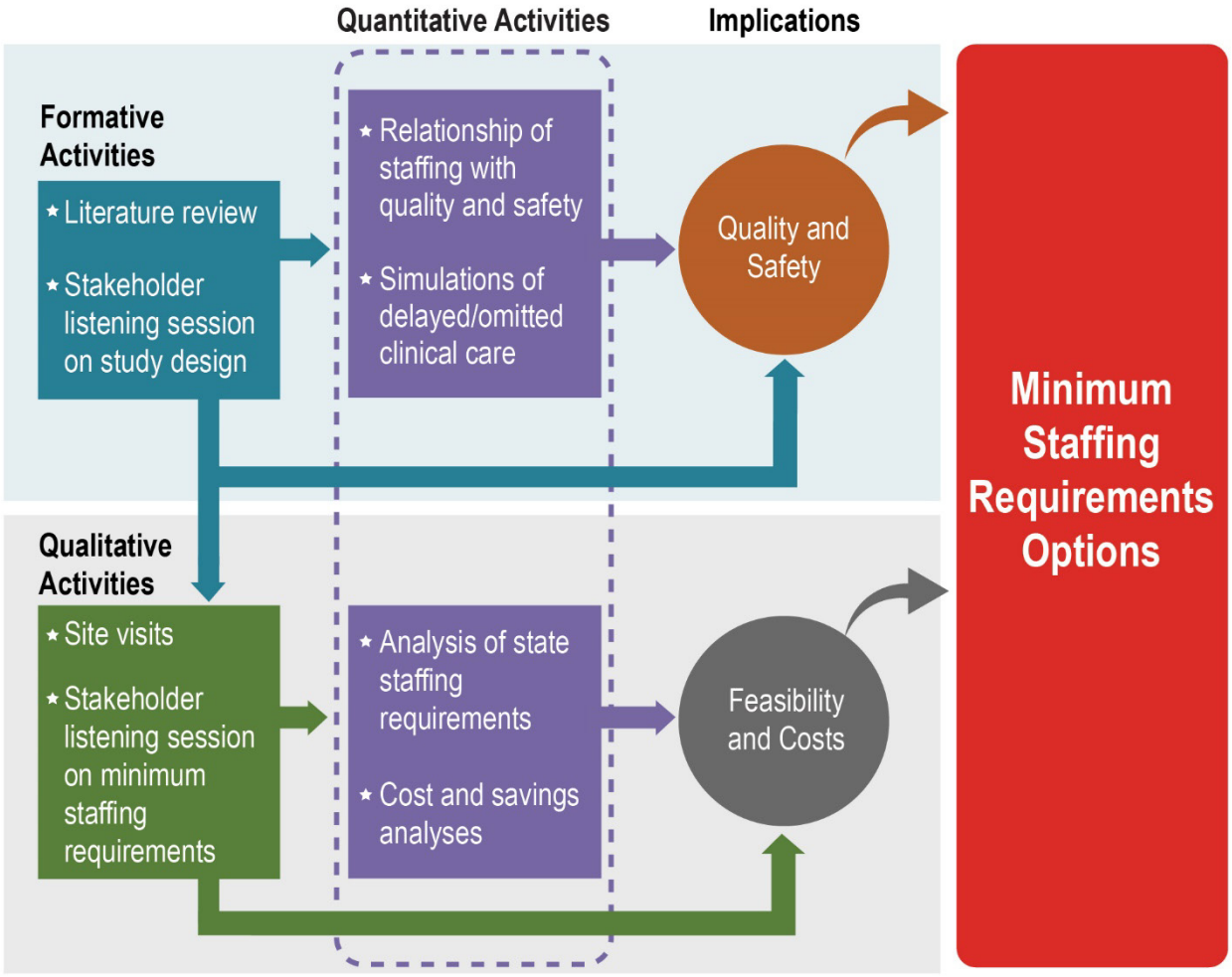


Source: Abt Associates analyses of 2022Q2 CMS Payroll Based Journal data (*N*=14,529).

1.3 Study Goals and Major Components

The main goal of this study is to support CMS in identifying potential minimum nursing home staffing requirements, using a mixed-methods approach. The Staffing Study synthesizes findings across a range of methods and activities to characterize expected quality and safety outcomes associated with potential minimum staffing requirement options, alongside information on projected feasibility and costs (**Exhibit 1.3**).

Exhibit 1.3: Nursing Home Staffing Study Components



In brief, initial work included formative activities to inform the overall Staffing Study design. These were a literature review focused on summarizing evidence on the relationship between staffing and quality, current state and federal standards for nurse staffing, the role of different nurse types in nursing homes safety and quality, and the costs associated with nurse staffing in nursing homes and with implementing minimum nurse staffing requirements, as well as a stakeholder listening session to gather input on the study design. These formative activities helped ensure that analyses and data collection activities would build on and complement existing evidence and provide contextual information to support framing and interpretation of findings.

Qualitative activities included collecting and analyzing data from interviews with nursing home leadership, nurse staff, residents, and families about the importance of adequate staffing, potential barriers to increased staffing levels, ways that nursing home staffing relates to quality, and potential unintended consequences associated with a minimum staffing requirement. A second stakeholder listening session solicited feedback on addressing disparities, making minimum staffing requirement information available, and cost and other considerations for establishing a minimum requirement from providers, advocates, associations, and others.

Quantitative study activities included examining the relationship of nurse staffing levels and type with acceptable quality and safety using existing secondary data from the Payroll Based Journal system and

Nursing Home Care Compare to identify specific staffing levels below which residents are at substantially increased risk of not receiving safe and quality care. Additionally, the Staffing Study included simulation modeling of delayed and omitted care using data from direct observation of common clinical tasks performed by licensed nurse staff. These two activities provide empirical evidence on expected implications of potential minimum staffing requirement options for quality and safety.

Two additional quantitative analyses provide evidence on anticipated feasibility and costs of potential minimum staffing requirement options. The study team examined trends in nursing home staffing levels and state staffing requirements—including an assessment of the impact of state-level minimum staffing requirements in Massachusetts, which provides plausibly causal evidence on the extent to which a federal staffing requirement might affect staffing levels and quality outcomes. Finally, cost and savings analyses estimate expected costs to nursing homes for additional staff time that would be associated with increases in staffing levels or changes to the mix of staff that would be required under different minimum staffing requirements. Those analyses also estimated potential savings to Medicare associated with reduced emergency department visits and hospitalizations and increased community discharges.

Together, these activities provide evidence to develop potential options for minimum staffing requirements to inform CMS. **Exhibit 1.4** provides additional detail on data sources and purpose for each study component.

Exhibit 1.4: Nursing Home Staffing Study Data Sources and Purpose, by Study Component

Study Component	Data Sources	Purpose
Formative Activities		
Literature review	• Peer-reviewed articles and informally published ("gray") literature	Summarize evidence on the relationship between staffing and quality, current state and federal standards for nurse staffing, the role of different nurse types (i.e., RNs, LPNs, nurse aides) in nursing home safety and quality, and the costs associated with nurse staffing in nursing homes and with implementing minimum nurse staffing requirements.
Stakeholder listening session on study design (June 2022)	• Listening session attended by 16 invited stakeholders	Gather feedback from professionals with expertise in nursing home staffing and policies on the Staffing Study design.
Qualitative Activities		
Site visits (September–November 2022)	• Interviews with >360 nursing home staff, residents, and family members in 31 nursing homes • Missed Nursing Care (MISSCARE) surveys completed by ~170 nursing home staff	Provide qualitative, contextual information through primary data collected on the importance of adequate staffing, potential barriers to increased staffing levels, ways that nursing home staffing relates to quality, recommended staffing ratios, and potential unintended consequences associated with a minimum staffing requirement.
Stakeholder listening session on minimum staffing requirement (August 2022)	• Listening session attended by 668 individual stakeholders	Gather feedback from providers, advocates, associations, and others about benefits and challenges of a minimum staffing requirement.

Study Component	Data Sources	Purpose
Quantitative Activities		
Relationship of staffing with quality and safety	• Payroll Based Journal (PBJ) system • Nursing Home Care Compare quality and safety measures	Develop staffing measures (nurse hours per resident day) and measures of nursing home quality and patient safety; estimate relationships between nurse staffing levels and probability of exceeding different thresholds of acceptable care quality and safety for different staffing levels. Also, to model predicted improvements in quality and safety associated with potential federal minimum staffing requirement options.
Simulations of delayed/omitted clinical care	• >8,000 timed observations of common clinical tasks in 20 nursing homes • Minimum Data Set (MDS) • PBJ system • Regulatory analysis • Expert consultation on simulation approaches	Simulate the impact of different licensed nurse staffing levels on delayed and omitted clinical care at different resident acuity levels. Also, to model predicted reductions in delayed and omitted clinical care associated with potential federal minimum staffing requirement options.
Analysis of state staffing requirements	• PBJ system • Certification and Survey Provider Enhanced Reports (CASPER) system • Nursing Home Care Compare quality measures	Identify states with recent changes in minimum nurse staffing requirements; use synthetic control[1] methods to estimate the impact of a new state-level minimum nurse staffing requirement in Massachusetts on staffing levels and quality and safety.
Cost and savings analyses	• Medicare's Skilled Nursing Facility Cost Report data set • Nursing Home Care Compare nursing home-level characteristics and claims-based quality measures	Estimate the costs to nursing homes associated with increases in staffing levels or changes to the mix of staff under potential minimum staffing requirement options; estimate potential savings to Medicare from reduced hospitalizations and emergency department visits and increased community discharges.

1.4 Overview of Comprehensive Report

This comprehensive report summarizes results from the Nursing Home Staffing Study components described in **Exhibit 1.4**.

- **Chapter 2** summarizes findings from formative activities, specifically the literature review on staffing and quality, nurse staff roles, current requirements, and staffing costs, as well as the stakeholder feedback on the study design obtained during a listening session with experts in nursing home staffing and policy.
- **Chapter 3** describes qualitative results from site visit interviews about the importance of adequate staffing, potential barriers to increased staffing levels, ways that nursing home staffing relates to quality, and potential unintended consequences associated with a minimum staffing requirement. It also summarizes a second stakeholder listening session on addressing disparities, making minimum staffing requirement information available, and cost and other considerations for establishing a minimum requirement.

[1] Synthetic control is a statistical method for estimating the causal effect of an intervention on a single or group of entities compared to those not part of the intervention. It combines outcomes for all those not part of the intervention to represent the expected experience if there were no intervention.

- **Chapter 4** summarizes results from four sets of quantitative analyses:
  - Descriptive analyses of the relationship between nursing home staffing levels and acceptable safe and quality care, including multivariate analyses
  - Simulation modeling analyses to assess how nursing home licensed nurse staffing levels influence the likelihood of delayed or omitted care
  - An examination of state minimum staffing requirements, including an impact analysis of Massachusetts's nursing home staffing requirement on nurse staffing levels and quality and safety outcomes
  - Nursing home costs and Medicare savings associated with increased staffing and changes in emergency department visits, hospitalizations, and community discharges
- Finally, **Chapter 5** synthesizes and discusses key findings across each study component regarding the benefits and challenges of a minimum staffing requirement and presents options for minimum staffing requirements for consideration by CMS.

2. Formative Activities

Particularly because of the Nursing Home Staffing Study's accelerated timeframe, it was critical for the study design to address gaps in the extant evidence base, rather than duplicating existing findings, to inform minimum staffing requirements. The Staffing Study team therefore refined the study design through two sets of formative activities: a systematic literature review and a listening session with experts on nursing home staffing issues and policies.

2.1 Literature Review

Key Takeaways

- Higher levels of nurse staffing are associated with improved resident care outcomes, but the literature did not generally identify staffing thresholds required for adequate quality of care.
- Federal nursing home staffing regulations specify that a registered nurse must be on site eight consecutive hours a day for seven days a week, and licensed nurses or other nurse personnel (e.g., a nurse aide) must be available 24 hours a day. State minimum nursing home staffing standards vary greatly from state to state. While evidence of the impact of staffing regulations is limited, literature suggests that current federal nursing home staffing regulations are not always met.
- Registered nurses are more likely to be assigned administrative roles in nursing homes and play key roles in resident assessment and care planning, while nurse aides are likely to spend the most time providing direct care to residents. Some literature suggests that increased training across varied care domains might allow nurse aides to assume greater responsibility for, and could improve, both quality of care and resident quality of life.
- The cost of implementing nurse staffing requirements depends on which nurse types a nursing home needs to hire, costs associated with nurse turnover and retention, and recent costs caused by the COVID-19 public health emergency.

The Nursing Home Staffing Study team conducted a systematic review of existing literature to provide context for quantitative and qualitative analyses and to identify any existing evidence supporting specific minimum staffing thresholds. More detail on methods and findings can be found in **Appendix A**. **Appendix A.1** provides additional details on the literature review methods, including search terms, gray literature sites, and review criteria. **Appendix A.2** provides an expanded presentation of the literature results, and **Appendixes A.3–A.6** present **s**upporting tables with detailed information on the individual sources referenced in the results.

Note that throughout this section and **Appendix A.2**, the study team is reporting the work of others. The team has used standardized terminology that could deviate from the authors' original terms (e.g., the report will use *resident* instead of *patient*) to avoid using several different terms that refer to substantively similar concepts, which might confuse the reader. Additionally, sources could have defined these terms, particularly staff types, differently than this report's **Glossary** (e.g., whether *nurse aide* includes aides in training will vary across cited sources). **Appendices A.3–A.4** reflect the author's original terms, including detailed information on how well staff type definitions align with this report's Glossary definition.

2.1.1 Overview

As a preliminary step, the Staffing Study team first conducted a scoping review to better understand the range of relevant literature pertaining to Staffing Study aims. Scoping reviews are intended to facilitate better understanding of the breadth and depth of existing literature associated with a given topic, typically within a short timeframe (see Arksey & O'Malley, 2005).

The scoping review used the terms "nursing home" and "staffing" with multiple search engines including EBSCO Discovery Service, the National Library of Medicine's PubMed database, EBSCO's Cumulative Index to Nursing and Allied Health Literature (CINAHL), Google Scholar, and JSTOR. The team filtered results for those sources published from 2015 to 2022, U.S.-based, and relevant to nursing home staffing and quality. This broad search returned 1,883 results, 44 of which were deemed sufficiently applicable to the research topics—though the majority were published earlier than the threshold the team established for the systematic review (i.e., 2019 or later). Overall, the scoping review identified literature demonstrating that staffing levels contribute to better nursing home resident outcomes. However, most focused on general correlative patterns rather than identifying specific thresholds required for adequate nursing care. Older articles identified in the scoping review that had particular relevance to our research topics have been incorporated into this Overview section.

A few empirical studies identified in the scoping review attempted to establish specific staffing levels required to meet nursing home resident needs. A 2004 observational study of California nursing homes examined the correlation of process measures with total nurse staffing hours per resident day (HPRD), including registered nurse (RN), licensed practical/vocational nurse (LPN), and nurse aide HPRD. Results suggest that nursing homes reporting between 4.5 and 4.8 total nurse staffing HPRD performed better on process measures related to social engagement, feeding assistance, incontinence care, and exercise and repositioning than did nursing homes with lower staffing ratios (Schnelle et al., 2004). A 2016 study using simulation modeling of time data collected from observation of specific nurse aide care tasks recommended that nursing homes have between 2.8 and 3.6 nurse aide HPRD, depending on the extent to which residents require assistance with activities of daily living (Schnelle et al., 2016).

Although the 2001 CMS Staffing Study (Abt Associates, 2001) did not identify *minimum* staffing levels required to help ensure residents were at low risk for receiving low-quality or unsafe care, results suggest that nursing home staffing levels that *maximized* quality of care are in the range of 0.55–0.75 RN HPRD, 1.15–1.30 licensed nurse (i.e., RN, LPN) HPRD, and 2.4–2.8 nurse aide HPRD. Above these staffing levels, no further meaningful improvement in quality was observed (Abt Associates, 2001).

However, researchers and industry alike commonly misinterpreted, applied, and emphasized these findings as a staffing minimum despite there being no associated federal requirement. Notwithstanding this common but erroneous understanding of the 2001 CMS Staffing Study indicating a minimum staffing level, few nursing homes achieve and maintain these staffing levels (U.S. Government Accountability Office, 2021; Office of the Inspector General, 2020; Medicaid and CHIP Payment and Access Commission [MACPAC], 2022b).

Based on results of the scoping review, the Staffing Study team, in consultation with CMS, identified four key research questions for the systematic literature review to better understand recent literature related to nursing home staffing:

1. What is the relationship between nurse staffing levels and safety and quality of care?
2. What are the current state and federal standards for staffing levels and types in nursing homes for weekdays, weekends, and evenings? What are the outcomes associated with these standards?
3. What is the role of different nurse types (i.e., RN, LPN, nurse aide) in ensuring safety and quality of nursing home care?

4. What are the costs associated with nurse staffing in nursing homes?

The systematic literature review was limited to articles published in 2019 to 2022.

2.1.2 Methods

After the initial scoping review, the Staffing Study team used a systematic, stepwise process to identify recent information relevant to the research intent. The team developed a specific set of search terms for each question, and applied each set of terms to three journal article databases: EBSCO Discovery Service, the National Library of Medicine's PubMed database, and EBSCO's Cumulative Index to Nursing and Allied Health Literature (CINAHL). All search results were exported into an EndNote library, with staff reviewing each article's abstract or full text to determine its recency (2019 or later) and relevance (U.S.-based and set in nursing homes).

The study team further identified relevant informally published ("gray") literature from government or government-related sites, provider associations, advocacy groups, foundations, and other health policy-focused organizations. Additional articles that stakeholders provided to the team that were not otherwise identified in the database or gray literature searches were also reviewed and included, as applicable.

The Staffing Study team reviewed final relevant peer-reviewed articles to determine the strength of the evidence using the National Service Framework for Long Term Conditions (see Turner-Stokes et al., 2006). Later in the study period, the team also assessed each peer-reviewed article's alignment with the definitions of staff type and quality measures used in this Nursing Home Staffing Study's quantitative analyses (**Chapter 4**). When considering alignment, the team assessed both the staff type description and the data set used in the article; both had to align with the Staffing Study for the alignment to be considered "good." The study team did not reject articles based on the strength of their evidence or their alignment with the Nursing Home Staffing Study quantitative analyses.

2.1.3 Results

Exhibit 2.1 summarizes the results of the literature search across the four research questions, including counts of articles by evidence grade and methodological alignment with Staffing Study quantitative analyses reported in subsequent chapters.

Exhibit 2.1: Summary of Literature Search, Evidence Grading, and Alignment with Staffing Study Quantitative Analyses

	Question 1	Question 2	Question 3	Question 4	Total[1]
Literature Search Results					
Total peer-reviewed articles	176	160	205	76	**461**
Total relevant sources	27	8	20	15	**59**
Peer-reviewed literature[2]	23	2	14	5	39
Gray literature	4	6	6	10	20
Evidence Grade[3]					
Evidence Type					
Expert	5	0	4	0	**8**
Research-based	18	2	10	5	**31**
Research Design					
Primary research–based evidence					
P1 Primary research using quantitative approaches	2	0	2	1	**4**
P2 Primary research using qualitative approaches	2	0	3	0	**4**
P3 Primary research using mixed methods	1	0	0	0	**1**

	Question 1	Question 2	Question 3	Question 4	Total[1]
Secondary research–based evidence					
S1 Meta-analysis of existing data analysis	0	0	0	0	**0**
S2 Secondary analysis of existing data	12	2	3	6	**20**
Review-based evidence					
R1 Systematic reviews of existing research	1	0	1	0	**1**
R2 Descriptive or summary reviews of existing research	0	0	1	0	**1**
Evidence Quality[4]					
High	15	2	9	4	**27**
Medium	3	0	1	1	**4**
Low	0	0	0	0	**0**
Alignment with Staffing Study Quantitative Analyses[5]					
Alignment of Staff Type[6]					
No alignment	1	1	1	2	**5**
Some alignment	16	0	7	1	**21**
Good alignment	6	1	6	2	**13**
Alignment of Quality Measures					
No alignment	13	1	8	4	**23**
Some alignment	3	0	3	0	**4**
Good alignment	7	1	3	1	**11**

Notes:

[1] The Total column reflects unique, deduplicated source counts and might not equal the sum of counts for the four questions, as some sources were used to support more than one topic.

[2] Includes articles retained from initial search and supplemental literature, except for Question 4. Question 4's supplemental source was a piece of gray literature.

[3] Based on the National Service Framework for Long Term Conditions (see Turner-Stokes et al., 2006). Consistent with the Framework, only peer-reviewed research-based evidence is rated.

[4] Evidence quality ratings are based on five questions scored from 0 to 2. The questions: (1) Are the research question/aims and design clearly stated? (2) Is the research design appropriate for the aims and objectives of the research? (3) Are the methods clearly described? (4) Is the data adequate to support the authors' interpretations/conclusions? (5) Are the results generalizable? The numeric score for each of the questions is summed, which creates a score that is associated with a High, Medium, or Low rating. See Appendices A.3 through A.6 for more information.

[5] Staff type and quality measure definitions were assessed for peer-reviewed literature but not for gray literature.

[6] Staff type alignment was based on the staff type indicated and data set used. No alignment = different staff types and different data set; Some alignment = same staff types but different data set; Good alignment = same staff types and same data set. See Appendices A.3 through A.6 for more information.

The remainder of this section provides an overview of major findings from the systematic literature review, organized by research question. **Appendix A.2** provides more-detailed results.

The Relationship of Nurse Staffing Levels with Safety and Quality of Care

Existing literature on nursing home staffing has focused on the ways in which increased staffing produces better outcomes, but it has not identified a minimum staffing level required for adequate care quality. Higher nurse staffing levels in nursing homes are associated with improved resident care outcomes such as reducing pressure ulcers, emergency department visits, rehospitalizations, and outbreaks and deaths related to COVID-19 (Clemens et al., 2021; Min & Hong, 2019; Wagner et al., 2021; Figueroa et al., 2020; Gorges & Konetzka, 2020; Snyder et al., 2021; Li et al., 2020; Gray-Miceli et al., 2021; Kingsley & Harrington, 2022). Increased staffing levels can be particularly beneficial to vulnerable sub-populations in nursing homes (e.g., residents with dementia or Alzheimer's disease) and for particular quality outcomes

(e.g., antipsychotic use, obesity rates, severity of depressive symptoms) (Orth et al., 2021; Rosenthal et al., 2022; Harris et al., 2020; Yuan et al., 2019).

While stakeholders generally favored minimum nursing home nurse staffing requirements, none presented a specific evidence-based minimum. All but one article explicitly noted that nursing home reform should include 24/7 RN coverage in every nursing home (Bakerjian et al., 2021; Kolanowski et al., 2021; Mollot, 2022; California Advocates for Nursing Home Reform et al., 2021; National Academies, 2022).

Federal and State Standards for Nursing Home Staffing

Federal nursing home requirements related to staffing are often non-specific, and they do not specify the types of staff that must be employed, or staffing levels required per resident (Nursing Services, 1989). As of August 2022, federal regulations stated that an RN must be on site eight consecutive hours a day, for seven days a week (42 C.F.R. § 483.35(b)(1)), and that nursing homes must have licensed nurses and other nursing personnel (e.g., nurse aides) available 24 hours a day (42 C.F.R. § 483.35(a)(1)(i)). A nursing home must also have a full-time RN director of nursing (DON) (42 C.F.R. § 483.35(b)(2)) and a licensed nurse (either RN or LPN) serving as a charge nurse on each tour of duty (42 C.F.R. § 483.35(a)(2)). Federal regulations require only that facilities provide staff sufficient to "ensure resident safety and attain or maintain the highest practicable physical, mental, and psychosocial well-being of each resident," which facilities should determine through "resident assessments and individual plans of care and considering the number, acuity, and diagnoses or the facility's resident population" (42 C.F.R. § 483.35).

At the state level, 38 states plus the District of Columbia currently have minimum nursing home staffing standards that exceed what would be required for a 100-bed facility to comply with the federal nursing home staffing regulations requiring a RN to be on site eight consecutive hours a day for seven days a week and licensed nurses or other nurse personnel available 24 hours a day, with wide variability of those standards among states (MACPAC, 2022a, 2022b; Consumer Voice, 2021).

Several states changed nursing home staffing requirements in response to the COVID-19 public health emergency. Changes varied by state and included increasing staffing minimums, decreasing staffing minimums, reducing direct care training requirements, changing how *direct care staff* is defined, and reallocating minimum staffing hours across shifts or staff types (Musumeci et al., 2022; MACPAC, 2022b). Examples of such changes include Connecticut increasing its minimum staffing requirements by an additional 0.168 HPRD, Georgia decreasing its minimum staffing requirement by 0.24 HPRD, Rhode Island narrowing its *direct care staff* definition to exclude DON hours, Wisconsin reducing nurse aide training requirements from 120 hours to 75 hours, and Florida maintaining the existing staffing requirements with a different staff mix by increasing the number of required LPN hours and decreasing the number of required nurse aide hours (Musumeci et al., 2022).

While there is little recent evidence on the effect of staffing regulations on nursing home staffing levels and quality of care, literature suggests that the limited existing federal nursing home staffing regulations are not always met. For example, a 2020 Office of the Inspector General (OIG) report found that approximately 7 percent of nursing homes were below the federally required RN staffing levels on at least 30 total days during the year 2018.

Role of Nurse Type in Nursing Homes

The literature review identified clear differences between the roles of nurse types within nursing homes.

RNs play key clinical roles in infection control, resident assessments, and care planning (CALTCM, n.d.). RNs are also more likely than other nurse types to be assigned administrative roles. RNs in these roles typically have less hands-on time with residents and greater need for non-clinical skills (e.g., managerial and time management skills). For example, RNs primarily serve as a nursing home's DON or the director

of quality and safety (Bonner et al., 2022). They are more likely to set priorities and have effective time management skills than are less-skilled nurse types (Burt, 2019). RNs are increasingly asked to supervise complex tasks and to delegate these tasks to LPNs and nurse aides, so they need to be skilled at motivating staff, decision-making, problem solving, and use of best practices (Bakerjian et al., 2021).

The study team found limited literature evidence specific to the role of LPNs; however, evidence suggests that they may have more-limited resident relationships than other nurse types. For example, a study of nursing home staff roles in the southeastern United States found that LPNs discussed resident relationships less than did both nurse aides and RNs, and when faced with resident care decisions, they often turned to the RN on duty or the DON (Firnhaber et al., 2020).

The review found the nurse aide role is typically to assist residents with activities of daily living (ADLs). Nurse aides spend the most time with residents and are most familiar with resident preferences (Bonner et al., 2022; Firnhaber et al., 2020). According to the National Academies of Sciences, Engineering, and Medicine, nurse aide roles can be expanded with additional training to benefit residents in areas such as dementia care, infection control, behavioral health, and chronic diseases. Others stated that more-comprehensive training across varied care domains (e.g., dementia care, personal care, meal preparation, and laundry) can help nurse aides assume greater responsibility for, and could improve, both quality of care and quality of life (National Academies, 2022; Reinhard & Hado, 2021).

Studies also showed that nurse practitioners and advanced practice registered nurses can meaningfully contribute to improved resident outcomes, though they are not typically considered part of nursing home staffing (Bakerjian, 2022; Katz et al., 2021).

The challenges nursing home staff face also vary by role. Nurse aides are more likely to have second jobs and have the longest work hours (Van Houtven et al., 2020). Both nurse aides and LPNs can also experience increasing responsibilities in their roles and might be asked to perform roles outside their scope (Bakerjian et al., 2021; Snyder et al., 2021). For example, a recent qualitative study found that 68 percent of nurse aides reported having added responsibilities (e.g., more cleaning responsibilities) and performing tasks beyond their scope of work—such as enforcing protocols, non-clinical care such as hairstyling, and moving residents within the facility (Snyder et al., 2021).

Advocacy groups recommend that RNs, LPNs, and nurse aides be given separate minimum staffing requirements, both because of the unique role each nurse type has within a nursing home and to deter nursing homes from meeting requirements using a disproportionate share of LPNs or nurse aides, since they are less costly to hire than RNs (Mollot, 2022).

Costs Associated with Nurse Staffing Requirements

While there is broad agreement that meeting new minimum nurse staffing requirements would incur significant costs for nursing homes, there has been limited analysis of the exact financial impacts. Some analyses have looked at nurse wages and estimated additional staff hiring needs (Weech-Maldonado, Lord et al., 2019; Weech-Maldonado, Pradhan et al., 2019; Denny-Brown et al., 2020; LeadingAge, 2022; Gerber & Nelb, 2022; Lepore et al., 2020; Hawk et al., 2022). One study estimated the annual cost of reaching 24-hour RN staffing in all nursing homes (approximately 15,000) to be $75 million (Long Term Care Community Coalition, 2021). One report suggested that a 4.1 HPRD requirement, inclusive of RNs, LPNs, and nurse aides, would cost the long-term care industry more than $10 billion annually (CLA, 2022), while another estimated the costs of such a requirement at $7.25 billion (Hawk et al., 2022).

Staff retention and turnover also affect how costly a minimum staffing requirement would be for nursing homes. Increased wages might help ensure high-quality care and low staff turnover but can also be costly for nursing homes to implement. A 2022 presentation to MACPAC found that facilities that paid higher wages had higher staffing levels (Gerber & Nelb, 2022). One study found that if the minimum wage were

increased to $15 per hour, 76 percent of nurse aides would receive increased wages, thereby increasing total direct labor costs in nursing homes by more than $2.5 billion (Lepore et al., 2020). Not all nursing homes are equally equipped to implement high minimum staffing levels and the high wages to offset staff turnover. High-Medicaid-census nursing homes particularly are at risk of financial strain and potential closure (Hawk et al., 2022; Weech-Maldonado, Lord et al., 2019).

Leveraging existing funding sources might help nursing homes offset the cost of improving resident care through minimum staffing requirements. For example, existing funding sources could be applied to lessen the financial burden of a minimum staffing requirement, such as by designating a portion of Medicare and Medicaid payments to direct care services or restricting related-party transactions or provider self-dealing (Edelman, 2021; National Academies, 2022).

2.1.4 Discussion

The study team identified recurrent themes on staffing and quality, nurse staff roles, current regulations, and staffing costs in the recent literature on nursing home staffing and quality, although recent evidence was not extensive. The total number of unique relevant articles selected for the systemic literature review was small (n=59), in part because the search was restricted to articles published during 2019–2022. In terms of evidence quality, 34 percent of articles were not subject to peer review, therefore considered gray literature. More than 20 percent of the relevant peer-reviewed literature reflected expert evidence (n=8), rather than research-based evidence (n=31). However, almost 90 percent of the research-based evidence was of high quality, and no research-based evidence was considered of low quality.

Existing literature is clear that adequate nursing home staffing is associated with better resident outcomes such as reductions in pressure ulcers, emergency department visits, and rehospitalizations (Clemens et al., 2021; Min & Hong, 2019; Wagner et al., 2021; Figueroa et al., 2020; Gorges & Konetzka, 2020; Snyder et al., 2021; Li et al., 2020). However, the literature review did not find evidence on a minimum staffing level required for adequate care quality.

Staff mix is also a meaningful contributor to quality of resident care, with RNs, LPNs, and nurse aides all making unique and valuable contributions. For example, nurse aides spend the most time with residents, while RNs support infection control and resident assessment (Bonner et al., 2022; Firnhaber et al., 2020).

The systematic literature review also found that federal nursing home staff regulations require that an RN be on site for eight consecutive hours each day, and that licensed nurses and other nurse staff be available 24 hours a day. However, the federal regulations do not specify the types of staff that must be employed, or staffing levels required per resident. State regulations vary widely. Recent literature examining how federal or state regulations influence actual staffing levels and quality of care is limited, but suggests that requirements are not routinely enforced or achieved. This leaves a gap that could be met by a federal minimum requirement.

Existing literature also suggests that maintaining minimum staffing levels in ways that achieve adequate staff mix and manage staff turnover will pose significant costs to nursing homes. Costs for establishing a 24-hour RN requirement are estimated to be $75 million (Long Term Care Community Coalition, 2021). Costs of establishing a total nurse staffing requirement at 4.1 HPRD, consistent with quality-maximizing levels previously identified by the 2001 CMS Staffing Study (Abt Associates, 2001), are estimated to be dramatically higher at $7.25 to $10 billion, depending on assumptions (Hawk et al., 2002; CLA, 2022).

In summary, the systematic literature review identified both potential benefits and potential challenges of a minimum staffing requirement. In general, literature review findings suggest that increased staffing would be associated with improved quality outcomes, with different roles for different nurse staff types. Moreover, findings suggest that existing federal and state regulations do not consistently ensure adequate nursing home staffing, indicating a potential role for a new federal minimum staffing requirement.

However, cost estimates from the literature review suggest that financial costs of such a requirement would be substantial.

2.2 Stakeholder Listening Session on Study Design

Key Takeaways

- Stakeholders recommended consideration of resident characteristics and care needs when developing staffing requirements.
- Stakeholders suggested consideration of staffing requirements not just for nurses but also for non-nurse staff, who may contribute to aspects of quality such as quality of life in addition to quality of care.
- Stakeholders generally acknowledged the complexity of nursing home staffing structures and organization, such that minimum staffing requirements should consider nuances such as weekday vs. weekend staffing needs and use of agency staff.
- Stakeholders recommended that the Staffing Study design should include analyses of delayed and omitted care.

Along with the literature review, formative study activities included a stakeholder listening session to obtain input on the study design from an invited group of 16 professionals with significant expertise in nursing home staffing issues and policies.

2.2.1 Overview

The listening session was held on June 27, 2022. Attendees primarily were stakeholders of two types, provider and clinician groups and advocacy groups (see Box A).

The intent of the listening session was to request feedback from these stakeholders on the preliminary Staffing Study design, solicit specific suggestions for factors to consider when formulating minimum staffing requirement options, and obtain expert opinions on appropriate methods and measures for use in the Staffing Study. **Appendix B** includes the PowerPoint presentation from this session.

Box A: Participants in Stakeholder Listening Session on Study Design

Provider and clinician groups:

- LeadingAge
- American Health Care Association (AHCA) / National Center for Assisted Living (NCAL)
- National Association of Directors of Nursing Administration in Long Term Care (NADONA)
- Society for Post-Acute and Long-Term Care Medicine (AMDA)
- American Association of Post-Acute Care Nursing (AAPACN)
- National Association of Health Care Assistants (NAHCA)

- ***Advocacy groups:***

- California Advocates for Nursing Home Reform (CANHR)
- Center for Medicare Advocacy
- The National Consumer Voice for Quality Long-Term Care (Consumer Voice)
- Long Term Care Community Coalition (LTCCC)

2.2.2 Methods

The listening session was held virtually via the Abt Associates WebEx platform. The Staffing Study team worked with CMS to develop objectives, meeting

materials, and discussion questions in advance of the session. The team facilitated the discussion and afterwards prepared a meeting summary highlighting key takeaways from the input received.

During the listening session, the team first provided an overview of the planned Staffing Study design, including key research questions to guide the overall study, and detail about its data sources and research methods. The Staffing Study team then facilitated an open discussion with the stakeholders to solicit their feedback on several "big picture" questions about minimum staffing requirements, along with planned discussion questions for the major study design components.

A complete list of discussion questions is provided in the PowerPoint presentation. Because of time limitations, the simulation slides were not presented or discussed.

2.2.3 Results

Key points from the listening session are summarized by discussion question below.

How should minimum staffing requirements be determined? (What factors should be considered, and what factors are most important?)

Stakeholder feedback centered on including non-nurse staff in a staffing requirement, such as therapists, behavioral health specialists, activities staff, medical directors/physicians, and pharmacy staff. Stakeholders also suggested potentially creating separate staffing requirements for non-nurse staff and considering quality of life as part of a staffing requirement, in addition to quality of care. Finally, there was consensus that patient/resident characteristics and needs should be considered when developing staffing requirements.

What concerns do stakeholders have with a minimum staffing requirement for nursing homes? Are there potential unintended consequences?

Stakeholder feedback noted that basic activities of daily living care and medication needs should not vary based on the day of the week, so any requirement should address both weekday and weekend staffing. Additionally, while stakeholders suggested that nursing homes' use of agency staff be included in the analyses, they also noted that there could be unintended consequences of using agency staff to meet minimum staffing requirements.

Will the site visits be useful for informing the development of minimum staffing requirements and why?

What topics should be included in the site interviews? What types of staff should site visitors interview?

What topics should be included in discussions with residents and family members?

Should site visits be announced in advance or unannounced?

In addition to suggesting interviews of nursing home leadership, direct care staff, and residents/family members, stakeholders recommended researchers interview the long-term care ombudsman, the medical director, and a representative from the resident and family councils at each site.

There was consensus that interviews should be announced ahead of time and nursing homes should be well informed of the purpose of the visits so staff can be helpful. Stakeholders noted that advance notice of the site visits would increase the likelihood that requested nursing home leadership and families would be available for interviews. Advance notice would also allow leadership to schedule staff for interviews so as not to disrupt resident care.

Stakeholders were firm in their belief that the site visit component should have CMS, state survey agency, and provider organization support, to ensure nursing homes would participate. There was some concern that nursing home staff might view site visits as punitive and not be forthcoming in interviews.

Stakeholders also noted that staff and residents might be concerned about retribution from speaking openly with interviewers.

Stakeholders requested that the leadership interviews contain questions about how staffing decisions are made and by whom. Finally, the stakeholders suggested that both high and low staffed nursing homes be included in site visits to determine whether innovative practices are being used for staffing.

How should analyses of the relationship between staffing levels and staff type versus quality and safety of care inform a minimum staffing requirement?

What feedback do stakeholders have on the staffing measures proposed for this study (type of staff, acuity adjustment, time period)?

What additional quality and safety measures should be considered for the study?

Are there additional analyses to examine the relationship between nurse staffing versus quality and safety that should be considered?

In response to these questions, stakeholders recommended the use of aggregated quality measure (QM) data for the analyses, with several stakeholders preferring use of claims-based QMs that are not self-reported over the Minimum Data Set (MDS)-based QMs. However, other stakeholders noted the potential issue of having a smaller pool of Medicare fee-for-service residents for claims-based QMs (compared to the MDS-based QMs).

Some stakeholders noted that current state staffing standards are not adequate, and there was consensus that a minimum requirement should be the same across the country (not state-specific).

Stakeholders also suggested the analyses include examining omitted or delayed care, and that analyses be conducted for periods before and after the COVID-19 public health emergency.

Finally, stakeholders again suggested that CMS consider non-nurse staff, such as dining staff, enrichment staff, and those who provide care in neighborhood units, in any minimum staffing requirement.

2.2.4 Discussion

Feedback from participants in the first listening session highlighted potential benefits and challenges of a federal minimum staffing requirement, as well as considerations for developing minimum staffing requirements. A national requirement would compensate for the varying and inadequate state-level requirements noted by participants and in the literature (MACPAC, 2022a, 2022b; Consumer Voice, 2021; Office of the Inspector General, 2020).

Using aggregated quality measures, considering resident acuity, and examining the role of staffing levels in delayed and omitted clinical care were noted as important to developing an appropriate minimum requirement. Existing literature confirms the importance of resident acuity in determining staffing needs (Geng et al., 2019; Kolanowski et al., 2021) and has used simulation approaches to investigate delayed and omitted ADL care (Schnelle et al., 2016), but not delayed or omitted clinical care. The noted lack of variation in resident need across the entire week implies structuring a requirement that does not vary by weekday and weekend.

Challenges raised by participants included the potential unintended consequences of using agency staff to meet minimum staffing requirements, and overall workforce shortages.

Consistent with its intent, the listening session also obtained recommendations on the design of the Staffing Study from experts familiar with nursing home staffing issues and policies. The final Staffing Study design incorporates some of these recommendations as follows.

Resident characteristics and needs were included in staff interviews during site visits (see **Section 3.1**) and risk-adjusted quality measures and acuity-adjusted staffing measures were used in the regression modeling. Simulation modeling (see **Section 4.2**) similarly investigated variation by resident acuity mix in licensed nurse staffing needs to avoid delayed or omitted care. As noted above, literature review results (**Section 2.1**) suggest that staffing needs can vary by resident acuity (Geng et al., 2019; Kolanowski et al., 2021), supporting this stakeholder recommendation.

Non-nurse staffing. Quantitative analyses examined the relationship of non-nurse staffing with quality and safety measures (**Appendix E**). This was not a focus of the literature review and addresses an evidence gap.

Weekday/weekend staffing. Qualitative interviews with nursing home staff during site visits (**Section 3.1**) explored differences in resident care needs on weekdays versus weekends. Due to the high correlation between weekend and all-day staffing, quantitative analyses (**Sections 4.1** and **4.3**) did not distinguish between weekday and weekend staffing; however, observation data collected to inform the simulation analyses (**Section 4.2**) was collected on both weekdays and weekends to support potential future investigation of these questions. None of the articles selected for the literature review included evidence on differences across shifts.

Agency staff. Staffing measures used in all quantitative analyses (**Sections 4.1** and **4.3**) included agency staff as suggested; qualitative interviews (**Section 3.1**) additionally explored staff and resident perspectives on use of agency staff.

Site visit protocol. The leadership interview guide was modified as a result of stakeholder input to include a question about how staffing is determined in each nursing home participating in qualitative site visits, as well as who makes the staffing decisions. Further input from the stakeholders led to the addition of a question to the resident/family interview guide to solicit information on what matters most to residents and families with respect to care provided in the nursing home.

Quality measures. Quantitative analyses (**Sections 4.1** and **4.3**) use both claims and MDS-based measures (CMS, 2002a) incorporated into a composite total QM score.

State staffing requirements. The final study design includes a robust exploration of state minimum staffing requirements, including descriptive information on the number and type of requirements currently enacted across states. It also includes an impact analysis using synthetic control methods to evaluate a new post-pandemic minimum staffing requirement in the state of Massachusetts (**Section 4.3**). This was a new analysis that built on gaps in the available literature.

Delayed and omitted care. The Staffing Study included on-site observations of common clinical care tasks performed by licensed nurses to support a simulation analysis of how staffing levels influence the likelihood of delayed or omitted clinical care among nursing home residents (**Section 4.2**). Previous simulation modeling work has been limited to nurse aides (Schnelle et al., 2016).

3. Qualitative Activities

Staffing Study qualitative activities reported on in this chapter, including site visits and a public stakeholder listening session on minimum staffing requirements, provide nuanced perspectives on the interplay of nursing home staffing with care quality and safety, as well as potential barriers to and facilitators of a potential minimum staffing requirement.

3.1 Site Visits

Key Takeaways

- Respondents reported that their usual nursing home shift/unit is frequently short staffed, which affects their ability to provide comprehensive, resident-centered, safe, and high-quality nursing care.
- Activities of daily living care tasks, including bathing, toileting, and mobility assistance, are the most frequently delayed tasks when shifts/units are short staffed; medication passes and meals are the priority when shifts/units are short staffed.
- Direct care staff believe that resident acuity, staff competence, shift type, optimum vs. minimum staffing levels, and having different staffing requirements for nurse aides and licensed nurses are important factors to consider when developing a minimum staffing requirement.
- Respondents noted multiple staffing challenges, including workforce shortages, low compensation for difficult work, competition with staffing agencies, recruitment and retention issues, and physical and emotional burnout in direct care staff.
- Families and residents were empathetic to the staffing challenges in nursing homes, but want safe, consistent, resident-centered, timely care to be the priority.
- "When there is not adequate staffing, you see staff burn out and stressful situations that escalate that don't need to… . Residents are more stressed from that, and the delivery of care is not as good. You don't have happy staff and you don't have happy residents."–Nursing home leadership.

In-person interviews with nursing home leadership, direct care staff, and residents and their family members were conducted to better understand the relationship among nurse staffing levels, staffing mix, and the safety and quality of resident care. This qualitative research used a case study approach for data collection and analysis.

3.1.1 Overview

The Staffing Study team conducted site visits to 31 nursing homes located across the country representing a mix of characteristics, including a range of staffing levels, quality ratings, and resident acuity. While 50 site visits were originally planned, Hurricane Ian in Florida, COVID-19 outbreaks affecting nursing homes that had site visits scheduled, concern about site visits occurring during survey windows, and difficulty recruiting low-staffed nursing homes because of the added burden of having to take direct care staff off the units to participate in interviews prevented their completion prior to submission of this report. Analysis of the interview data from the 31 nursing homes found strong concordance in themes across participating sites and within domains, suggesting thematic saturation. The Staffing Study team continued to reach out to and recruit additional nursing homes for site visits. This report describes findings from the 31 site visits completed through the first week of November 2022.

During each site visit, the team completed on-site interviews and surveys with nursing home leadership and direct care staff to understand care provider perspectives on staffing. During interviews, direct care staff were asked to identify the number of residents for whom they believed they could provide high-quality, safe care and to recommend minimum staffing requirements. In addition, the team interviewed nursing home residents and family members, to better understand how staffing levels and staff mix contribute to perceived quality of care and safety for these groups. Interview guides and the survey instrument used to collect data on missed care, along with more detailed findings, can be found in **Appendix C**.

The rich contextual information provided by site visit participants provides a basis for better understanding potential facilitators of and barriers to minimum staffing requirements among those most likely to be directly affected by such a policy change.

3.1.2 Methods

This section briefly describes methods for the Staffing Study site visits, including nursing home sample selection and recruitment, the site visit protocol and instruments, and the analytic approach.

Sample Selection

The Staffing Study team first identified a convenience sample of 14 states targeted for site visits (see Box B). Because of the short study timeline, the team first selected 5 states in close geographic proximity to study team members, then identified 9 additional states to ensure at least one state in each of the 10 CMS regions.

Box B: Site Visit States

- California
- Colorado
- Florida
- Illinois
- Massachusetts
- Maryland
- Missouri
- North Carolina
- New York
- Ohio
- Pennsylvania
- Virginia
- Washington
- Wyoming

To select a sample of nursing homes to recruit for site visits from within these states, the Staffing Study team then used the Nursing Home Care Compare Provider Summary (which is derived from the Provider Information files available at www.data.cms.gov) to select an initial random sample of 500 nursing homes in the targeted site visit states. The sample was then manually adjusted to ensure it accommodated the following sampling criteria:

- Geography—10 CMS regions
- Urbanicity—urban, rural
- Bed size—small, medium, large
- Ownership type—non-profit, for-profit, government
- Payer mix—0–40 percent Medicaid, >40–70 percent Medicaid, >70 percent Medicaid
- Use of agency staff—0 percent, 1–10 percent, >10 percent
- Staffing level—high staffed (Five-Star staffing rating of 4 or 5), low staffed (Five-Star staffing rating of 1 or 2)
- Quality—five Five-Star Quality Rating System rating categories (one, two, three, four, or five stars) for three different star ratings (overall rating, staffing rating, and quality measure rating)
- Social deprivation indicators—located in a community with a high social deprivation index score or not (see Butler et al., 2012)

- Acuity—high acuity or not, where high acuity means more than 10 percent of residents are in the Resource Utilization Group-Version 4 (RUG-IV) Extensive Services group

From that initial 500-nursing home sample, the team randomly selected a subsample of 50 nursing homes for initial recruitment. The team made manual adjustments to the initially selected list to include nursing homes across all criteria of interest as listed above. Starting in August 2022, the Staffing Study team began recruiting nursing homes for site visits through emails and telephone calls. Nursing homes from the original subsample of 50 that declined to participate were replaced with purposive selection from the larger pool with nursing homes with similar characteristics, so that the final sample of nursing homes included in site visits remained balanced. Replacement sites were required to be an exact match on most characteristics, but when exact matches were not available in the sample, the candidate list was expanded to include sites with similar but not identical characteristics on quality (e.g., a site with a 3-star rating might replace a site with a 2-star rating). In all, 62 replacement nursing homes were identified for recruitment in addition to the original subsample of 50 nursing homes, for a total of 112 nursing homes targeted for recruitment. The Staffing Study team made more than 340 phone calls and sent 170 emails to these nursing homes, requesting participation. In addition, the Staffing Study team also mailed hard copy recruitment materials to the sampled nursing homes, including a CMS Letter of Support for the site visits, a letter from the Staffing Study team outlining the purpose and process for the site visits, and a one-page Information Sheet about the staffing study and site visits that could be distributed to nursing home staff.

In all, the Staffing Study completed 31 site visits between September 7, 2022, and November 3, 2022. As noted above, the Staffing Study team subsequently continued to recruit additional nursing homes to participate as a part of ongoing validation work, but findings in this section are based only on the 31 site visits completed during this timeframe. Findings from an additional 16 visits conducted after November 3, 2022 are presented in **Appendix C.5.**

Site Visit Protocol

The Staffing Study team developed a detailed site visit protocol and semi-structured interview guides for use in the site visits. The interview guides were designed to collect data systematically while allowing interviewers sufficient autonomy to organize their inquiries around individual question responses and staffing issues identified by the interview participants. Interviewer guides were developed for four participant groups:

- Interviews with ***nursing home leadership (administrators and directors of nursing)*** focused on topics such as how staffing decisions within the nursing home are made, including the mix of staff and number of staff per unit/shift, barriers to adequate staffing, and potential unintended consequences of a minimum staffing requirement.
- Interviews with ***licensed nurses (registered nurses [RNs] and licensed practical/vocational nurses [LPNs])*** and ***nurse aides*** focused on topics such as workload (e.g., how many residents they typically care for and how this varies across shifts and on weekends); perceptions of whether staffing levels are adequate to provide safe, high-quality care (e.g., including information on the amount of care that is missed or delayed because of staffing issues); challenges that might result from inadequate staffing; and benefits that might result from higher staffing.
- Interviews with ***residents and family/caregivers*** focused on topics such as their perceptions of the quality of care at the nursing home; the adequacy of nursing home staffing to meet their care needs, with a focus on activities of daily living (ADL) assistance and receipt of medications; and what matters most to them with respect to staffing.

The site visit protocol and interview guides were reviewed and approved by the Abt Associates Institutional Review Board.[2] The Staffing Study team conducted cognitive testing of the interview guides with staff from two nursing homes prior to their being finalized for the site visits. A detailed Data Security Plan was also developed to safeguard the qualitative data collected from participating nursing homes.

The Staffing Study team's site visit leads provided comprehensive training to all researchers participating in the site visits that included a thorough review of the interview guides and site visit logistics, an overview of nursing home staffing policies and issues, and a review of effective interview techniques.

Each site visit team comprised a senior qualitative researcher with experience in the nursing home setting and qualitative research, and a notetaker. Site visit teams spent up to two days at each nursing home. At the start of each site visit, either nursing home leadership provided study team members with a list of potential staff, residents, and family members/caregivers to interview, or staff volunteered for interviews when they were able to and alerted other staff members of availability for interviews when their interview was completed.

Interview participants were asked for their consent to have the interviews recorded so that site visit teams could refer to the recordings, if necessary, to ensure the notes from each site visit were comprehensive and accurate. If a participant was willing to be interviewed but declined to be recorded, they were not recorded. All recordings were stored on a secure hard drive and transferred to a secure server at Abt Associates after the completion of the site visit. The recordings will be deleted at study completion.

The site visit teams distributed anonymous Missed Nursing Care (MISSCARE) surveys at nurses' stations and in break rooms, as well as at the end of interviews with direct care staff. Staffing Study respondents placed completed surveys in a secure envelope, collected at the end of the site visit. The MISSCARE survey was developed by researchers at the University of Michigan to measure and determine the reasons for missed nursing care (Kalish & Williams, 2009); it was modified by the Staffing Study team for the nursing home setting. The paper survey, which is expected to take 5 to 10 minutes to complete, asks participants to report how frequently specific nursing care tasks are missed throughout the course of a shift, using a five-point Likert scale, from Never Missed to Always Missed. The survey also includes questions about the reasons why care is missed (e.g., emotional or physical exhaustion, lack of time, interruptions or multitasking, lack of cues/reminders, inadequate support from leadership).

Analysis

During the data collection period, the study team facilitated two theming meetings to allow the site visit teams to share their experiences with one another. The first meeting focused primarily on common themes emerging from the nursing home leadership interviews; the second meeting focused primarily on themes emerging from the direct care staff interviews. The site visit teams also discussed any complications or issues experienced during on-site visits.

After each site visit, interviewers reviewed and formalized their field notes and summarized the site visit in a standardized template; these summaries were coded in NVivo 12 software for efficient analysis of the interview and survey data. Site visit teams submitted envelopes containing the completed MISSCARE surveys and transferred all site visit documents and recordings to Abt's secure server. MISSCARE survey data were coded and entered in Excel, and then analyses were conducted using SAS.

The NVivo 12 codebook used in the analysis initially was developed using the domains from the interview protocols; thereafter, it was iteratively revised to include any new themes that arose during

[2] https://abtimpact.com/mission-impact-2020/ethics-and-governance/

coding. Two coding teams, each consisting of one senior-level and one junior-level researcher, coded each nursing home field notes template. The coders met weekly during the coding period to discuss findings and reach consensus on coding issues. Interrater reliability was tested and resulted in a kappa coefficient of 0.9, showing there was strong agreement among the coders. Framework matrices were used to examine data across interview types as well as across nursing home types.

3.1.3 Results

This section begins with summary statistics on the characteristics of participant nursing homes and individual interview participants. The remainder of the section summarizes qualitative findings by interview type and domain, with results from the MISSCARE surveys integrated throughout the section.

Characteristics of Participating Nursing Homes

Participating nursing homes were from 14 different states in nine CMS regions. The sample included urban and rural nursing homes and for-profit, non-profit, and government-owned nursing homes, with bed sizes ranging from small (<50) to large (>150) (**Exhibit 3.1**). Nursing homes visited ranged broadly in use of agency staff; percentage of Medicaid residents; and Nursing Home Care Compare Five-Star Quality Rating System overall and in its staffing and quality measure ratings.

Exhibit 3.1: Characteristics of Nursing Homes Participating in Site Visits

Nursing Home Characteristic	*n*		
Urbanicity			
Urban	29 (94%)		
Rural	2 (6%)		
Bed Size			
Small (0–80 beds)	8 (26%)		
Medium (81–119 beds)	11 (35%)		
Large (120+ beds)	12 (39%)		
Ownership Type			
Non-profit	12 (39%)		
Government	3 (9%)		
For-profit	16 (52%)		
Payer mix			
0–40% Medicaid	5 (16%)		
>40–70% Medicaid	15 (48%)		
>70% Medicaid	11 (35%)		
Use of Agency Staff			
0%	8 (26%)		
1–10%	12 (39%)		
>10%	11 (35%)		
Five-Star Quality Ratings			
	Overall Quality Rating	*Staffing Rating*	*Quality Measure Rating*
1 star	2 (6%)	3 (9%)	0 (0%)
2 stars	5 (16%)	8 (26%)	4 (13%)
3 stars	7 (23%)	4 (13%)	6 (19%)
4 stars	10 (32%)	12 (39%)	12 (39%)
5 stars	7 (23%)	4 (13%)	9 (29%)

Nursing Home Characteristic	*n*
High Social Deprivation Index[1]	6 (19%)
High Acuity[2]	3 (10%)

Source: Nursing Home Care Compare Provider Summary (which is derived from the PROVIDERINFO files available at www.data.cms.gov)
Notes: Includes 31 nursing homes visited September 2022–November 2022 in the following states: CA, CO, FL, IL, MA, MD, MO, NC, NY, OH, PA, VA, WA, WY. Initial recruitment efforts included nursing homes from all 10 CMS Regions; however, the first 31 site visits did not include any nursing homes from Region 6.

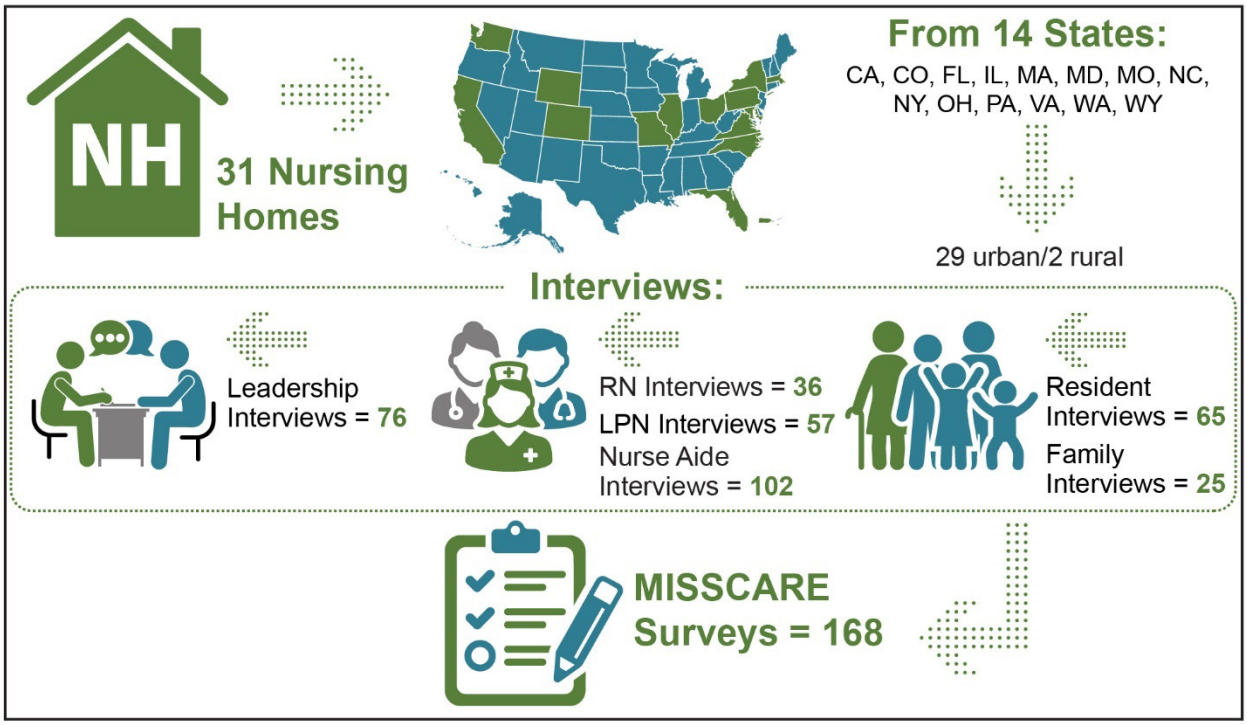
[1] Number of nursing homes that are in communities with a high social deprivation index score.
[2] Number of nursing homes that have >10% of residents in the Extensive Services RUG-IV group.

Characteristics of Individual Respondents

Exhibit 3.2 shows characteristics of the 361 individual interview respondents across all 31 nursing homes participating in the site visits. The study team spoke to staff including administrators or directors of nursing, RNs, LPNs, and nurse aides in every nursing home. Participating staff typically worked the day or evening shifts, but many respondents reported working a rotating weekend shift. They also had a broad range of experience within each nursing home, as well as experience in long-term care. Nursing home resident respondents included those who had been in facilities for a short period to many years; families most frequently visited weekly or daily.

The study collected MISSCARE surveys in 21 of the 31 participating nursing homes across 13 of the 14 states. The average number of surveys completed per facility was 8, with a range from 1 to 23. The majority of responses to the survey were from nurse aides (57 percent); 35 percent of responses were from licensed nurses (RNs, LPNs), including nurse managers. The remainder were other staff types, such as support aides. Nearly 70 percent of responses were from staff with at least 2 years' experience on their current unit; 30 percent of responses were from staff with more than 10 years' experience on their current unit.

Exhibit 3.2: Summary of Individual Site Visit Respondents



Staff Characteristic	Leadership n=76	RN n=36	LPN n=57	Nurse Aide n=102
Years in facility (mean, minimum–maximum)	4.8 (0.1–40)	5.7 (0.3–40)	6.9 (0.1–31)	7.6 (0.1–35)
Years in long-term care (mean)	18.3 (1–42)	11.3 (1–43)	15 (0.1–38)	14.5 (0–44)
Typical Shift Worked[1]	**RN**	**LPN**	**Nurse Aide**	
All	1	1	2	
Day	23	35	72	
Day and evening	6	12	11	
Typical Shift Worked[1]	**RN**	**LPN**	**Nurse Aide**	
Day and weekend	0	2	0	
Evening	3	3	12	
Evening and night	1	1	1	
Night	1	1	3	
Varies	1	1	1	
Missing	0	1	0	
Family/Resident Characteristics (N=90)[1]	**Mean**	**Minimum**	**Maximum**	
Length of time as a resident (in years)	3.07	0.01	25	
Frequency of Visits by Family (N=90)[1]				
Daily	11			
Weekly	17			
Monthly	9			
Annually	3			
No visits	3			
Missing	47			

Source: Data collected during participant interviews.

[1] Not all participants provide responses to all interview questions; counts reflect total number of responses rather than total number of interviews.

Qualitative Findings by Interview Type and Domain

This section provides high-level findings from the interview and MISSCARE survey, organized by four key domains: (1) impact of resident assignment on care delivery; (2) impact of shift/unit staffing on care delivery; (3) staffing challenges; and (4) considerations for a minimum staffing requirement. It presents common themes that emerged in each domain, synthesizing responses across participant types.

Throughout this section, sample sizes for included tables may vary because not all participants responded to every interview or survey question.

Impact of Resident Assignment on Care Delivery

Direct care staff described how increasing numbers of residents they are assigned to care for affects their ability to complete clinical care in a timely and safe manner, noting that often a higher resident assignment led to prioritizing competing demands rather than caring comprehensively for all residents. A high resident assignment often also led to less time for communication with family or other health providers or both, as well as less ability to proactively prevent medical and/or behavioral issues. Some staff stated that rushing through care because of having high-acuity residents or a high resident assignment led to medication errors and safety issues. One nurse said, *"If it's just me with 33 patients, it's not safe*."

Approximately half of all nurse staff respondents reported that their assignments were reasonable to provide high-quality, safe care to residents. This ranged from 44 percent of LPN respondents to 52 percent of nurse aide respondents; 48 percent of RN respondents reported their typical assignment was reasonable. The other half emphasized that they believed they could provide the bare minimum of care, but that the quality of that care often suffered and negatively affected staff-resident relationships. One nurse aide described how having the right staffing and resident caseload meant "*the resident becomes central to the care provided.*"

> *"When we're short staffed, residents are getting bladder infections and bed sores; sometimes they're falling on the floor trying to get to the bathroom."*
>
> –Nurse

Direct care respondents (RNs, LPNs, nurse aides) consistently noted that resident acuity was more important than the actual number of assigned residents in determining whether their assignments were reasonable. Having residents with cognitive impairment and higher levels of personal care needs could affect the staff's ability to provide care adequately and safely more so than could having a higher number of residents assigned without those same impairments and care needs.

> *"Grooming and hygiene tasks are often delayed or missed if [nurse aides] have too many residents assigned to them. There are not enough staff to physically do all the transfers out of bed in the mornings, so residents often stay in bed … staff do not have time to walk people … and then there is a loss of mobility that results over time. Call lights are not answered in a timely manner and residents become incontinent."*
>
> –Nurse aide

Nurse aides noted that the rise in number and acuity of their resident assignments has affected their ability to perform aspects of ADL care, most often bathing and daily hygiene, as well as delaying delivery of meals.

Many direct care respondents reported that they wish they had more time to provide the care their residents need, and disappointment in their job performance and satisfaction when they feel pressured to rush through their assignments. They also described the emotional effects of having too many residents assigned to them, including guilt and frustration from having less time to connect with residents and their families. Leadership similarly noted their staff are increasingly unhappy with their inability to connect with residents and believe their work is solely focused on "physical survival," leading to burnout and turnover and noting the connection to quality of resident care.

> *"When there is not adequate staffing, you see staff burn out and stressful situations that escalate that don't need to … . Residents are more stressed from that, and the delivery of care is not as good. You don't have happy staff and you don't have happy residents"*
>
> –Leadership

Families and residents described understanding how overworked and burdened nurse staff are; however, many expressed serious concerns about not receiving high-quality care. Residents who need toileting assistance sometimes waited a long time when they rang call bells for help because the staff were busy doing other tasks. One resident recalled having to sit in a soiled diaper for hours, causing "big sores." Timeliness of care was also frequently cited as an opportunity for improvement.

> *"Sometimes I press my button, pretty close to being an emergency, and it takes hours for staff to respond. Sometimes I have to use the bathroom around lunchtime, and that's their busiest time—delivering trays, picking up trays. … They just can't get to you! Almost every day, this happens."*
>
> –Resident

Impact of Shift/Unit Staffing on Care Delivery

To better understand the impact of short staffing on care delivery, researchers first inquired about the benefits, both to residents and staff, of staff working on shifts/units that are fully staffed.

Benefits of working fully staffed. Direct care staff were asked how working fully staffed (meaning all staff who were scheduled to work were present) benefits providing care to their resident assignment. Across all staff types, respondents stated that being fully staffed leads to safer and more-efficient care, increased resident satisfaction with care, improved job satisfaction, and less staff burnout and turnover. Respondents agreed that being fully staffed meant that they were able to provide better care to residents, focusing on person-centered care and providing a more home-like environment to residents. Better collaboration and teamwork were mentioned consistently, since being fully staffed allows everyone to focus on the tasks and skills best suited to their role. Both licensed nurses and nurse aides described how being fully staffed increased their ability to communicate and connect more with residents, which was beneficial for everyone and an essential aspect of job satisfaction.

> *"Residents are getting quality care, and you get to leave knowing you provided good care. ... Everything flows more easily, and you can do things with a positive attitude."*
>
> –Nurse

Frequency of short staffing. A majority of respondents reported working short staffed multiple times a week (**Exhibit 3.3**), exemplified by one nurse saying, "*I don't know the last time we had [a full shift].*"

Exhibit 3.3: "Over the Last Month, How Often Did You Work Short Staffed?"

Response Option	RN (n=34)	LPN (n=55)	Nurse Aide (n=84)
Every other week	0%	7%	10%
Every week	15%	11%	13%
Multiple times a week	62%	56%	58%
Other	24%	25%	19%

Source: Data collected during participant interviews

Respondents noted that when they are working short staffed, multiple demands on their time mean they must make decisions about care priorities; as a result, some care could be delayed and sometimes completely missed. Respondents across all interview types noted the impact of short staffing on residents and resident care as well as on the staff themselves, frequently citing physical exhaustion and burnout.

Prioritizing, delaying, and missing care tasks. When working short staffed, licensed nurses and nurse aides described triaging care priorities based on resident acuity and personal needs; the highest-acuity residents and residents with a sudden change in status are typically tended to first. Medication administration is a top priority when prioritizing care. One nurse described working short staffed as only being able to prioritize care by the hour, especially given the rising acuity of residents. When asked about delayed or missed care, staff described how they make decisions about which tasks could be handed off to the next shift.

> *"You can't have mistakes with med passes. You know what the absolutes are. If someone needs a dressing changed two times a day and you have inspected it and it looks good, you know you can save it for the next shift and focus on someone with blood pressure meds who needs it."*
>
> –Nurse

> *"Sometimes showers don't get done because we don't have enough staffing. There are times when we get people cleaned or washed, but we can't get them out of bed because we are that far behind. … There are people who [use] lifts and Hoyers that need that much extra assistance to get them out of bed or back in. … Sometimes we leave them in bed for the day, which isn't right, but we're that short of staff."*
>
> –Nurse aide

For nurse aides, top priorities were ensuring residents were fed and cleaned up if soiled. Some ADL care including feeding assistance and toileting was prioritized over grooming and other hygiene tasks such as brushing hair/teeth, showering, and straightening resident rooms. Tasks related to resident mobility or engaging residents in activities were often delayed or not performed. One respondent noted that if they are short staffed, only residents who require assistance with eating, are at risk for choking, or require supervision at mealtimes are fed in the dining room, while less-dependent residents eat in their rooms.

In response to the question, "How frequently are the following care tasks missed by direct care staff on your shift/unit?" the most commonly reported missed tasks included response to call lights, toileting assistance, oral care, bathing, and ambulation. Across all tasks, reported frequency of missed care does not significantly vary by job type. The MISSCARE survey results show that missed care is most common when staffing is reported to be adequate only 25 percent of the time (**Exhibit 3.4**). The most significant reasons reported for missed care included inadequate staff and inadequate assistive personnel, followed by emotional/physical exhaustion, interruptions or multitasking, and an unexpected rise in acuity (**Exhibit 3.5**).

Exhibit 3.4: Frequency of Missed Care by Percentage of Time Staffing Is Adequate (n=151)

Task	Mean Frequency of Missed Care (0–4 scale) How Often Staffing Is Adequate[1]				
	0% of the Time	25% of the Time	50% of the Time	75% of the Time	100% of the Time
Ambulation/mobilization	2.11	2.42	1.73	1.30	1.53
Pressure relieving interventions	2.12	1.87	1.38	1.16	1.58
Feeding residents while food at proper temperature	1.61	1.94	1.50	1.05	1.68
Meal set-up	0.89	1.43	0.68	0.73	1.20
Medications administered as scheduled	1.07	1.84	1.25	1.03	1.07
Assessment of vital signs	1.33	1.51	1.30	0.74	1.11
Monitoring intake/output	1.35	1.67	1.37	1.03	1.21
Full documentation of care	1.78	2.27	1.67	1.27	1.80
Bathing/showering	1.89	2.48	2.13	1.28	1.53
Oral care	2.18	2.45	2.20	1.30	1.47
Glucose monitoring	0.53	0.92	0.67	0.53	0.54
IV/central line site care	0.55	1.00	0.78	0.76	1.00
Response to call light w/in 5 minutes	1.50	2.69	2.13	1.55	1.75
Act on PRN med request w/in 15 minutes	1.20	1.93	1.40	1.16	1.40
Attend interdisciplinary care conferences	1.60	2.42	2.00	1.04	0.91
Toilet assist w/in 5 minutes	1.56	2.73	1.72	1.33	1.89
Skin/wound care	1.06	1.68	1.00	0.94	1.07
Surveillance of cognitively impaired	1.67	2.12	1.36	1.10	1.28
All tasks combined	**1.48**	**2.04**	**1.51**	**1.09**	**1.38**

Source: Data collected from MISSCARE survey

[1] Responses coded 0-4 where 0 = 0% of the time,1 = 25% of the time, 2 = 50% of the time, 3 = 75% of the time, and 4 = 100% of the time.

Exhibit 3.5: Significance of Reasons for Missed Care

Reason	Significance of Factor as Reason for Missed Care (n=151)[1]								
	Not a Reason (0)		Minor Reason (1)		Moderate Reason (2)		Significant Reason (3)		Mean (0-3 scale)
	n	%	n	%	n	%	n	%	
Inadequate staff	21	14.1%	18	12.1%	29	19.5%	81	54.4%	2.14
Inadequate assistive personnel (nurse aide, med tech)	25	16.3%	23	15.0%	31	20.3%	74	48.4%	2.01
Emotional or physical exhaustion	29	19.3%	24	16.0%	40	26.7%	57	38.0%	1.83
Interruptions/multitasking	24	15.7%	28	18.3%	53	34.6%	48	31.4%	1.82
Unexpected rise in acuity	25	17.2%	32	22.1%	47	32.4%	41	28.3%	1.72
Tension/communication w/in nursing or med staff	33	21.7%	38	25.0%	40	26.3%	41	27.0%	1.59
Lack of back-up support from team	34	22.2%	38	24.8%	42	27.5%	39	25.5%	1.56
Urgent resident situations	32	21.2%	35	23.2%	53	35.1%	31	20.5%	1.55
Tension/communication w/ other staff/departments	36	23.4%	41	26.6%	40	26.0%	37	24.0%	1.51
Inadequate support from nursing leadership	40	26.3%	38	25.0%	35	23.0%	39	25.7%	1.48
Unbalanced resident assignments	42	28.0%	39	26.0%	39	26.0%	30	20.0%	1.38
Inadequate supervision of nurse aides	39	25.7%	46	30.3%	40	26.3%	27	17.8%	1.36
Supplies/equipment not available when needed	36	24.2%	52	34.9%	40	26.8%	21	14.1%	1.31
Inadequate hand-off previous shift/unit	46	30.1%	44	28.8%	34	22.2%	29	19.0%	1.30
Supplies/equipment not functioning	47	30.9%	46	30.3%	35	23.0%	24	15.8%	1.24
Lack of cues/reminders	54	35.3%	45	29.4%	31	20.3%	23	15.0%	1.15
Medications not available when needed	54	38.0%	37	26.1%	28	19.7%	23	16.2%	1.14
Heavy admission and discharge activity	49	33.3%	46	31.3%	37	25.2%	15	10.2%	1.12
Other departments did not provide needed care	56	36.8%	51	33.6%	29	19.1%	16	10.5%	1.03

Source: Data collected from MISSCARE survey.

[1] Responses coded 0-3 where 0 = Not a Reason, 1 = Minor Reason, 2 = Moderate Reason, and 3 = Significant Reason for Missed Care.

Additional help during short staffing. Many respondents described ways in which they attempted to help one another and support resident care while working short staffed, but there was mixed feedback about the availability of other types of staff to help when a shift/unit was short staffed. The availability or willingness of others to help was not evident in all nursing homes and depended on availability of additional staff and the culture of the nursing home. Some nursing homes pulled ancillary staff such as social workers, therapists, and activity directors, as well as administrative and front desk staff, to come to the floors and support clinical and ADL care when shifts/units were short staffed.

> *"If [there are] not enough [nurse aides], I pitch in and help them with the bathing and other care tasks. Some other nurses do this, but some nurses won't. The activity staff help the residents so much; they bring water and make sure the residents are comfortable."*
>
> –Nurse

Respondents acknowledged that pitching in is helpful in meeting the minimum care needs of residents, but it is not a long-term solution because ancillary staff are not as familiar with clinical caregiving and resident routines. Some respondents reported that while resident safety might not be compromised when other staff help, the quality of that care can be diminished. "Borrowing" staff from other departments also prevents those staff from completing their own work. For example, medication administration and other administrative tasks take longer than usual if RNs are being pulled to do ADL care.

> *"If you're behind on your work, you know what you have to do to catch up. You can't say, 'Hey, can you do all my paperwork?' You know what I mean?"*
>
> –Nurse

Personal impact of working short staffed. Asked how short staffing affects their personal health and well-being, the overwhelming majority of nurse staff respondents reported physical, emotional, and mental burnout from working short staffed, as well as lasting impacts on their well-being.

Respondents noted that the lasting effects of exhaustion from the COVID-19 public health emergency have not subsided. Staff reported difficulties with processing their grief from losing family, residents, and colleagues. As a result of short staffing, respondents described not being able to take breaks they need, which had consequences for their physical health.

> *"We are all tired. Nursing post-COVID versus pre-COVID is completely different. Before we were tired, and some had insane hours, but before you felt more comfortable saying you weren't going to pick stuff up or do XYZ. Now there is a guilt with it. People are really overexerting themselves. They are tired and grumpy, and they don't realize they are. Someone might stay until 2 a.m. because no one else would do it. You want to take care of your residents so much, so you are tired. That's when injuries happen for staff, workplace injuries."*
>
> –Nurse

Feedback about staffing. Residents provided mixed feedback about staffing. Families and residents reported empathy and kindness towards the staff at the facilities where they resided: "*Most of the staff truly enjoy and take pride in their work. They're anxious to help the residents*." Residents with consistent staff assignments reported enjoying having staff who knew their routines and preferences. Another resident described being pleased with the staff but believed the staff were held too tightly to specific tasks, wishing they were able to be more flexible in their ability to assist residents: *"They are kind and helpful, but they are restricted by their roles."*

Many residents and families reported that basic care needs were being met, such as medications, but that, consistent with reports from nurse staff respondents, needs such as showering, hygiene care, hot meals, meal options, and getting to bed in a timely manner frequently are not met, or not met when they would prefer. One family member described their disappointment with their resident's hygiene care as "*the care he's not getting. Sometimes he'll go two weeks without a bath*."

Some nurse staff respondents raised concerns about agency staff brought in to provide direct care, noting they were transient and less familiar with the residents. Staff working in facilities with higher levels of agency staffing felt undervalued because agency staff have "more power" in being able to make their own schedules and earn significantly higher pay than employed staff. Families and residents also expressed concerns with agency staffing, speaking to a lack of person-centered care as well as a lack of care continuity.

Challenges to Adequate Staffing

Asked about the biggest challenges their nursing home faces with staffing, the overwhelming majority of respondents reported it was recruitment of new staff and retention of current and newly hired staff. Leadership respondents consistently cited the lack of staff available to fill open positions. They described short staffing as being directly related to poor outcomes and safety risks, and acknowledged how frequently shifts/units are short staffed. They believed they could not overcome these staffing challenges, however.

> *"It is bad. I did increase the ratio … but I can't get it staffed. … It has been the short staffing problem over nine years. I have never been fully staffed for the nine years"*
>
> –Leadership

Staffing challenges were attributed to long-standing issues related to the stigma of working in nursing homes, low pay, and difficult working conditions. Respondents noted that this situation was exacerbated by COVID-19, when many direct care staff left the long-term care workforce completely because of burnout and difficult working conditions. As one leadership staff member described the situation, "*You have people leaving the industry faster than we can educate, hire, and onboard new staff*."

Another common challenge reported was workforce competition. According to respondents, nursing homes found themselves competing with better-paying jobs in other health care sectors, such as hospitals, and with staffing agencies offering better pay and more flexibility. Some respondents also cited competition with local businesses unrelated to health as making filling nurse aide positions particularly challenging.

Highlighted by the COVID-19 public health emergency, challenges in nursing homes have persisted over many years. The site visit findings suggest that a minimum staffing requirement should consider nurse staff pay as well as the local area labor pool. Staff and residents alike expressed concern with the use of agency staff to fill staffing gaps; they seek limits on agency staff pay and more investment in the employed staff in nursing homes. While direct care staff in general have been leaving nursing home employment, many respondents expressed a wish to stay with the places they know and provide good care but would like better pay and more flexible schedules like these agencies are able to offer.

Considerations for a Minimum Staffing Requirement

Respondents described both benefits of and concerns about implementing a minimum staffing requirement. Perceived benefits included the possibility of having a fully staffed nursing home on each shift/unit. Respondents believed that a minimum requirement would decrease staff burnout, improve person-centered care, and decrease safety concerns. Nurse staff respondents stated that with a minimum staffing requirement in place, administrators would be required to keep units and shifts fully staffed and to have back-up plans in place for short-staffing incidents.

> *"It will give a foundation for [nursing homes] to know that they need to run staffing at a level to take care of their residents. Some corporations dictate staffing levels that aren't adequate for the residents being served."*
>
> –Nurse

Conversely, respondents reported concerns about being unable to meet a minimum staffing requirement because of existing hiring and retention challenges.

> *"The timing of a minimum staffing requirement couldn't be worse. On the heels of COVID and the Great Resignation, there is not enough staff to fill the open positions. The ratios for staffing will likely be unattainable and the facility won't be able to meet them. If penalties are put in place, many facilities will have to decrease the number of beds available, discharge current residents, or have fewer admissions. … Many facilities will close their doors if penalties and fines are put in place."*
> –Nurse

Particularly in rural areas and for nursing homes with fewer financial resources, respondents reported concerns about having a limited staffing pool to draw from and not being able to offer competitive wages to recruit and hire new staff to meet a minimum requirement. Additional leadership concerns were lower quality ratings and financial penalties associated with not being able to meet a minimum requirement.

Some respondents reported concerns about a potential minimum staffing requirement being set too low, fearing that some administrators will understaff shifts, or that the minimum will become the maximum, despite staff struggling to provide high-quality, safe care at their current staffing levels. Finally, many respondents were concerned about using a "one-size-fits-all" approach for a federal staffing requirement. As one respondent described, *"I don't know if you can put a minimum on taking care of someone's loved one."*

Factors to consider when developing a minimum staffing requirement. Respondents noted factors that should be considered when developing a minimum staffing requirement:

- Resident acuity
- Staff competence
- Shift type
- Optimum staffing, instead of minimum staffing
- Different staffing requirements for nurse aides and licensed nurses

Respondents were often unsure whether a minimum requirement is necessary or whether a minimum staffing requirement would solve the root cause of the staffing problems in nursing homes, which they indicated as a lack of available employees to fill open positions.

When emphasizing the need for resident acuity to be considered in a minimum staffing requirement, respondents noted that higher-acuity residents can be at greater risk of falls; aggressive behaviors; cognitive decline; and the need for assistance with feeding, mobility, and toileting. As such, those types of residents will require more care and hence higher staffing than will residents without that same acuity and morbidity.

Respondents also emphasized the importance of quality, rather than quantity, of staff. One nurse noted that working fully staffed is irrelevant if the workers are inexperienced and not well trained. Another nurse cited her 28 years of experience as a reason to assign her a higher number of residents, whereas *"Anyone who has a lack of knowledge is going to take more time to seek the right answer. It's hard to guess when it comes to nursing."* Several leadership respondents agreed that quantity of staff does not equate to success; rather than a minimum staffing requirement, they stated they "*would like to see mandates for additional staff training or education."*

Respondents reported mixed perspectives on considerations that should be given to staffing by shift type. Some reported higher needs for staffing across day and evening shifts compared to night shifts. Some respondents believed that all shifts should be staffed equally, in case of medical emergencies. Others believed weekends require different staffing compared to weekdays because residents do not typically have out-of-nursing-home appointments or other external obligations on the weekends.

Respondents stated that being able to provide thorough, personalized care to residents should be more important than a specific staffing level. They noted that the staffing requirements should accommodate more than just bare minimum duties. Secondary tasks such as shaving, clipping nails, and conversing with residents about their lives should be factored into a minimum requirement.

> *"I wish we could stop looking at the bare minimum; the goal is not to scrape by. But that feels like what we've had to do. We haven't had the freedom to be comfortable in such a long time. We are constantly scraping by. I wish the bare minimum didn't have to be the pinnacle of hope."*
>
> –Leadership

Nurse staff frequently described collaborating with one another, but they emphasized the importance of separate staffing requirements for each type of direct care staff. They noted that nurse aides and licensed nurses constitute "two different worlds" given their unique set of responsibilities, and so there should be distinct requirements for each staff type.

> *"There's a fine line between enough staff and too many staff. Sometimes, the more help, the less gets done—they're busy talking and taking longer breaks."*
>
> –Leadership

Most respondents were in favor of reducing workloads by increasing staffing levels, but a few leadership respondents were concerned about the possibility of overstaffing.

Residents and family members described their understanding of short-staffing issues throughout health care, and more specifically in their nursing homes, but also consistently expressed frustration at not being able to receive the care they want and need for themselves and their loved ones. The majority of family and resident respondents described having safe, consistent, resident-centered, timely care as the most important aspect to be considered for staffing levels. Some others included wanting to feel like they were being treated like family, that the facility was clean, and food was served warm.

Some leadership respondents believed that any staffing requirement should be a guideline instead of a mandate—and that rather than penalizing nursing homes that fail to meet the minimum, the government could provide financial incentives to high-performing facilities that exceed the minimum. Alternatively, a "minimum quality of care" requirement would be a more direct measure of success. Respondents from nursing homes in states with their own staffing mandates believed that existing guidelines were sufficient, and that a federal mandate would be excessive.

Finally, respondents had reservations about a minimum staffing requirement being a reactive solution. As one leader described, *"Changing the requirement is not fixing the problem; it's just putting more stipulations on the problem."* Given the shortage of applicants for permanent jobs in nursing homes, many leadership respondents emphasized the importance of addressing the pipeline problem before mandating a staffing requirement.

Unintended consequences of a minimum staffing requirement. Some respondents reported how a minimum staffing requirement could lead to overall decreased nursing home admissions and to preferential placement of lower-acuity residents.

> *"You will see nursing homes not take admissions in order to stay compliant. … Facilities know they will make more money off certain residents and [thus] not take difficult patients."*
>
> –Leadership

Additionally, they stated that nursing homes that struggle to secure enough staff might be forced to discharge their residents prematurely or to close. Respondents overall noted that a minimum requirement might improve quality of care for some current nursing home residents while precluding others from entering or staying at nursing homes altogether.

Some respondents also reported concerns that a staffing requirement might widen disparities between nursing homes, causing *"a bigger divide between the facilities that are patient-focused and money-focused."* They described concern that if the minimum requirement is lower than a facility's current standards, administration might lay off some staff to save money. Other respondents believed non-profit nursing homes will suffer from a minimum requirement, whereas for-profit nursing homes will "*likely be okay*." Some noted that facilities in rural areas might struggle to meet the staff requirement.

> *"The lowest-performing facilities will hopefully close. At the end of the day, our primary function is to help the community. If those nursing homes are already terrible, then realistically the folks that are there would be better going somewhere else—if there is somewhere else to go to. For instance, this is a 150-bed facility, but we are operating at half capacity. There's something to be said for consolidation of resources if those staff choose to stay in the industry and transfer to a higher-performing nursing home."*
>
> –Leadership

Proposed minimum requirements by staff type. Respondents were asked what they think the federal minimum staffing requirement should be. Nurse staff respondents suggested minimum staffing requirements in terms of the number of residents per shift/unit they felt they could safely manage. Nurse aides proposed a range of 5 to 14 residents per aide. RNs and LPNs suggested ratios from 8 to 25 residents per licensed nurse, while some gave higher numbers for RNs. These suggestions were sometimes lower than the number of residents they currently supported. Staff elaborated on their suggestions, recommending that these numbers could fluctuate based on resident acuity, unit type, and time/duration of shift.

3.1.4 Discussion

The site visit interviews give an important voice to nursing home staff and residents to share their experience. These findings provide contextual evidence on the quality and safety implications of minimum staffing requirements, along with other potential benefits. Collectively, these findings also provide insight into challenges that nursing homes currently face in providing safe, high-quality care to residents that could be mitigated by a minimum staffing requirement, as well as potential barriers to implementing a federal requirement.

Overall, respondents reported pervasive short staffing in their nursing homes. Only about half of nurse staff respondents reported that their typical assignment was reasonable to provide safe and high-quality care. Respondents also reported that they could provide higher-quality and safer care when fully staffed. This finding is consistent with the literature showing a relationship between staffing and quality outcomes, such as lower prevalence of pressure ulcers, less use of physical and chemical restraints (Harrington et al., 2020; Shin & Bae, 2012; Bostick et al., 2006), and lower rates of acute care transfers (Spector et al., 2013; Grabowski et al., 2008).

Respondents described different roles and care tasks performed by licensed nurses and nurse aides similarly to what is noted in the literature (Bonner et al., 2022; Firnhaber et al., 2020), with the latter spending the most time with residents and being most familiar with resident preferences. Activities of daily living, such as bathing or showering and oral care, were reported to be delayed or omitted when short staffed, which aligns with research showing the relationship between nurse aide staffing and ADL care delays (Schnelle et al., 2016). Because respondents reported prioritizing clinical tasks when staffing was inadequate, a minimum staffing requirement could enhance timely receipt of ADL support and quality of resident life. Nurse staff respondents and families and residents both reported that adequate staffing enables more person-centered care. These represent important dimensions of resident experiences not readily captured by existing quantitative measures.

Staff interview responses additionally suggest that a minimum staffing requirement would potentially benefit nurse staff as well as residents. These staff reported dissatisfaction in having to rush through

resident care, as well as emotional and physical burnout from having high resident assignments because of staffing shortages. Leadership respondents also noted the impact of short staffing on staff satisfaction.

The site visit findings also highlight potential challenges to a minimum staffing requirement, as well as possible unintended consequences. Respondents described the difficulty of keeping nursing homes adequately staffed currently and the day-to-day challenges of recruiting health care workers to long-term care that have contributed to staffing shortages. They reported challenges filling open positions and high staff turnover, as well as the impact of the COVID-19 public health emergency on staffing and morale, consistent with other research (Gasdaska, 2020; AHCA/NCAL, 2022).

Leadership respondents additionally raised concerns about the costs of using agency staff to fill vacant positions. Some noted that a minimum requirement could result in nursing home closures. Published estimates of the potential costs of a minimum staffing requirement reinforce cost concerns, with one report suggesting that a 4.1 nurse staff hours per resident day (HPRD) requirement would cost the long-term care industry more than $10 billion annually (CLA, 2022). Another estimated the additional staffing costs of a 4.1 nurse HPRD threshold at $7.25 billion (Hawk et al., 2022). Other potential unintended consequences reported by respondents include decreased nursing home admissions and preferential placement of lower-acuity residents.

Findings from the site visits should be viewed in the context of a few study limitations. While the study team used a stratified sampling approach for identifying and recruiting nursing homes to participate in the study, participating facilities are not necessarily a representative sample of all nursing homes nationwide. There were study recruitment challenges because of COVID-19 outbreaks, significant weather events including Hurricane Ian, concern about site visits occurring during survey windows, and difficulty recruiting low-staffed nursing homes because of the added burden of having to take direct care staff off the units to participate in interviews. Additionally, findings are based on self-reported information from individual participants. The estimated length of time it takes to complete tasks and other concrete responses are subjective but support triangulation with other study data. Despite these limitations, the interview findings provide important evidence on staffing and potential benefits of and challenges to minimum staffing requirements that may not be readily assessed using quantitative data.

3.2 Public Stakeholder Listening Session on Minimum Staffing Requirements

Key Takeaways

- Stakeholders supported consideration of race and socio-economic status when assessing nursing home staffing given implications for equity.
- Stakeholders recommended prominent visible displays of staff-to-resident ratios in the nursing home to inform residents and staff of staffing levels.
- Stakeholders suggested low Medicaid reimbursement levels and staff burnout/workforce shortages would present substantial challenges for implementation of a federal minimum staffing requirement. A more adequately trained workforce and more availability of training and education are needed.
- Stakeholder feedback indicated minimum staffing requirements should account for resident acuity and should consider quality of life in addition to quality of care.
- Stakeholders reported that CMS should consider including non-nurse staff in minimum staffing requirements.

This section describes the second stakeholder listening session, which was focused on obtaining public input on minimum staffing requirements. Attendees provided feedback on addressing disparities, making minimum staffing requirement information available, and cost and other considerations for establishing a minimum requirement.

3.2.1 Overview

The second stakeholder listening session, held on August 29, 2022, was open to the general public and included 668 individual participants. This session was intended to obtain feedback on specific questions related to minimum staffing requirements from a broad group of stakeholders and to provide additional contextual evidence. The questions posed for stakeholder discussion were:

- How do we ensure that issues of health equity / health care disparities are addressed when establishing minimum nurse staffing levels?
- How do we ensure that both health care staff and residents are aware of their nursing home staffing levels and whether or not they are in compliance with minimum staffing requirements?
- Should minimum staffing requirements be displayed in nursing homes in consumer-friendly ways and be accessible for both visitors and staff?
- When examining the regulatory/economic impacts related to establishing minimum staffing requirements, CMS recognizes that RN/LPN/CNA salaries vary by state. How should minimum staffing requirements consider differences in costs for job categories and variations across states?
- What else should CMS consider as part of the staffing study? And what else should CMS consider in establishing minimum staffing requirements that has not been discussed?

3.2.2 Methods

The second listening session was held virtually via the Abt WebEx platform. The Staffing Study team worked with CMS to develop objectives and questions for discussion, as well as facilitating the virtual discussion and summarizing key takeaways.

The session was open to the general public, with attendance capped at 3,000 registrants. CMS announced the listening session through various channels including a CMS blog post, and the Staffing Study team promoted the session through its existing network of nursing home stakeholders. Registrants indicated whether they wanted to provide a brief response (no more than three minutes) to any of the five questions posed for the session; speaking opportunities were limited to the first 30 registrants who expressed interest in offering responses to the questions.

The listening session began with an overview of the Staffing Study design, followed by a review of the five questions. A copy of the presentation may be found in **Appendix D**.

3.2.3 Results

Key points from the second listening session for each of the questions discussed were as follows.

How do we ensure that issues of health equity / health care disparities are addressed when establishing minimum nurse staffing levels?

Stakeholders noted that race and socio-economic status should be examined when evaluating nursing home staffing because staff working in nursing homes are disproportionately women, people of color, and immigrants. Stakeholders suggested looking at staffing levels stratified by race and socio-economic status. They suggested the study implement an equity or racial impact analysis of required staffing

changes to help understand how a new minimum staffing requirement might help or hurt minority populations. Stakeholders also urged CMS to create a nursing home health equity advisory committee.

How do we ensure that both health care staff and residents are aware of their nursing home staffing levels and whether or not they are in compliance with minimum staffing requirements? Should minimum staffing requirements be displayed in nursing homes in consumer-friendly ways and be accessible for both visitors and staff?

Stakeholders suggested staffing ratios be posted so that residents and family members could confirm with individual staff if their resident assignment complied with the posting. Stakeholders also noted the need to display daily staff-to-resident ratios for all shifts in a consumer-friendly manner in a readily visible spot in the nursing home.

How should minimum staffing requirements consider differences in costs for different job categories and variations across states?

Stakeholders noted that the geographic location of nursing homes and the cost of living in the area around them affect the available applicant pool. They noted that disparity in Medicaid reimbursement across states will make it difficult for many nursing homes, especially those in high cost of living areas, to attract needed staff to meet minimum staffing requirements.

Stakeholders noted a need for adequate Medicaid reimbursement for nursing homes to be able to pay competitive salaries to attract and retain staff. They contended that nursing homes are spending approximately 50 percent more on hourly wages now than in the past two to three years, yet there has been no concomitant increase in Medicaid reimbursement. They noted that many nursing home providers are facing insolvency in states with chronically underfunded Medicaid reimbursement rates.

There was general concern about the ability of nursing homes to meet minimum staffing standards, especially nursing homes in areas of the country already struggling with a workforce shortage. Without competitive salaries, staff often work multiple jobs, contributing to burnout, the spread of illness, and chronic short staffing as staff call out of scheduled shifts.

Stakeholders suggested CMS could offer incentives to small, rural, and standalone (not part of a corporation) nursing homes to help them meet minimum staffing requirements. Finally, stakeholders noted that new requirements without funding will make it even more difficult for nursing homes in areas with significant workforce shortages to hire staff necessary to meet minimum requirements.

What else should CMS consider as part of the Staffing Study? And, what else should CMS consider in establishing minimum staffing requirements that has not been discussed?

Many speakers recommended that CMS consider resident acuity levels when developing minimum staffing requirements. Stakeholders also recommended CMS evaluate staffing differences between non-profit versus for-profit nursing homes, rural versus urban nursing homes, chain versus standalone nursing homes, and nursing home ownership as part of the Staffing Study. They added that CMS should consider the use of agency staff versus employee nursing home staff, as the use of agency staff can have an impact on quality of care.

Stakeholders suggested that CMS look at the entire interdisciplinary team and the care provided by non-nurse staff when developing a minimum staffing requirement, adding that these staff should be able to count towards the minimum.

Stakeholders recommended that the Staffing Study consider quality of life in addition to quality of care and that CMS provide incentives for staff to have time for both. Stakeholders urged CMS to consider the time needed for staff to have meaningful interaction with residents and/or family members and be able to

be present for an extended time when a resident is in emotional distress. Additionally, nurse aides, who often know the residents best, should have time available to participate in resident care conferences.

Finally, stakeholders repeatedly expressed concern that there might not be enough eligible people in the workforce to meet the minimum requirements, and that staff in the industry need to be well trained and compensated (with pay and benefits). Stakeholders suggested CMS collaborate with other government agencies to increase the available supply of potential staff, assist with securing work visas for incoming immigrants/refugees, offer a waiver program for trained immigrants/refugees who want to work in direct care and have a license in another country, and support student training and apprenticeship programs. There was a consistent call by stakeholders for initiatives to expand the long-term care workforce.

3.2.4 Discussion

The second stakeholder listening session gathered broad public input on specific issues related to nursing home staffing, including health equity, variation in staffing costs across the country, and variation in the availability of trained personnel to fill needed positions. This feedback illustrated considerations on the benefits and potential challenges of a minimum staffing requirement.

Stakeholders indicated that a minimum staffing requirement could address disparities experienced by minority populations, and also help residents and families understand staffing ratios, if displayed in a consumer-friendly way. Nurse staff need time to meaningfully interact with residents and families. Stakeholders also noted the importance of staff impact on resident quality of life in addition to quality of care, which is consistent with a large body of current literature (Clemens et al., 2021; Min & Hong, 2019; Wagner et al., 2021; Figueroa et al., 2020; Gorges & Konetzka, 2020; Snyder et al., 2021; Li et al., 2020; Bonner et al., 2022; Firnhaber et al., 2020).

Stakeholders also raised several implementation challenges to a minimum staffing requirement, along with potential unintended consequences. Foremost were concerns about the adequacy of the workforce to meet a minimum requirement, particularly in areas already experiencing shortages, echoing recent reports in the literature of workforce constraints (Gasdaska, 2020; AHCA/NCAL, 2022). The literature further indicates that staff turnover is associated with both poorer quality of care and poorer quality of life (Kennedy et al., 2020; Consumer Voice, 2022). Low Medicaid reimbursement rates, low wages, and high cost of living were also cited as potential impediments. Recent studies have concluded that the costs of retaining staff could cause those facilities less able to bear those costs to close (Hawk et al., 2022; Weech-Maldonado, Lord et al., 2019).

Finally, stakeholders suggested several analyses to understand the impact of a minimum staffing requirement on different groups, including non-profit versus for-profit nursing homes, rural versus urban nursing homes, chain versus standalone nursing homes, and different ownership types, as well minority populations. Existing literature suggests that facility characteristics such as bed size, ownership (for-profit or non-profit), and community characteristics do influence both staff turnover rates and ability to meet staffing level requirements (Kennedy et al., 2020; Hawk et al., 2020). The Staffing Study design includes a descriptive analysis of staffing levels by nursing home characteristics to provide additional insight on these considerations.

4. Quantitative Activities

The quantitative analyses presented in this chapter seek to augment the existing literature by establishing anticipated trade-offs between potential quality and safety gains against challenges related to feasibility and costs of implementation for a range of federal minimum staffing requirement options. In particular, this chapter summarizes results from four sets of quantitative analyses.

The first two sections provide empirical evidence on expected implications of potential minimum staffing requirement options for quality and safety:

- Descriptive analyses of the relationship between nursing home staffing levels and acceptable safe and quality care, including multivariate analyses
- Simulation modeling analyses to assess how nursing home licensed nurse staffing levels influence the likelihood of delayed or omitted care

Two additional quantitative analyses provide evidence on anticipated feasibility and costs of potential minimum staffing requirement options:

- Examination of state minimum staffing requirements, including an impact analysis of Massachusetts's nursing home staffing requirement on nurse staffing levels and quality outcomes
- Nursing home costs and Medicare savings associated with increased staffing and changes in emergency department visits, hospitalizations, and community discharges

4.1 Relationship of Staffing With Quality and Safety

Key Takeaways

- Staffing levels across U.S. nursing homes vary substantially, including differences by nursing home characteristics and geography.
- Nursing homes with higher staffing levels tend to have better performance, regardless of the outcome measure or standard for acceptable quality and safety used in the analyses. There is no obvious plateau at which quality and safety are maximized or "cliff" below which quality and safety steeply decline.
- Among nurse staff types, RN staffing has the strongest relationship with nursing home quality and safety. LPN staffing did not have a consistent relationship with quality or safety.
- There is a strong positive relationship between quality and nurse aide staffing at high staffing levels only (8th decile or above).
- Based on observed associations from multivariate models, after adjusting for nursing home characteristics, the predicted percentage of nursing homes exceeding the current 25th or 50th quality and safety performance percentiles would increase between 1 percentage point (~100 nursing homes) and nearly 8 percentage points (~1,200 nursing homes) across four potential minimum staffing requirement options ranging from low (below the current median) to high staffing, depending on the requirement structure.
- Results of these analyses suggest a potential role for minimum staffing requirements.

To establish an empirical basis to inform potential minimum staffing requirement options, this section explores extant secondary data to examine the association of nursing home staffing levels with performance on quality and safety metrics.

4.1.1 Overview

While earlier research has firmly established that there are strong associations between staffing levels and nursing home performance, changing workforce conditions and resident care needs in the wake of the COVID-19 public health emergency necessitate updated analyses to investigate whether these relationships have persisted in the present context. In addition, these new analyses leverage robust staffing measures from the Payroll Based Journal (PBJ) system that were unavailable for use in earlier studies. **Appendix E** provides additional details on methods used to construct the staffing, quality, and resident safety measures used in these analyses; multivariate regression results for the relationship of staffing with quality and safety, by staffing decile; nurse staffing levels by state; and analyses of non-nurse staffing.

4.1.2 Methods

The Nursing Home Staffing Study uses recent staffing and quality data to update and expand upon previous analyses. In particular, the Staffing Study uses multivariate logistic regression models to estimate relationships between nurse staffing levels and the level and type of nurse staffing needed to provide acceptable safe and quality care in nursing homes.

Data and Measures

Analyses in this section use PBJ staffing data from 2021Q3–2022Q2 (the four most recent quarters for which data were available) and quality measures (QMs) and health inspection survey results from the October 2022 Nursing Home Care Compare update. Claims-based QMs from that update are for 2021Q1–2022Q1; the time period for Minimum Data Set (MDS)–based QMs varies but includes 2021Q3–2022Q2 for most measures. Safety measures based on health inspection surveys cover the three most recent survey cycles as of the October 2022 update (surveys are typically conducted annually), the same time period that is used in CMS's Five-Star Quality Rating System.

Staffing measures. The source for reported nurse staffing hours is CMS's PBJ system. PBJ data are submitted quarterly by each Medicare- and/or Medicaid-certified nursing home and are due 45 days after the end of each reporting period. The PBJ system is the best available source of nursing home staffing data because it is based on payroll and other verifiable and auditable data that are collected in a uniform format according to specifications established by CMS (2022b).

The Staffing Study employed exclusion criteria identical to those used for CMS's Nursing Home Care Compare website and Five-Star Quality Rating System to identify and exclude nursing homes with highly improbable PBJ staffing data (CMS, 2022a). This includes exclusion of nursing homes with zero nurse staffing for days with at least one resident and nursing homes with reported staffing levels that are excessively low or excessively high.

Both the earlier 2001 CMS Staffing Study (Abt Associates, 2001) and more-recent literature have identified substantial variation in the relationship between staffing levels and quality for different staff types. In general, previous studies have found that relationships between staffing and clinical care quality are stronger for registered nurses (RNs) than for other nurse staff types (Dellefield et al., 2015; Clemens et al., 2021; Yang et al., 2021). This variation could reflect the differing roles of different staff types within nursing homes: RNs and licensed practical/vocational nurses (LPNs) more likely to take on clinical care tasks requiring advanced training, and nurse aides more likely to handle direct care related to assistance with activities of daily living (ADLs) (Bonner et al., 2022).

For this reason, analyses in this **Section 4.1** separately examine the relationship of staffing with quality and safety for

- Total nurse staffing (all three nurse staff types in aggregate)
- Individual nurse staff types (RNs, LPNs, and nurse aides considered separately)

The Staffing Study team created annual staffing measures for each of these staff types by taking the (unweighted) average of daily staff hours worked across a full year defined as 2021Q3–2022Q2. Given the high correlation of staffing measures across quarters, the team included nursing homes with valid staffing data for one or more quarters, calculating staffing levels using data only from quarters for which valid data are available.

The Staffing Study team used acuity-adjusted staffing measures, employing the same adjustment method that is used for the Five-Star Quality Rating System. Reported staffing levels are adjusted for acuity using the distribution of residents by Resource Utilization Groups-Version IV (RUG-IV) group and estimates of daily RN, LPN, and nurse aide hours from the CMS Staff Time and Resource Intensity Verification (STRIVE) Study.[3] The resident census is based on a daily resident census measure that is calculated by CMS using MDS assessments (CMS, 2022a).

Finally, adjusted staffing hours for each staff type are then divided by the daily resident census to obtain staffing levels expressed in terms of hours per resident day (HPRD) for each nursing home.

Quality measures. The Staffing Study team used a set of QMs from the MDS and Medicare claims data to describe the quality of care provided in nursing homes (Box C). These QMs address a broad range of function and health status indicators and are a subset of the QMs that are used in the Five-Star Quality Rating System. QMs were selected for use in that Rating System based on their validity and reliability, the extent to which nursing home practice can affect the measures, statistical performance, and the importance of the measures (CMS, 2022a). All claims-based measures used in the Five-Star Quality Rating System QMs and a subset of MDS-based QMs are risk-adjusted to account for resident-level characteristics associated with differences in QM performance.

For analyses presented here, the study team dropped several QMs that have a low prevalence (<5 percent) or a lower weight in the Five-Star Quality Rating System QM rating methodology and that preliminary analyses indicated were weakly or not significantly related to nursing home staffing levels.[4] Using the remaining QMs shown in Box C, the team calculated a composite measure of nursing home quality, referred to hereafter as the "total QM score." For these calculations, the team replicated the methodology used in the Five-Star Quality Rating System.

Box C: Staffing Study Quality Measures

Short-Stay Measures

- Community discharge
- Hospital readmissions
- Emergency department visits
- Functional improvement

Long-Stay Measures

- Activities of daily living decline
- Antipsychotic medication use
- Mobility decline
- High-risk pressure ulcer
- Hospitalizations
- Emergency department visits

[3] CMS used a RUG-based system (first RUG-III and then RUG-IV) for Medicare Skilled Nursing Facility payment from 1998 to 2019.

[4] QMs used in the Five-Star Quality Rating System but excluded from these analyses were short-stay pressure ulcer, catheter, urinary tract infection, falls with major injury, and short-stay antipsychotic medication use.

Safety measures. Safety measures were calculated based on findings from on-site health inspections (called "inspection surveys") using the same methodology as CMS's Five-Star Quality Rating System. Nursing homes that participate in the Medicare and/or Medicaid programs have these on-site inspection surveys annually on average; only very rarely do more than 15 months elapse between them. The inspections are unannounced and are conducted by a team of health care professionals who spend several days in the nursing home to assess compliance with federal requirements. Inspectors provide a comprehensive assessment, reviewing practice and policies in such areas as resident rights, quality of life, medication management, skin care, resident assessment, nursing home administration, environment, and kitchen/food services (CMS, 2022a).

These health inspections are based on federal regulations, which inspectors implement using national interpretive guidance and a federally specified survey process. Despite federal oversight designed to improve consistency in the survey process, there remains variation among states in both the inspection process and its outcomes. Such variation derives from many factors, including survey management (e.g., variation among states in the skill sets of inspectors, supervision of inspectors, and the inspection processes), state licensing laws, and state Medicaid policies (e.g., nursing home eligibility rules, payment, and other policies in the state-administered Medicaid program) (CMS, 2022a). To appropriately account for this state-level variation, the Staffing Study uses a health-inspection-based safety measure based on the relative performance of nursing homes within each state.

Minimum Acceptable Quality Levels

The study team used two definitions of acceptable quality and safety based on the current distribution of the total QM score and within-state performance on health inspection surveys. The models consider minimum acceptable performance thresholds at the 25th and 50th percentiles for the measures. The study focuses on the composite measures because they reflect performance on multiple dimensions of nursing home quality and resident safety, providing the best available summary measures for analyzing the relationship between staffing and nursing home performance.

Statistical Models

All analyses in this section were conducted at the nursing home level. The section begins with some simple descriptive analyses of staffing levels in U.S. nursing homes, including distribution plots and descriptive statistics on variation in staffing levels by nursing home characteristics and across states. Descriptive analyses of staffing levels overall and by state include all nursing homes with valid staffing data for 2022Q2 (N=14,529). Descriptive analyses of staffing levels by nursing home characteristics include all nursing homes with at least one valid quarter of staffing data for 2021Q3–2022Q2 (N=15,129).

Next, the section describes results of analyses examining the relationship of nurse staffing levels with the measures of minimum acceptable quality and safety. These analyses include all nursing homes with valid staffing, quality, and patient safety data (N=14,948). First, a set of descriptive line charts provide visual evidence on how the probability of exceeding minimum acceptable quality and safety thresholds varies by staffing level for each individual staff type (RNs, LPNs, and nurse aides).Then, a series of multivariate analyses measure the relationship of nurse staffing levels with the measures of minimum acceptable quality and safety, adjusting for other nursing home characteristics that might also be associated with quality and safety. In addition to confirming existing evidence on these relationships in a more recent context, this analysis seeks to identify whether there are any minimum staffing levels below which safety and quality sharply decline, or staffing thresholds above which there are no further improvements in safety or quality.

The dependent variable in each model is whether the nursing home was above the 25th or 50th percentile for total QM score and above the 25th or 50th percentile for within-state health inspection score. The use of

risk-adjusted quality measures accounts for differences in resident health conditions across nursing homes that might influence unadjusted quality metrics. The key explanatory predictors in each multivariate model are indicators for staffing decile. One set of models includes indicators for case-mix-adjusted total nurse staffing decile. Instead of continuous or more granular staffing levels, the study used staffing deciles in these models to ensure adequate sample size in each staffing category and to facilitate interpretation. Nursing homes in the lowest two total nurse staffing deciles serve as the reference category. Case-mix adjusted staffing levels were used in these models to adjust for differences in resident acuity across nursing homes. A second set of models includes separate case-mix-adjusted staffing deciles for RNs, LPNs, and nurse aides. For each staff type, nursing homes in the lowest two staffing deciles for that staff type serve as the reference category. Combining two staffing deciles as the reference category in each set of models increased stability of results. The staffing measures used in these models are acuity adjusted using the same methodology that is used in CMS's Five-Star Quality Rating System. This reduces the number of covariates that the team needs to include in the models.

The multivariate models also include measures of nursing home characteristics as covariates, to adjust for variation at the nursing home level. Specific covariates include ownership type (non-profit, government; with for-profit as the reference category), size (number of certified beds), whether the nursing home is hospital-based, Medicaid quartile, whether the nursing home is in a rural location, whether the nursing home is part of a continuing care retirement community, and participation in the Special Focus Facility (SFF) program[5] (SFF, SFF candidate, or neither). These additional covariates were created based on data from the October 2022 Nursing Home Care Compare update. Descriptive statistics for included model covariates appear in **Exhibit 4.2**.

Finally, the section reports a series of "what if" scenarios describing the increase in the predicted percentage of nursing homes that would exceed minimum acceptable quality and safety thresholds under a range of potential minimum staffing requirement options that were set based on total nurse and RN staffing deciles. Estimated logistic regression model coefficients from staffing decile indicators were used to generate estimated regression-adjusted percentages of nursing homes predicted to exceed minimum quality and safety thresholds under each scenario. One nursing home in Guam was excluded from the scenario projections, resulting in an *N* of 14,947. These estimates make two assumptions:

1. All nursing homes currently staffing below the specified levels would successfully increase staffing to required levels.

2. Nursing homes already staffing at or above the specified requirements would maintain staffing at current levels.

The resulting percentages are useful quantitative metrics illustrating the expected improvement in nursing home quality and safety under each scenario as compared to the status quo.

4.1.3 Results

Results in this section provide descriptive evidence on current nursing home staffing levels in the United States, followed by an exploration of the relationship of staffing levels with likelihood of meeting minimum acceptable quality and safety standards, using multivariate logistic regression models. These findings can inform development of potential minimum staffing requirement options for CMS consideration. The section concludes with an exploration of predicted improvements in quality and safety that would be associated with different minimum staffing requirement levels.

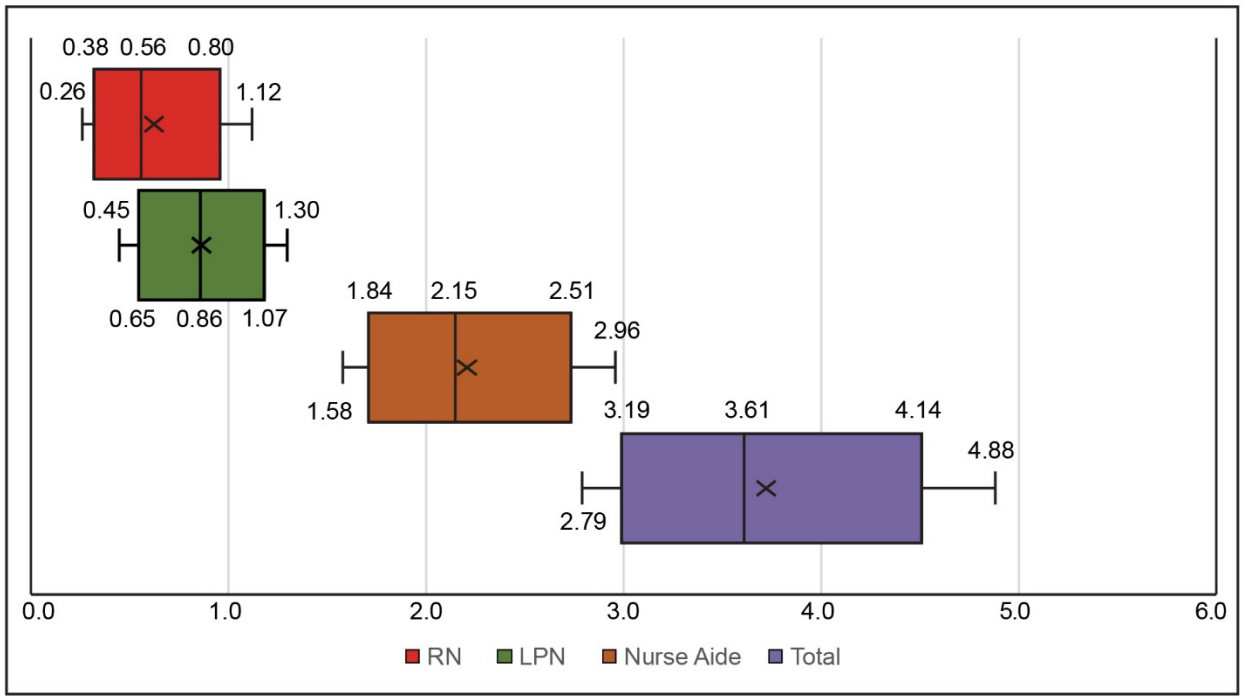
---

[5] The SFF variables were not included in analyses of within-state health inspection surveys, as health inspection survey performance is used to determine SFF eligibility.

Nursing Home Staffing Levels

In 2022Q2, the mean RN staffing level in U.S. nursing homes was 0.67 HPRD, the mean LPN staffing level was 0.88 HPRD, the mean nurse aide staffing level was 2.22 HPRD, and the mean total nurse staffing level (RNs, LPNs, nurse aides) was 3.76 HPRD. However, there is considerable variation in nurse staffing levels across nursing homes around those means, with many nursing homes staffing at considerably higher levels and many nursing homes at considerably lower levels (**Exhibit 4.1**).

Exhibit 4.1: Distribution of Nurse Staffing Levels in U.S. Nursing Homes, 2022Q2 (in HPRD)



Notes: "X" represents mean, left bracket represents 10th percentile, left edge of box represents 25th percentile, central line represents median, right edge of box represents 75th percentile, right bracket represents 90th percentile.
Source: Abt Associates analyses of Payroll Based Journal system staffing data for 2022Q2 (*N*=14,529)

There is a negative and statistically significant correlation between LPN and RN staffing in nursing homes (correlation coefficient = -.109, p=0001). That is, on average, nursing homes with lower LPN staffing tend to have higher RN staffing, and vice versa.

Nursing Home Characteristics Associated with Different Staffing Levels

Nursing home staffing levels vary substantially across different nursing home characteristics (**Exhibit 4.2**), such that effects of a minimum staffing requirement will be more salient for some groups.

Exhibit 4.2: Average Staffing Levels, by Nursing Home Characteristics (in HPRD)

Group	Number of Nursing Homes	Total	RN	LPN	Nurse Aide
All	**15,147**	**3.76**	**0.67**	**0.88**	**2.22**
Ownership Type					
For-profit	10,748	3.57	0.57	0.89	2.10
Non-profit	3,439	4.28	0.91	0.86	2.50
Government	959	4.19	0.83	0.87	2.49

Group	Number of Nursing Homes	Total	RN	LPN	Nurse Aide
Size					
<50 beds	1,817	4.67	1.20	0.89	2.58
50–99 beds	5,788	3.76	0.65	0.87	2.24
100–149 beds	5,059	3.57	0.55	0.90	2.12
150–199 beds	1,611	3.57	0.54	0.91	2.12
200+ beds	872	3.51	0.60	0.80	2.11
Hospital-Based Status					
Freestanding nursing home	14,579	3.71	0.63	0.88	2.20
Hospital-based nursing home	568	5.24	1.60	1.00	2.64
Continuing Care Retirement Community (CCRC) Status					
Not part of a CCRC	13,547	3.69	0.64	0.87	2.18
Part of a CCRC	1,600	4.41	0.89	0.95	2.57
Percentage of Residents Covered by Medicaid (Quartile)					
First quartile (<48.5%)	3,774	4.33	0.94	0.95	2.44
Second quartile (48.5–64.2%)	3,842	3.66	0.62	0.85	2.19
Third quartile (64.3%–76.2%)	3,787	3.55	0.55	0.87	2.13
Highest quartile (>76.2%)	3,744	3.53	0.56	0.86	2.11
Special Focus Facility (SFF) Status					
Not SFF	15,058	3.77	0.67	0.88	2.22
SFF	89	3.56	0.51	0.90	2.15
SFF candidate	440	3.44	0.51	0.85	2.08
Urban/Rural Location					
Rural location	4,174	3.66	0.64	0.80	2.23
Urban location	10,973	3.80	0.67	0.91	2.21

Source: Abt analysis of 2021Q3–2022Q2 Payroll Based Journal system data and Certification and Survey Provider Enhanced Reports (CASPER) data (*N*=15,147).

For-profit nursing homes have lower mean staffing levels (3.57 HPRD) than non-profit (4.28 HPRD) or government nursing homes (4.19 HPRD). Larger nursing homes have lower mean staffing levels than smaller nursing homes; specifically, nursing homes with fewer than 50 residents have mean staffing levels of 4.67 HPRD, whereas nursing homes with 50 or more residents have mean staffing levels ranging from 3.51 to 3.76 HPRD across size categories.

Staffing levels for freestanding nursing homes (3.71 HPRD) are much lower than staffing levels for hospital-based nursing homes (5.24 HPRD), particularly for RNs (0.63 HPRD compared to 1.60 HPRD). Nursing homes that were not part of a continuing care retirement community are lower staffed (3.69 HPRD) than nursing homes that were (4.41 HPRD).

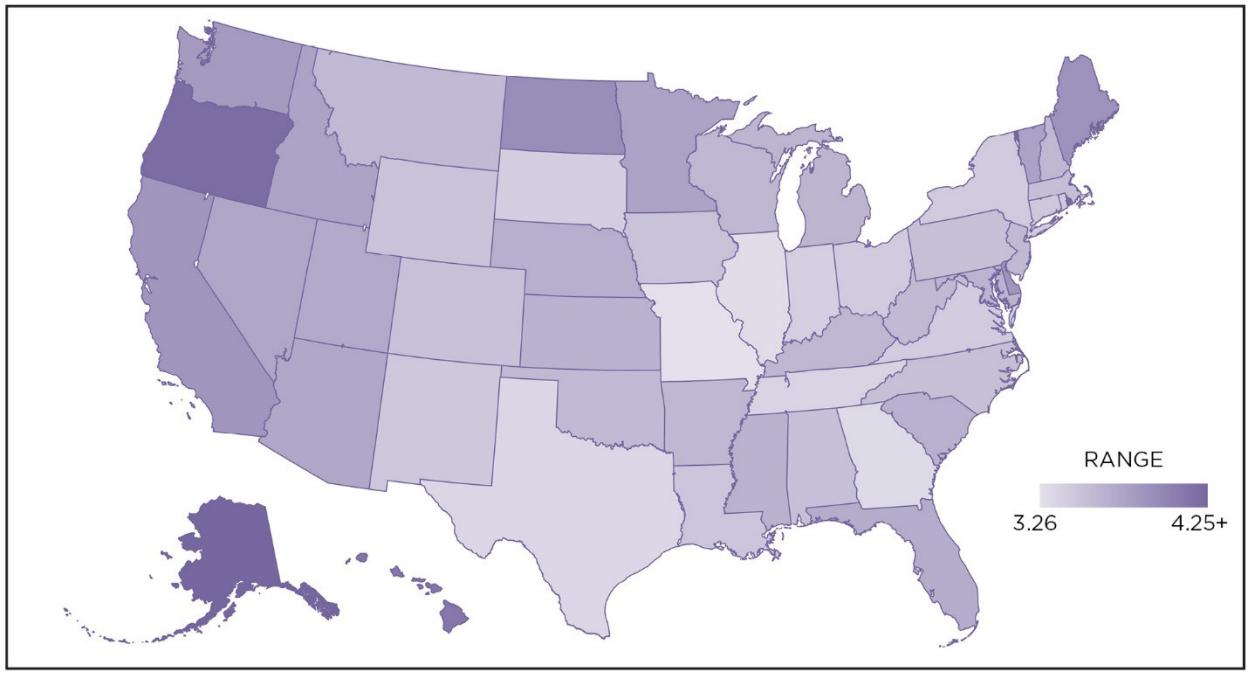
Nursing homes with higher proportions of Medicaid residents have lower staffing levels than nursing homes with lower proportions of Medicaid residents. Average total staffing levels are 4.33 HPRD for nursing homes in the lowest Medicaid quartile compared to 3.53 HPRD for nursing homes in the highest Medicaid quartile. The differences are driven by lower RN and nurse aide staffing for high-Medicaid nursing homes. The average RN staffing level is 0.94 HPRD for nursing homes in the lowest Medicaid quartile compared to 0.56 for nursing homes in the highest quartile; average nurse aide staffing is 2.44 HPRD for nursing homes in the lowest quartile compared to 2.11 HPRD for nursing homes in the highest Medicaid quartile. Differences in average LPN staffing by Medicaid quartile are much smaller.

Staffing levels for both SFF nursing homes and candidates for the SFF program are lower than for other nursing homes. SFF is a special program to stimulate improvements in quality of care for selected nursing homes that have a history of serious quality issues (Center for Clinical Standards and Quality / Quality Safety & Oversight Group, n.d.).

Finally, differences in staffing levels by urbanicity are not large, with average staffing levels slightly higher for nursing homes in an urban location (3.80 HPRD) than for nursing homes in a rural location (3.66 HPRD).

Exhibit 4.3 shows there is additional geographic variation across nursing homes. Average total nursing HPRD are less than 3.5 in five states (Georgia, Illinois, Missouri, Tennessee, Texas) and are above 4.25 in eight states (Alaska, California, Delaware, Hawaii, Maine, North Dakota, Oregon, Washington) and the District of Columbia. In general, nursing homes in states with lower current staffing levels will be more affected by a minimum staffing requirement in terms of additional staffing needed and associated staffing costs. (A table with detailed staffing levels by state, including total nurse staffing and separate averages by staff type, appears in **Appendix E**.)

Exhibit 4.3: Total Nurse Staffing, by State, 2022Q2 (in HPRD)



Source: Abt Associates calculations from Payroll Based Journal system staffing data (*N*=14,529).

Descriptive Analysis of Relationship of Staffing Levels with Percentage of Nursing Homes Exceeding Quality and Safety Thresholds

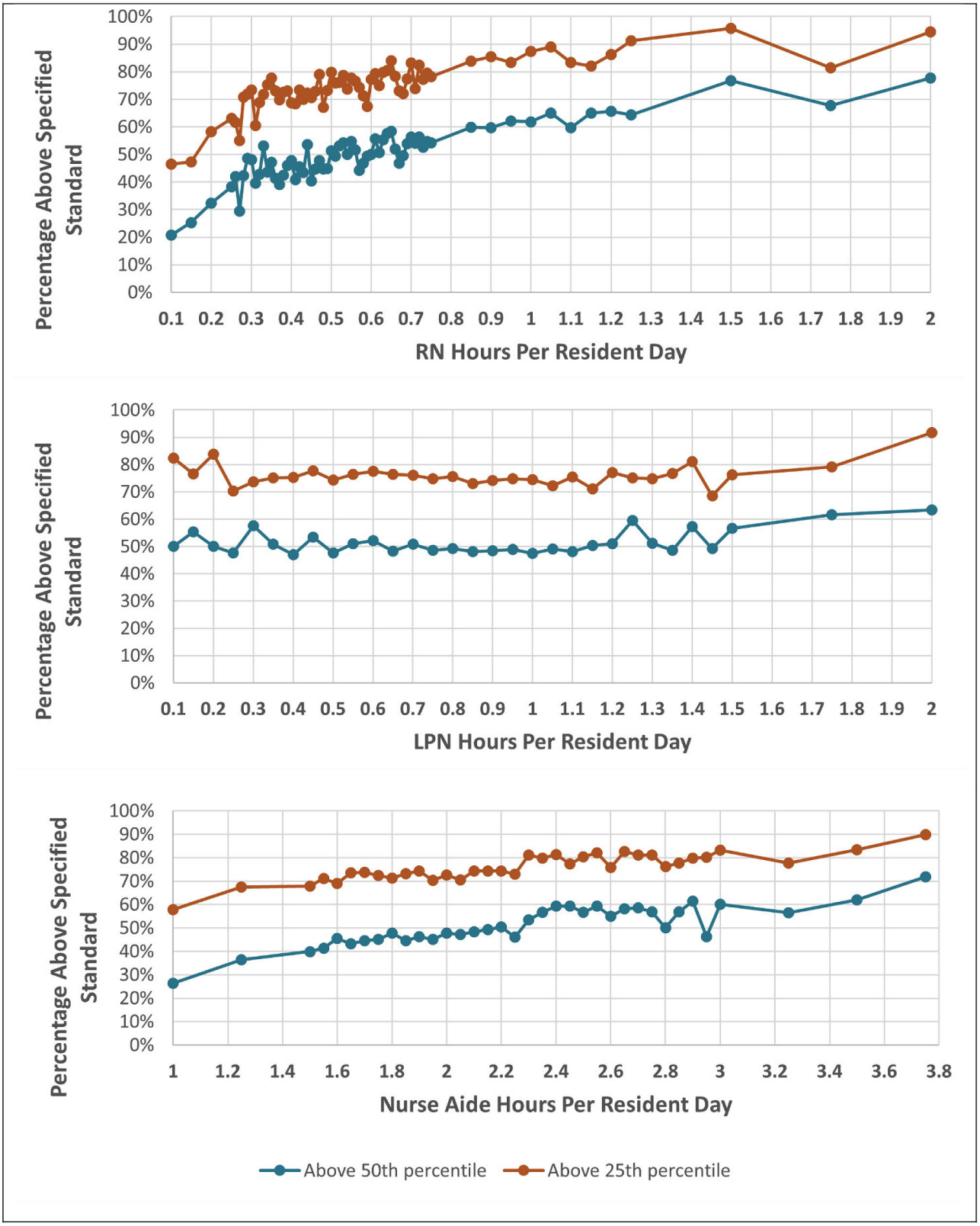
Descriptive analysis shows that as RN and nurse aide staffing levels increase, higher percentages of nursing homes exceed minimum acceptable quality and safety thresholds, with no such consistent relationship for LPN staffing levels.

Exhibit 4.4 shows how the percentage of nursing homes exceeding the 25th and 50th QM percentiles changes as staffing levels increase for RNs, LPNs, and nurse aides. Visual inspection shows a steady increase in the probability of exceeding quality thresholds for RNs as staffing levels rise, with particularly steep increases at the lower part of the staffing distribution. For nurse aides, the probability

of exceeding quality thresholds also rises steadily with staffing levels, but at a slower rate than for RNs. In contrast to both RNs and nurse aides, for LPNs, the relationship appears relatively flat.

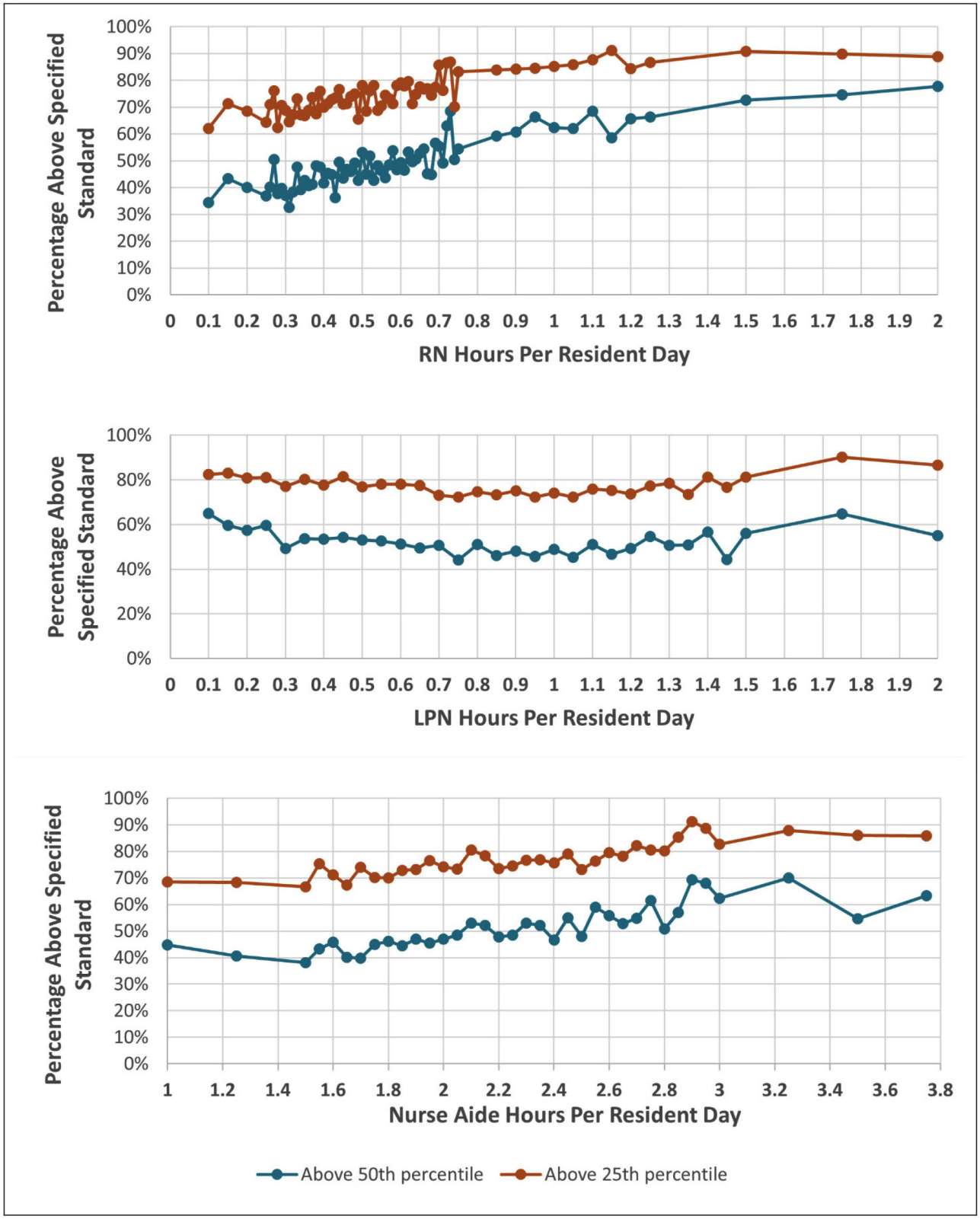
Exhibit 4.5 shows parallel analyses of how the percentage of nursing homes exceeding the 25th and 50th percentiles in performance on health inspection surveys increases with staffing for each staff type. Overall, these results are visually similar to the QM results, with a steep increase in the probability of exceeding safety thresholds as RN staffing rises, a more moderate increase as nurse aide staffing rises, and no consistent increase or decrease associated with LPN staffing increases.

Exhibit 4.4: Percentage of Nursing Homes Exceeding Minimum Acceptable Quality Standards for QM Score, by Staff Type



Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=14,948).

Exhibit 4.5: Percentage of Nursing Homes Exceeding Minimum Acceptable Safety Standards for Health Inspection Surveys, by Staff Type



Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=14,948).

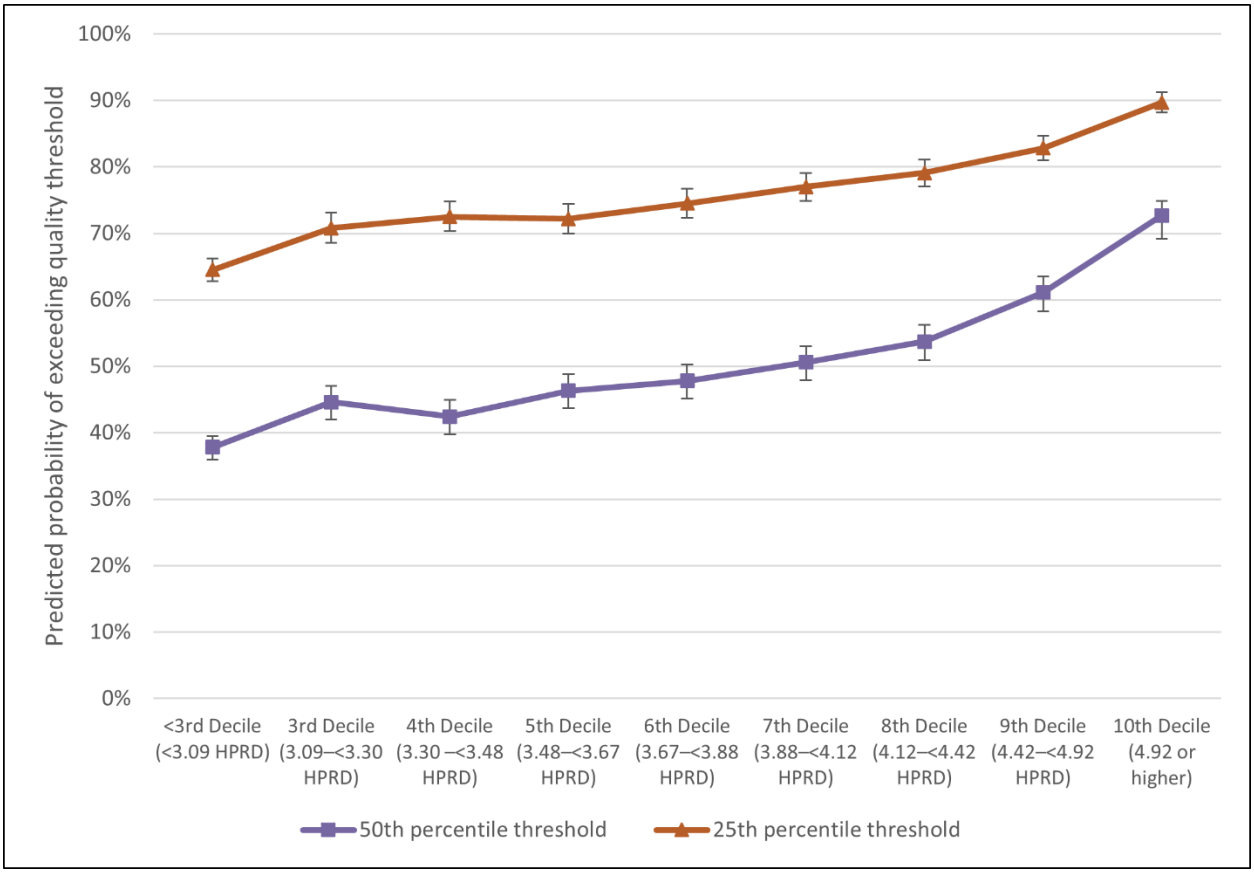
Multivariate Analysis of Relationship of Staffing Levels with Probability of Exceeding Quality and Safety Thresholds

Exhibit 4.6 shows predicted regression-adjusted probabilities from the logistic regression total nurse staffing decile models for the total QM score thresholds. For each staffing decile shown, predicted probabilities represent the likelihood that a nursing home in that decile will exceed minimum acceptable quality thresholds (in this analysis, the 25th and 50th percentiles in total QM score). Unlike the descriptive charts in the previous section, these multivariate analyses adjust for a range of other nursing home characteristics that may confound the relationship of staffing levels with quality and safety.

For both minimum acceptable quality thresholds examined (25th and 50th percentiles), there is a steady increase in the predicted probability of exceeding the threshold across the full distribution of nurse staffing levels. As is evident in the graph, there is little evidence of staffing levels beyond which higher staffing is no longer associated with additional improvements in quality, or below which there is a steep decline in quality.

On average, the predicted probability of exceeding the 50th percentile total QM score rises from 40.9 percent (95% confidence interval [CI]: 37.8–44.1 percent) for nursing homes below the 3rd total nurse staffing decile (less than 3.09 HPRD) to 61.2 percent (95% CI: 56.1–66.2 percent) for nursing homes in the 10th total nurse staffing decile (4.92 HPRD or higher). This increase from 40.9 percent to 61.2 represents a gain with increasing total nurse staffing of more than 20 percentage points (p<.0001 for difference).

Exhibit 4.6: Predicted Probability of Exceeding Minimum Acceptable Quality Standards for Total QM Score, by Total Nurse Staffing Level



Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Similarly, the predicted probability of exceeding the 25th percentile total QM score rises from 66.9 percent (95% CI: 63.6–70.0 percent) to 85.1 percent (95% CI: 81.1–88.4 percent), a gain with increasing total nurse staffing of more than 18 percentage points (p<.0001 for difference).

Detailed findings in **Appendix E** show that, adjusting for staffing levels and the other facility-level covariates in the models, performance was lower for nursing homes with higher proportions of Medicaid residents. For example, the predicted probability that a nursing home with more than 76.2 percent Medicaid residents [top quartile] is above the 50th percentile of the QM score is just 37.6 percent. In comparison, the probability for a nursing home with less than 48.5 percent Medicaid residents [the lowest quartile] is 62.5 percent.

Combined with the descriptive finding that nursing homes with higher proportions of Medicaid residents tend to have lower staffing levels than other nursing homes, these results suggest that a minimum nurse staffing requirement will reduce, but not eliminate, disparities in quality and patient safety for nursing homes that provide care to high shares of Medicaid residents.

Next, **Exhibit 4.7** below shows predicted probabilities of exceeding 50th and 25th percentile total QM score thresholds by staffing decile for each nursing home staff type, based on logistic regression models examining independent associations. These results show substantial variation in relationships by staff type:

- **RN staffing** (top panel) shows a strong and consistent positive relationship with probability of exceeding acceptable quality thresholds across the full distribution of staffing levels. For the 50th percentile threshold, predicted probabilities range from 36.6 percent for nursing homes below the 3rd RN staffing decile (0.38 HPRD) to 67.8 percent for nursing homes in the 10th RN staffing decile (1.28 HPRD), a 31 percentage point gain (p<.0001 for difference).

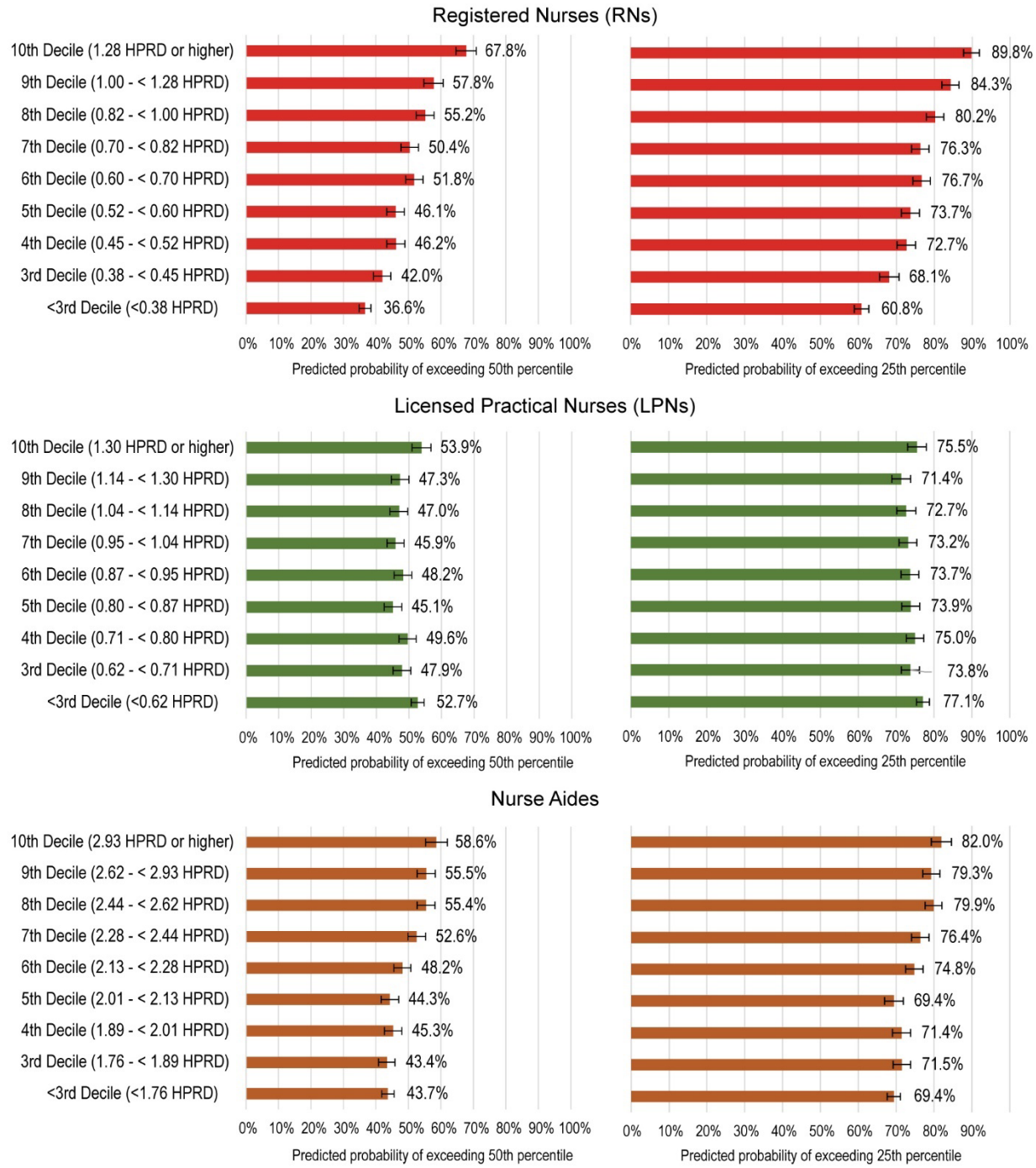
  Similarly, for the 25th percentile threshold, predicted probabilities range from 60.8 percent for nursing homes below the 3rd RN staffing decile to 89.8 percent for the 10th RN staffing decile, a 29 percentage point gain (p<.0001 for difference).

- **LPN staffing** (middle panel), in contrast, has no significant relationship with the probability of exceeding quality thresholds for either measure after adjusting for RN and nurse aide staffing deciles. Probability of exceeding the 50th percentile threshold ranges from 45.1 percent to 53.9 percent across LPN staffing deciles. Probability of exceeding the 25th percentile threshold ranges from 71.4 percent to 77.1 percent. There was no significant difference across decile categories and no evident upward or downward trend as LPN staffing levels increase.

- **Nurse aide staffing** (bottom panel) shows no evidence of an increasing trend in probability of exceeding acceptable total quality thresholds at lower staffing deciles (7th decile and below, <2.44 HPRD). However, probability of exceeding 25th and 50th percentile quality thresholds is significantly greater for nursing homes at the highest nurse aide staffing deciles (8th through 10th deciles, 2.44 HPRD and higher) as compared to nursing homes at the lowest staffing levels (below the 3rd decile, <1.59 HPRD).

In summary, multivariate logistic regression results suggest a positive relationship between total nurse staffing levels and quality that is driven primarily by a strong positive relationship of quality with RN staffing levels. Nurse aide staffing is positively associated with quality only at very high nurse aide staffing levels (8th decile and above), contributing to the overall positive relationship of quality with total nurse staffing at those levels. After accounting for RN and nurse aide staffing levels, LPN staffing levels are not independently associated with the probability of exceeding the quality and patient safety thresholds.

Exhibit 4.7: Predicted Probability of Exceeding Minimum Acceptable Quality Standards for Total QM Score Across Case-Mix-Adjusted Nurse Staffing Deciles, by Staff Type



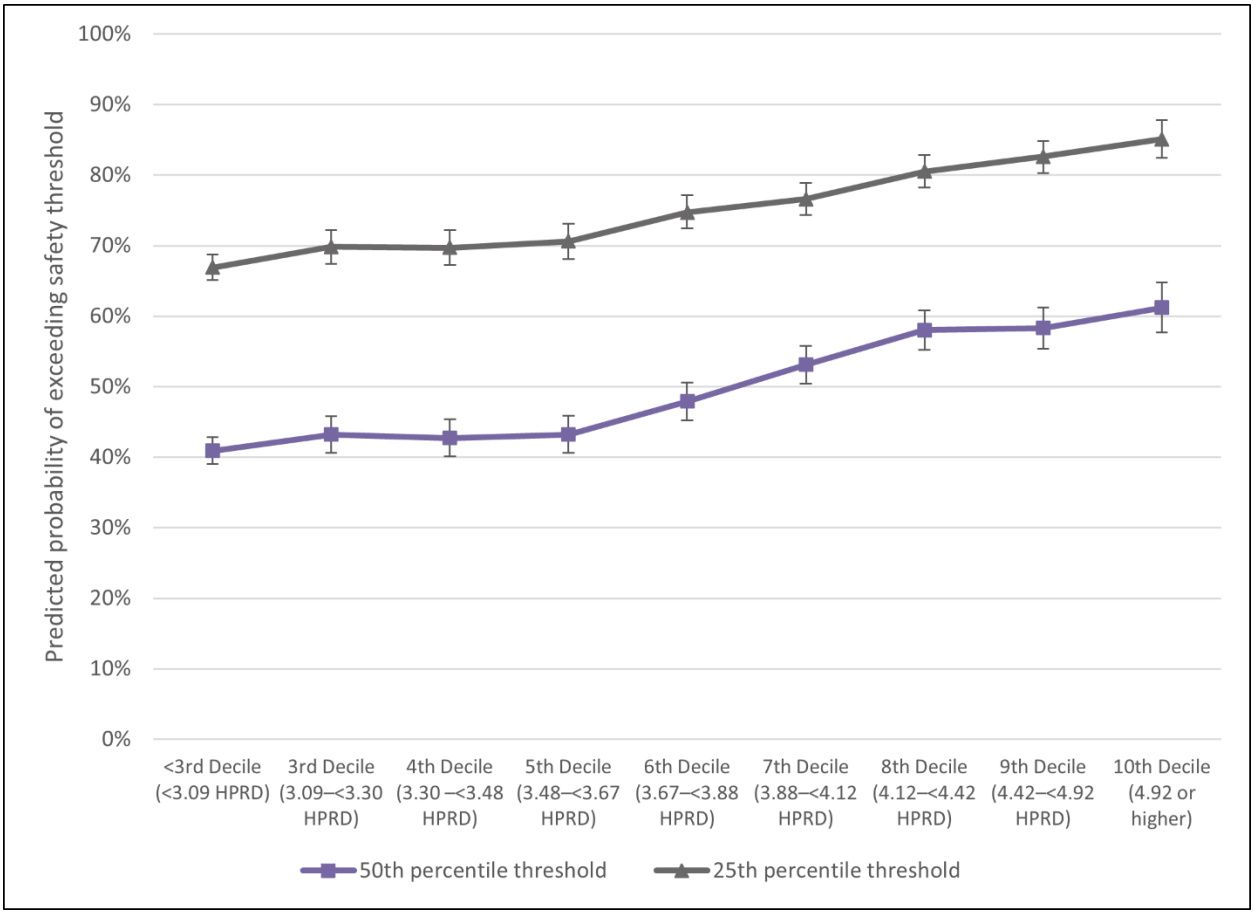
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=14,948).

Results for the within-state weighted health inspection survey score, a proxy for nursing home safety, are qualitatively similar to the results for the quality metric. **Exhibit 4.8** illustrates predicted regression-adjusted probability of exceeding the health inspection survey score thresholds (25th and 50th percentiles) by nursing home total nurse staffing level. As with the total QM score, there is a clear association between total nurse staffing level and probability of exceeding the safety threshold across the entire staffing distribution. Again, the graph shows no sudden declines at low staffing levels or a plateau at higher staffing levels beyond which safety no longer increases with increased staffing. Full logistic regression model results for the weighted health inspection score models appear in **Appendix E**.

The predicted probability of exceeding the current 50th percentile safety threshold rises from 37.8 percent (95% CI: 35.2–40.4 percent) for nursing homes with total nurse staffing below the 3rd decile (<3.09 HPRD) to 72.7 percent (95% CI: 69.3–75.9 percent) for nursing homes with total nurse staffing in the 10th decile (4.92 HPRD or higher). The increase between the lowest and highest deciles examined is 34.9 percentage points (p<.0001 for difference), an even greater gain with increased staffing levels than for total QM score.

Similarly, the predicted probability of exceeding the 25th percentile safety threshold rises from 64.5 percent (95% CI: 61.8–67.2 percent) for nursing homes with total nurse staffing below the 3rd decile to 89.7 percent (95% CI: 87.4–91.6 percent), a gain of 25.2 percentage points (p<.0001 for difference).

Exhibit 4.8: Predicted Probability of Exceeding Minimum Acceptable Quality Standards for Weighted Health Inspection Survey Score, by Total Nurse Staffing Level

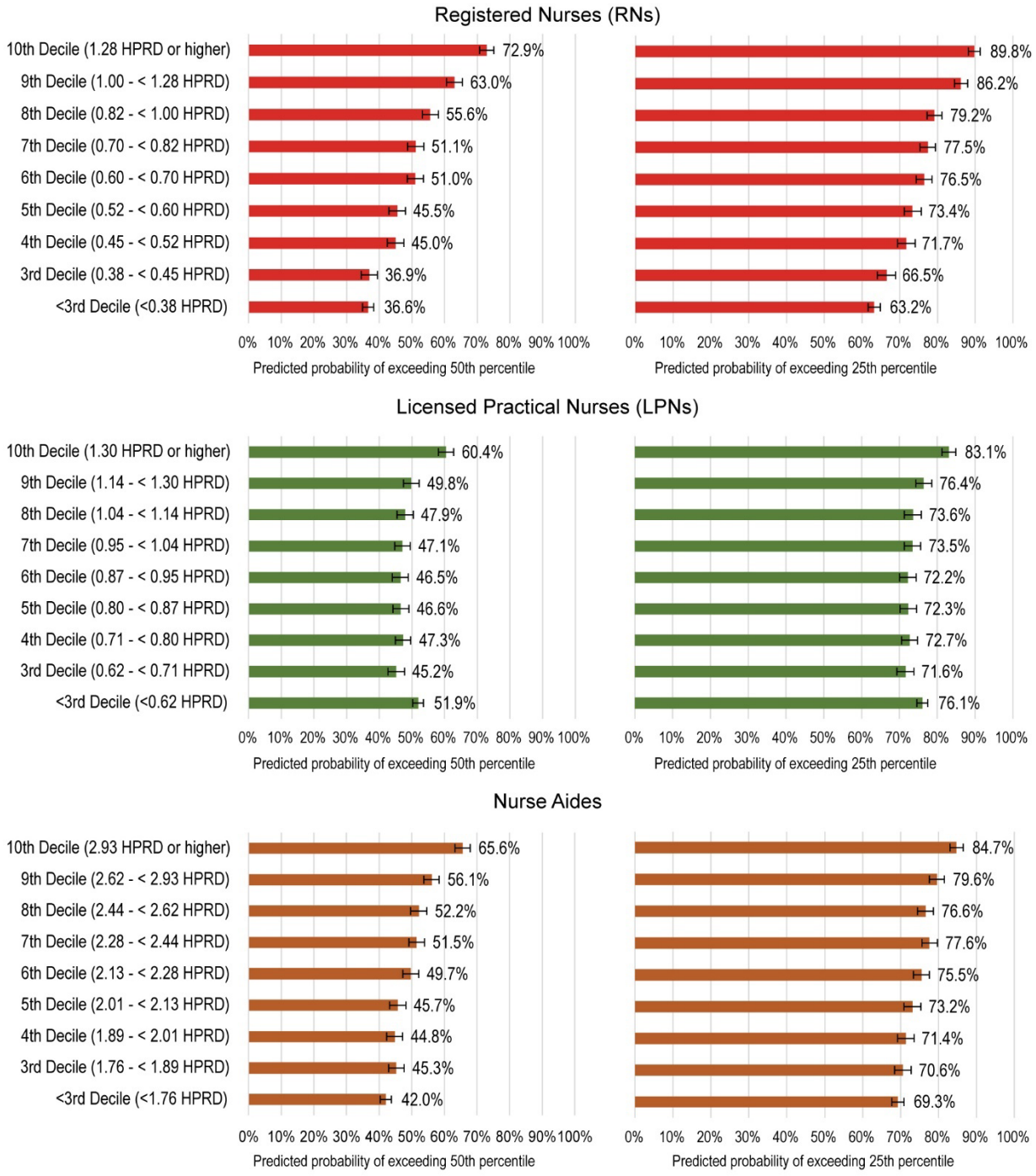


Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=14,948).

Weighted health inspection survey score results by staff type (**Exhibit 4.9**) were similar to those for the total QM score models. In particular:

- **RN staffing** (top panel) shows that predicted probabilities of exceeding safety thresholds rise consistently with staffing decile. For the 50th percentile threshold, the predicted probability climbs from 36.6 percent for the 3rd RN staffing deciles (<0.38 HPRD) to 72.8 percent, a 36.2 percentage point gain (p<.0001 for difference); for the 25th percentile threshold, the predicted probability climbs from 63.2 percent for the 3rd RN staffing deciles to 89.7 percent, a 26.5 percentage point increase (p<.0001 for difference).
- **LPN staffing** (middle panel) shows no significant relationship with the probability of exceeding safety thresholds. Probabilities range from 45.2 percent to 60.4 percent across staffing deciles for the 50th percentile threshold and from 71.6 percent to 83.1 percent for the 25th percentile threshold. No consistent pattern of increasing probabilities by LPN staffing level is evident.
- **Nurse aide staffing** (bottom panel) shows a statistically significant increase in the predicted probability of exceeding the 50th and 25th percentile safety thresholds only for the 7th staffing decile and above (≥2.28 HPRD). There is no evidence that the probability of exceeding these safety thresholds increased between the lowest two deciles (<1.59 HPRD) and the 6th decile (2.13–<2.28 HPRD).

Exhibit 4.9: Predicted Probability of Exceeding Minimum Acceptable Standards for Weighted Health Inspection Survey Score Across Case-Mix-Adjusted Nurse Staffing Deciles, by Staff Type



Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=14,948).

Appendix E presents additional analyses considering the relationship of non-nurse staffing levels with quality and safety. These analyses found some evidence of moderately higher total QM scores for several non-nurse staff categories.

"What-If" Scenarios: Nursing Homes Exceeding Performance Standards Under Alternative Minimum Staffing Requirements

This section uses predicted probabilities from the logistic regression model results described above to generate "what-if" scenarios representing the percentage of nursing homes predicted to exceed the 50th and 25th percentile performance standards under different minimum staffing requirements. The intent of these analyses is to model changes in predicted quality and safety associated with implementing potential minimum staffing requirements.

The specified minimum staffing requirement thresholds in this section represent the 4th-7th decile cut-points for total nurse and RN staffing, with proportional increases in LPN and nurse aide staffing (**Exhibit 4.10**). The relatively small change in LPN staffing levels across these scenarios reflects the small improvements in quality and safety associated with higher levels of LPN staffing (see **Exhibit 4.7** and **Exhibit 4.9**), findings that suggest that increases in RN staffing will lead to the largest improvements in quality and safety. Given that RN staffing has a stronger relationship with nursing home performance than LPN staffing, the options in **Exhibit 4.10** include a specific RN requirement and allow substitution of RNs for LPNs in a total licensed nursing staff requirement. As noted above, overall, the Study Team found a negative correlation (correlation coefficient of -0.109) between RN and LPN staffing levels, suggesting that RNs and LPNs are substitutes at many nursing homes. For similar reasons, the options include a requirement for total nurse staffing that allows nursing homes to substitute licensed staff for nurse aides. This would ensure that nursing homes that have high overall staffing levels would be in compliance with a staffing requirement even if their nurse aide staffing was low.

Exhibit 4.10: Minimum Staffing Requirement Levels Examined for "What If" Scenarios

Decile (Total Nurse and RN)	Minimum Required Staffing Level (in HPRD)				
	Registered Nurses (RNs)	LPNs	Nurse Aide	Licensed Nurses (RNs and LPNs)	Total Nurse Staff (RNs, LPNs, and Nurse Aides)
Low/4th	0.45	0.70	2.15	1.15	3.30
Medium/5th	0.52	0.71	2.25	1.23	3.48
Higher/6th	0.60	0.72	2.35	1.32	3.67
Highest/7th	0.70	0.73	2.45	1.43	3.88

These minimum staffing requirement scenarios make two assumptions:

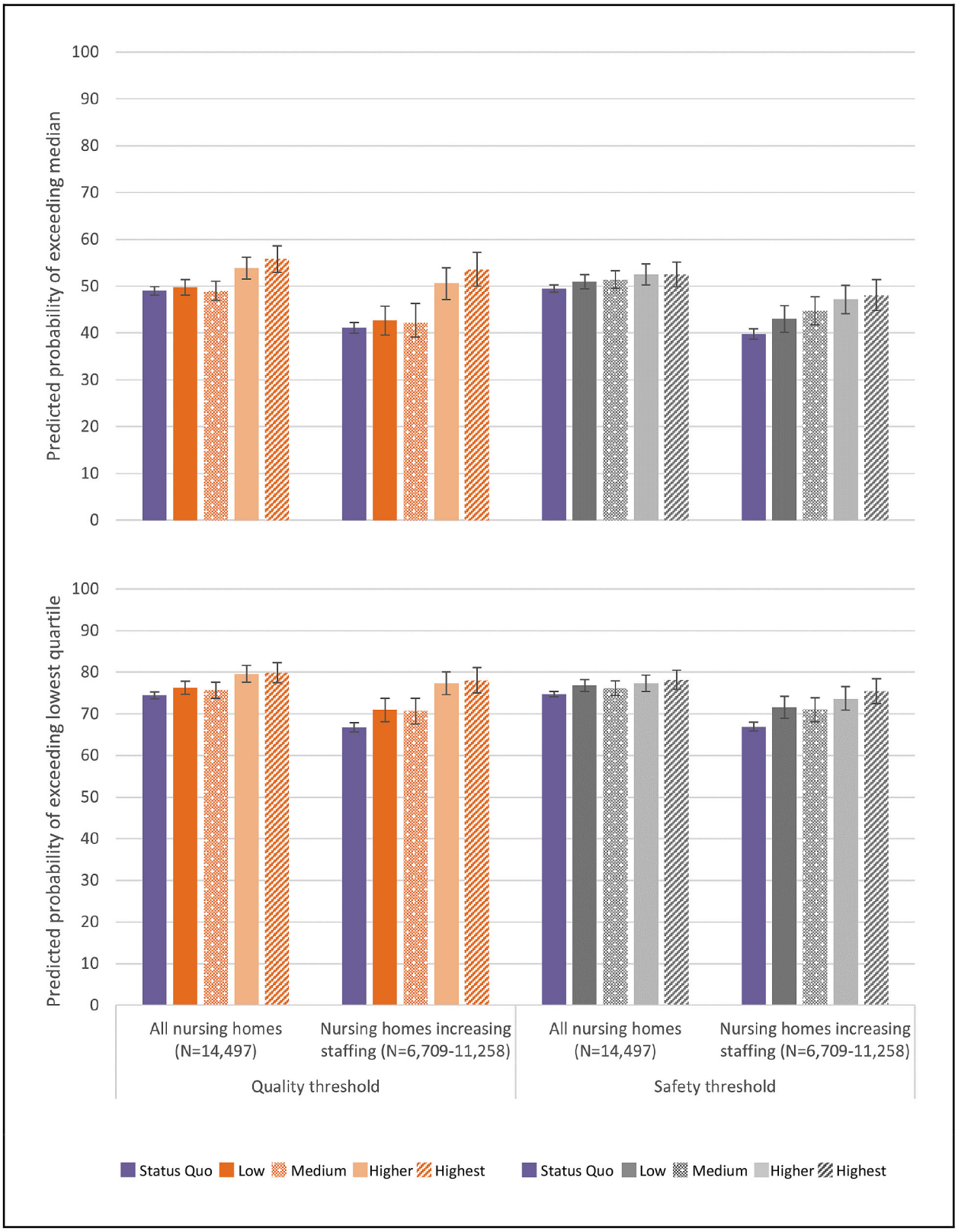
1. Nursing homes currently staffing below specified thresholds will increase staffing to meet those thresholds.
2. Nursing homes with staffing above the specified thresholds will make no change in staffing levels.

For simplicity, these scenarios are referenced as *Low, Medium, Higher, Highest.* **Exhibit 4.11** shows the percentage of nursing homes predicted to exceed the 50th percentile quality and safety thresholds (top panel) and 25th percentile quality and safety thresholds (bottom panel) for the minimum staffing requirements in **Exhibit 4.10**. Predicted percentages are shown for two different groups: all nursing homes and the subset of nursing homes that would need to increase staffing to reach the specified staffing thresholds. For comparison purposes, this exhibit also shows the percentage of nursing homes predicted to exceed performance standards under the "status quo" scenario; that is, at existing nursing home staffing levels.

In general, the percentage of nursing homes predicted to exceed the performance thresholds is lower for the nursing homes that would need to increase staffing levels. For example, under the *Highest* (7th staffing

decile) requirement scenario, 55.8 percent of all nursing homes are predicted to exceed the 50th percentile quality threshold, compared to 53.6 percent of nursing homes that would need to increase staffing to meet that threshold. This is because the nursing homes needing to increase staffing, by definition, are lower staffed on average than are other nursing homes, and lower staffing, as noted above, is associated with lower overall quality.

Exhibit 4.11: Nursing Homes Exceeding Performance Thresholds Under Different Minimum Nurse Staffing Requirement Scenarios



In both groups, the percentage of nursing homes predicted to exceed performance thresholds generally increases as the staffing decile requirement increases, with a few exceptions. However, the increase is largest for the nursing homes that would need to increase staffing levels to reach the specified decile, the group that stands to experience associated quality and safety gains. When the parallel metric is calculated for all nursing homes, including those that would *not* need to increase staffing to reach the specified decile, the safety and quality improvements are effectively diluted (**Exhibit 4.12**).

For example, for the total QM score, the percentage of all nursing homes predicted to exceed the median increases from 49.1 percent under the status quo to 55.8 percent under the *Highest* scenario, a difference of 6.7 percentage points. By comparison, the increase is 44.7 percent to 53.6 percent, an 8.9 percentage point difference, among the group of nursing homes needing to increase staffing.

Exhibit 4.12: Predicted Percentage of Nursing Homes Exceeding Quality and Safety Thresholds Associated with Select Staffing Levels: Three Requirements (RN, Licensed Nurse, Total Nurse Staff)

Option	Status Quo (95% CI)	All Nursing Homes (N=14,947)			Nursing Homes Increasing Staffing			
		Predicted Value (95% CI)	Difference from Status Quo		Number Needing to Increase Staffing	Status Quo (95% CI)	Predicted Value (95% CI)	Difference from Status Quo (95% CI)
			Percentage Points (95% CI)	Number of Nursing Homes (95% CI)				
Total QM Score (above median)								
Low	49.1 (48.2–50.0)	49.8 (48.2–51.5)	0.7 (-0.7–2.2)	105 (-135–359)	N=6,709	41.1 (39.9–42.2)	42.8 (39.6–45.7)	1.6 (-1.6–4.9)
Medium		49.0 (47.0–51.0)	−0.1 (-1.8–1.7)	-15 (-314–284)	N=8,352	42.3 (41.3–43.4)	42.2 (39.1–45.3)	−0.1 (-3.2–3.0)
Higher		53.8 (51.4–56.2)	4.8 (2.6–7.0)	703 (344–1,061)	N=9,857	43.3 (42.3–44.3)	50.5 (47.2–53.9)	7.3 (3.9–10.7)
Highest		55.8 (52.9–58.7)	6.7 (4.1–9.4)	1,001 (568–1,435)	N=11,258	44.7 (43.8–45.6)	53.6 (50.0–57.2)	8.9 (5.4–12.4)
Total QM Score (above lowest quartile)								
Low	74.4 (73.6–75.2)	76.3 (74.8–77.9)	2.0 (0.5–3.2)	299 (75–238)	N=6,709	66.8 (65.6–67.9)	70.9 (68.1–73.8)	4.2 (1.1–7.2)
Medium		75.7 (73.8–77.6)	1.3 (-0.5–3.1)	209 (-75–493)	N=8,352	68.3 (67.3–69.3)	70.7 (67.6–73.7)	2.4 (-0.8–5.6)
Higher		79.6 (77.6–81.5)	5.2 (3.4–7.0)	792 (493–1,076)	N=9,857	69.4 (68.5–70.4)	77.3 (74.6–80.0)	7.9 (5.2–10.6)
Highest		79.9 (77.6–82.3)	5.5 (3.3–7.8)	837 (493–1,196)	N=11,258	70.7 (69.8–71.6)	78.0 (75.0–81.1)	7.4 (4.4–10.3)
Health Inspection Survey Score (above median)								
Low	49.5 (48.7–50.3)	50.9 (49.3–52.4)	1.4 (0.1–2.8)	209 (-30–433)	N=6,709	39.8 (38.7–40.9)	43.0 (40.0–45.8)	3.2 (0.2–6.2)
Medium		51.4 (49.5–53.3)	1.9 (0.2–3.6)	284 (0–568)	N=8,352	41.2 (40.3–42.2)	44.7 (41.7–47.7)	3.4 (0.4–6.5)
Higher		52.5 (50.3–54.7)	3.0 (1.0–4.9)	448 (120–777)	N=9,857	42.6 (41.7–43.5)	47.2 (44.2–50.2)	4.5 (1.6–7.5)
Highest		52.5 (49.9–55.1)	3.0 (0.5–5.5)	448 (60–837)	N=11,258	44.0 (43.2–44.9)	48.1 (44.8–51.4)	4.0 (0.7–7.3)

Option	Status Quo (95% CI)	All Nursing Homes (N=14,947)			Nursing Homes Increasing Staffing			
		Predicted Value (95% CI)	Difference from Status Quo		Number Needing to Increase Staffing	Status Quo (95% CI)	Predicted Value (95% CI)	Difference from Status Quo (95% CI)
			Percentage Points (95% CI)	Number of Nursing Homes (95% CI)				
Health Inspection Score (above lowest quartile)								
Low	74.8 (74.1–75.4)	76.8 (75.4–78.2)	2.1 (0.8–3.3)	299 (90–508)	N=6,709	66.9 (65.9–68.0)	71.6 (68.9–74.2)	4.6 (1.9–7.4)
Medium		76.1 (74.4–77.9)	1.3 (-0.3–3.0)	194 (-60–463)	N=8,352	68.6 (67.6–69.5)	71.0 (68.1–73.9)	2.4 (-0.5–5.3)
Higher		77.4 (75.4–79.3)	2.6 (0.7–4.4)	389 (90–673)	N=9,587	69.7 (68.9–70.6)	73.7 (70.9–76.5)	3.9 (1.1–6.7)
Highest		78.2 (75.9–80.5)	3.4 (1.2–5.6)	508 (164–852)	N=11,258	70.9 (70.1–71.7)	75.5 (72.5–78.4)	4.5 (1.6–7.4)

For comparison purposes, the Study Team used the same approach to generate "what-if" scenarios representing the percentage of nursing homes predicted to exceed 50th and 25th percentile performance standards for two alternative minimum staffing requirement structures *not* allowing nursing homes to substitute across staff types: two requirements (RN and nurse aide; **Exhibit 4.13**) and four requirements (RN, LPN, nurse aide, and total nurse staff; **Exhibit 4.14**).

Like the three-requirement results presented in **Exhibit 4.12**, minimum required staffing levels under these alternative scenarios are the same as presented in **Exhibit 4.10**. However, because these alternatives do not permit substitution across staff types, more nursing homes would need to add staff to meet requirements structured in this way. For example, a nursing home with 3.30 total nurse HPRD including 0.65 RN HPRD, 0.60 LPN HPRD, and 2.05 nurse aide HPRD would be compliant with the *Low* three-requirement structure but would need to increase nurse aide staffing to meet the *Low* two-requirement structure and would need to increase both LPN and nurse aide staffing to meet the *Low* four-requirement structure. Unless this nursing home concurrently reduced RN staffing levels, the needed increase in LPN and nurse aide staffing to meet the four-requirement structure would cause the nursing home to exceed total nurse staffing of 3.30 HPRD.

In general, predicted quality and safety for the two- and four-requirement alternatives are slightly higher than for the three-requirement structure described above. However, predicted quality and safety are similar across the two- and four-requirement structures, since LPN staffing levels were not statistically associated with the probability of exceeding minimum quality and safety thresholds in Staffing Study multivariate models.

Exhibit 4.13: Predicted Percentage of Nursing Homes Exceeding Quality and Safety Thresholds Associated with Select Staffing Levels: Two Requirements (RN and Nurse Aide)

Option	Status Quo (95% CI)	All Nursing Homes (N=14,947)			Nursing Homes Increasing Staffing			
		Predicted Value (95% CI)	Difference from Status Quo		Number Needing to Increase Staffing	Status Quo (95% CI)	Predicted Value (95% CI)	Difference from Status Quo (95% CI)
			Percentage Points (95% CI)	Number of Nursing Homes (95% CI)				
Total QM Score (above median)								
Low	49.1 (48.2–50.0)	51.8 (49.8–53.7)	2.7 (1.0–4.4)	404 (105–688)	N=9,159	43.7 (42.7–44.8)	48.1 (45.4–50.9)	4.4 (1.6–7.2)
Medium		51.6 (49.6–53.7)	2.6 (0.7–4.4)	374 (75–688)	N=10,371	44.6 (43.6–45.5)	48.3 (45.5–51.1)	3.7 (1.0–6.4)
Higher		55.9 (53.5–58.4)	6.9 (4.7–9.1)	1016 (658–1,390)	N=11,454	45.4 (44.5–46.4)	54.4 (51.4–57.4)	9.0 (6.1–11.8)
Highest		56.5 (53.6–59.4)	7.4 (4.6–10.2)	1,106 (673–1,540)	N=12,397	46.4 (45.5–47.3)	55.3 (52.1–58.6)	9.0 (5.6–12.3)
Total QM Score (above lowest quartile)								
Low	74.3 (73.6–75.1)	77.8 (76.1–79.5)	3.5 (1.9–5.0)	523 (269–777)	N=9,159	69.6 (68.6–70.6)	75.2 (72.8–77.7)	5.7 (3.1–8.2)
Medium		78.1 (76.3–79.9)	3.8 (2.1–5.4)	568 (299–837)	N=10,371	70.5 (69.5–71.4)	75.9 (73.5–78.3)	5.4 (3.0–7.8)
Higher		79.4 (77.4–81.5)	5.1 (3.2–7.0)	762 (463–1,076)	N=11,454	71.3 (70.4–72.1)	77.9 (75.4–80.4)	6.6 (4.2–9.1)
Highest		81.1 (78.9–83.4)	6.8 (4.6–8.9)	1,016 (688–1,360)	N=12,397	72.0 (71.2–72.9)	80.2 (77.6–82.8)	8.2 (5.6–10.8)
Health Inspection Survey Score (above median)								
Low	49.5 (48.7–50.3)	51.9 (50.1–53.7)	2.4 (0.8–3.9)	359 (90–628)	N=9,159	43.4 (42.5–44.3)	47.3 (44.7–49.9)	3.9 (1.4–6.4)
Medium		51.7 (49.7–53.6)	2.2 (0.5–3.9)	329 (30–613)	N=10,371	44.3 (43.5–45.2)	47.5 (44.9–50.1)	3.1 (0.7–5.6)
Higher		53.7 (51.4–55.9)	4.2 (2.1–6.3)	628 (284–957)	N=11,454	45.2 (44.4–46.1)	50.7 (47.9–53.5)	5.5 (2.7–8.2)
Highest		52.7 (50.1–55.3)	3.2 (0.7–5.7)	478 (90–867)	N=12,397	46.1 (45.3–47.0)	50.0 (47.0–53.0)	3.9 (0.8–6.9)
Health Inspection Score (above lowest quartile)								
Low	74.8 (74.1–75.4)	76.8 (75.2–78.5)	2.1 (0.6–3.5)	299 (60–553)	N=9,159	70.3 (69.4–71.1)	73.6 (71.3–76.0)	3.4 (1.0–5.7)
Medium		77.2 (75.5–79.0)	2.5 (0.9–4.0)	359 (105–628)	N=10,371	71.0 (70.2–71.9)	74.6 (72.2–76.9)	3.5 (1.3–5.7)
Higher		78.7 (76.8–80.6)	4.0 (2.1–5.8)	583 (299–867)	N=11,454	71.8 (71.0–72.6)	77.0 (74.6–79.4)	5.2 (2.8–7.6)
Highest		77.4 (75.1–79.7)	2.6 (0.4–4.9)	389 (45–732)	N=12,397	72.5 (71.8–73.3)	75.7 (73.0–78.3)	3.2 (0.4–5.9)

Exhibit 4.14: Predicted Percentage of Nursing Homes Exceeding Quality and Safety Thresholds Associated with Select Staffing Levels: Four Requirements (RN, LPN, Nurse Aide, and Total Nurse Staff)

Option	Status Quo (95% CI)	All Nursing Homes (N=14,947)			Nursing Homes Increasing Staffing			
		Predicted Value (95% CI)	Difference from Status Quo		Number Needing to Increase Staffing	Status Quo (95% CI)	Predicted Value (95% CI)	Difference from Status Quo (95% CI)
			Percentage Points (95% CI)	Number of Nursing Homes (95% CI)				
Total QM Score (above median)								
Low	49.1 (48.2–50.0)	51.6 (49.5–53.7)	2.5 (0.7–4.4)	374 (60–688)	N=10,977	46.2 (45.3–47.2)	49.7 (47.1–52.3)	3.5 (1.0–6.0)
Medium		52.0 (49.7–54.3)	2.9 (0.9–5.0)	433 (90–777)	N=11,903	46.6 (45.7–47.5)	50.3 (47.6–53.0)	3.7 (1.1–6.3)
Higher		56.3 (53.6–58.9)	7.2 (4.9–9.6)	1,076 (673–1,465)	N=12,736	47.0 (46.1–48.0)	55.5 (52.5–58.5)	8.5 (5.7–11.3)
Highest		56.8 (53.8–59.9)	7.8 (4.8–10.8)	1,151 (703–1,614)	N=13,411	47.6 (46.7–48.5)	56.3 (53.0–59.5)	8.7 (5.4–12.0)
Total QM Score (above lowest quartile)								
Low	74.3 (73.6–75.2)	77.9 (76.1–79.7)	3.6 (2.0–5.2)	538 (269–807)	N=10,977	71.8 (70.9–72.6)	76.6 (74.4–78.8)	4.9 (2.7–7.1)
Medium		78.5 (76.6–80.4)	4.2 (2.4–6.0)	628 (344–912)	N=11,903	72.2 (71.3–73.0)	77.5 (75.2–79.7)	5.3 (3.0–7.5)
Higher		79.9 (77.7–82.0)	5.5 (3.5–7.5)	837 (508–1,151)	N=12,736	72.6 (71.8–73.4)	79.1 (76.7–81.5)	6.5 (4.1–8.8)
Highest		81.5 (79.2–83.8)	7.2 (5.0–9.4)	1,076 (732–1,420)	N=13,411	73.1 (72.2–73.9)	81.0 (78.5–83.5)	8.0 (5.5–10.5)
Health Inspection Survey Score (above median)								
Low	49.5 (48.7–50.3)	51.6 (49.7–53.5)	2.2 (0.5–3.8)	314 (30–598)	N=10,977	46.1 (45.2–46.9)	49.0 46.6–51.4)	2.9 (0.7–5.2)
Medium		52.2 (50.1–54.3)	2.7 (0.8–4.6)	404 (90–717)	N=11,903	46.5 (45.7–47.4)	49.9 (47.4–52.4)	3.4 (1.0–5.8)
Higher		54.2 (51.8–56.6)	4.7 (2.4–7.1)	703 (344–1,061)	N=12,736	47.0 (46.2–47.8)	52.6 (49.9–55.3)	5.6 (2.9–8.3)
Highest		53.2 (50.5–56.0)	3.7 (1.1–6.4)	553 (149–972)	N=13,411	47.6 (46.8–48.4)	51.7 (48.8–54.7)	4.2 (1.2–7.1)
Health Inspection Score (above lowest quartile)								
Low	74.8 (74.1–75.4)	76.8 (75.1–78.4)	2.0 (0.5–3.5)	299 (45–538)	N=10,977	72.2 (71.4–73.0)	74.9 (72.8–77.0)	2.7 (0.6–4.8)
Medium		77.5 (75.7–79.4)	2.8 (1.1–4.4)	404 (135–688)	N=11,903	72.6 (71.9–73.4)	76.1 (73.9–78.3)	3.5 (1.4–5.5)
Higher		79.0 (77.0–81.0)	4.3 (2.3–6.3)	628 (329–927)	N=12,736	73.1 (72.3–73.8)	78.1 (75.8–80.3)	5.0 (2.7–7.4)
Highest		77.7 (75.3–80.1)	2.9 (0.6–5.3)	433 (75–792)	N=13,411	73.5 (72.8–74.2)	76.7 (74.2–79.3)	3.3 (0.7–5.9)

4.1.4 Discussion

The 2001 CMS Staffing Study identified a strong relationship between nurse staffing levels and selected quality measures for a sample that included more than 5,000 nursing homes in 10 states (Abt Associates, 2001). The study identified maximum staffing levels above which there were no further improvements in quality. However, that study noted that available staffing data at that time (from the CMS Online Survey Certification and Reporting System, or OSCAR) were not sufficiently accurate to assess compliance, such that a federal minimum staffing requirement was not feasible given the available data.

Since that time, the 2010 Affordable Care Act established a requirement for nursing homes to electronically report direct care staffing data quarterly, using payroll and other auditable data. Nursing homes began reporting into the resultant PBJ system in the second half of calendar year 2016. In addition, substantial changes to Nursing Home Care Compare since its 2002 release, including introduction of the Five-Star Quality Rating System in 2008, have expanded the number and type of publicly available quality measures and methods for measuring nursing home performance.

Beyond these data infrastructure improvements, the last two decades have seen substantial changes in the long-term care landscape, as baby boomers have reached retirement age and home- and community-based care options have continued to expand. Most recently, the COVID-19 public health emergency has worsened mental and physical health among nursing home residents (U.S. Government Accountability Office, 2022) and exacerbated existing strain on the long-term care workforce (Gasdaska et al., 2022; AHCA/NCAL, 2022).

While numerous studies since the 2001 CMS Staffing Study have investigated and confirmed staffing-quality relationships (Clemens et al., 2021; Min & Hong, 2019; Wagner et al., 2021; Figueroa et al., 2020; Gorges & Konetzka, 2020; Snyder et al., 2021; Li et al., 2020; Gray-Miceli et al., 2021; Kingsley & Harrington, 2022), none to date has assessed whether those relationships have persisted in the wake of the COVID-19 public health emergency. To inform development of a federal minimum staffing requirement, Staffing Study analyses presented in this section are intended to fill this evidence gap. These novel analyses leverage CMS investments in the nursing home data infrastructure over the past two decades, including high-quality staffing data from the PBJ system (CMS, 2022b) and up-to-date quality and safety measures based on publicly available Nursing Home Care Compare data (CMS, 2022a).

Using these robust data sources, the Staffing Study uses multivariate logistic regression models to estimate relationships between nurse staffing levels and the level and type of nurse staffing needed to provide acceptable safe and quality care in nursing homes. The analysis results demonstrate associations between higher nurse staffing levels and the likelihood that nursing homes exceed minimum standards for acceptable quality and safety, particularly for RN staffing. These analyses did not consistently identify thresholds above which higher total nurse and RN staffing levels were no longer associated with improvements in quality and resident safety. That finding contrasts with the findings of the prior 2001 CMS Staffing Study (Abt Associates, 2001), which found maximum staffing thresholds above which staffing increases were no longer associated with quality improvements. However, neither the earlier study nor the present Staffing Study found evidence of staffing "cliffs" below which quality and safety precipitously decline. There were no statistically significant differences in quality or safety associated with differences in LPN staffing, and differences for nurse aides were found only for the highest staffing deciles.

The Staffing Study examined two definitions of minimally acceptable quality and safety standards, based on the 25th and 50th percentiles of the total QM score and the within-state health inspection survey score. Findings suggest that some nursing homes are staffed at levels that place their residents at substantially higher risk of poor quality (e.g., being in the lowest quartile of QM score) and low safety (e.g., lowest quartile of performance on health inspection surveys). Results show that there is an association between nurse staffing levels and the likelihood that nursing homes will exceed acceptable quality and safety

thresholds, suggesting a role for policies intended to increase nursing home staffing, such as minimum staffing requirements, particularly those targeting RN and total nurse staffing.

Findings in this section additionally have equity implications for a minimum staffing requirement. Nursing homes with a high percentage of Medicaid residents are shown to have lower staffing levels, on average. Nursing homes with a high Medicaid resident share would benefit the most from having minimum staffing requirement, reducing disparities between these nursing homes and those that serve fewer Medicaid residents, although a requirement is unlikely to eliminate disparities on its own.

Even with the strong relationship between staffing and nursing home performance, some nursing homes with high staffing levels still fall below the acceptable quality and safety standards used in these analyses. This suggests the importance of unmeasured factors such as management practices; nurse staffing experience, skill, and motivation; models of care; and other factors that were not included in the regression models that might also influence nursing home safety and quality, consistent with the Staffing Study conceptual framework (see **Exhibit 1.1)**.

"What if" scenario findings reported in this section suggest that successful implementation of minimum staffing requirements would be associated with improvements in predicted percentage of nursing homes exceeding minimum performance standards, with such improvements ranging from 1 to 8 percentage points, depending on the minimum requirement option and structure. Concurrent improvements in other dimensions of nursing home practice as identified in the conceptual framework may have potential to further improve nursing home performance.

Descriptive analyses identified considerable variation in nurse staffing levels across nursing homes. This variation could affect how nursing homes might respond to a new federal minimum staffing requirement. Because the range of current staffing levels is so wide, even a quite low minimum staffing threshold requirement would require staffing increases for a non-negligible fraction of lower-staffed nursing homes, particularly within subgroups of nursing homes with lower staffing levels. Higher minimum staffing requirements are associated with larger predicted improvements in the "what if" scenario models, particularly in lower-staffed nursing homes. To get those improvements, however, will require more nursing homes to increase staffing, which may pose feasibility challenges given recent workforce challenges related to the COVID-19 public health emergency (Gasdaska et al., 2022; AHCA/NCAL, 2022).

"What if" scenarios further suggest that minimum staffing requirements structured to allow substitution across staff types at nursing home discretion will require fewer nursing homes to increase staffing to comply than requirements setting separate minimum staffing requirements for each staff type. For example, fewer nursing homes would need to increase staff to meet the *Low* requirement threshold of 1.15 licensed nurse staff HPRD than under separate requirements of 0.70 RN HPRD and 0.45 LPN HRPD. Predicted quality and safety improvements associated with separate staff type requirement structures were only minimally higher than for requirements at equivalent staffing thresholds that do allow substitution across staff types. In addition, because the multivariate models informing the "what if" scenarios indicate weak and inconsistent relationships of LPN staffing with nursing home quality and safety, predicted improvements under a "four-requirement" scenario including separate staffing requirements for LPNs along with RNs, nurse aides, and total nurse staffing are virtually identical to those under a "two-requirement" scenario including only RN and nurse aide requirements.

It is also important to consider the behavior of nursing homes currently staffing at high levels even *without* a federal minimum staffing requirement in place. The "what if" scenarios explicitly assume that nursing homes already staffing above the threshold specified by a new federal minimum staffing requirement will not change staffing levels in response to its enactment. However, it is also possible that higher-staffed nursing homes could interpret a minimum requirement as signaling an *optimal* staffing

level and reduce perceived "excess" staffing levels accordingly. If this happens, the benefits of a minimum staffing requirement would be reduced relative to the "what if" predictions.

The data sources used for analyses in this section have some limitations. The PBJ data do not capture information on hours worked by shift, preventing the Staffing Study from examining staffing levels at different times of day or based on the presence of staff types on specific shifts (e.g., 24-hour RN staffing). The lack of shift-level data also precludes the study from reporting on staff-to-resident ratios, since it is not possible to know how many staff are working at any specified time. Additionally, the PBJ system does not fully capture all staffing hours because of caps on hours reported for salaried workers. For example, if a salaried employee works 10 hours but is paid for only 8 hours, only 8 hours are reported.

The Nursing Home Care Compare QM data has several limitations. QMs are calculated at the nursing home level, preventing examination of within-facility differences for subgroups of nursing home residents to support further investigation of disparities or equity. The MDS-based quality measures are based on information that is self-reported by nursing homes and are limited in scope to a subset of quality constructs. The claims-based measures are not available for Medicare Advantage residents. There are differences in results of health inspection surveys across states that might not be related to quality of care. Lastly, though these QM data capture a wide range of quality and safety metrics, there are important dimensions of quality that are meaningful for residents or other stakeholders (e.g., quality of life) that these analyses are unlikely to capture.

Because it was not possible for the study to use an experimental or quasi-experimental design, it is not possible to establish a causal relationship between staffing and quality. The associations between staffing and measures of quality and safety identified could be because of other factors that are correlated with staffing, rather than to staffing levels and the mix of staff. These other factors include resident factors that are not reflected in the Resource Utilization Group-Version 4 nursing index used for acuity adjustment, staff proficiency (e.g., competency, skill set), staffing model (assignments, use of team nursing), community support/resources (e.g., proximity to police, fire, ambulance services, hospital), facility layout, and use of technology (e.g., electronic medical records, telehealth, advanced call light systems, activity systems).

In sum, analyses presented in this section indicate positive relationships of staffing with nursing home quality and safety that have persisted in recent years despite the COVID-19 public health emergency. These findings validate similar findings from earlier studies using robust, high-quality staffing and quality data capturing the full population of U.S. nursing homes. Results suggest a potential role for minimum staffing requirements and other policies that can successfully increase nursing home staffing.

4.2 Simulations of Delayed/Omitted Clinical Care

Key Takeaways

- Simulation findings suggest that a staffing level of four licensed nurses (RNs+LPNs) would reduce delayed or omitted clinical care to a rate below 5 percent in a 70-resident nursing home. At least five licensed nurses would virtually eliminate delayed or omitted care in this setting. These staffing levels correspond to at least 1.7 licensed nurse HPRD at such a nursing home.
- In combination with previous findings from the literature (Schnelle et al., 2016), simulation findings suggest that a total nurse (RN+LPN+nurse aide) staffing level between 3.8 HPRD and 4.6 HPRD would be adequate to keep rates of both omitted activities of daily living care and omitted clinical care below 10 percent.
- Simulation findings support inclusion of a total licensed nurse staffing threshold in a minimum staffing requirement to ensure adequate levels of licensed nurse staffing for timely completion of key clinical care tasks.

Simulation analyses in this section assess how licensed nurse staffing levels influence the likelihood of delayed or omitted clinical care. Simulation output is also used to model predicted reductions in delayed and omitted clinical care associated with potential federal minimum staffing requirement options.

4.2.1 Overview

The gold standard approach for a single study to build evidence for policy is experimentation with random assignment (Evans, 2003). However, randomizing different nursing home staff levels is unethical because it could compromise resident care. Computer simulation is an alternative to randomization, modeling the effects of differing staffing levels on delayed and omitted care in a simulated nursing home setting while holding other factors, such as resident acuity, constant. This approach mimics random assignment without the ethical and practical concerns of a real-world experiment.

Simulation methods have been used to determine minimal nurse aide staffing levels needed to provide key care processes (Abt Associates, 2001) and ADL care to nursing home residents (Schnelle et al., 2016). However, simulation methods have not been similarly applied to determine minimal licensed nurse (RN and LPN) staffing levels to perform common clinical care tasks. Given the distinct roles played by licensed nurses and nurse aides as previously established in the literature (Bakerjian et al., 2021; Bonner et al., 2022; Burt, 2019; Firnhaber et al., 2020), this represents an important evidence gap to be filled by Staffing Study analyses presented in this section.

In particular, the Staffing Study team developed an observational study of common clinical tasks in nursing homes typically performed by licensed nurse staff and then used computer simulations to model the effects of different staffing levels on successful and timely completion of those tasks. **Exhibit 4.15** provides an overview of how the simulation modeling process works. The observational study and accompanying simulations used an acuity-based approach to define clinical care provided by different licensed nurse staff. Together they address the following research question: *What is the relationship between licensed nurse staff levels and projected delays and omissions in clinical care?* **Appendix F**

provides additional detail on methods and full findings, including separate results from alternative simulation software.

Simulations are particularly useful for understanding scenarios with a complex set of needs and limited resources. In this study, the simulation's available resource—licensed nurses—must respond with the appropriate urgency to the multiple care needs of residents with different acuity levels. The allocation of nursing resources can lead to unintuitive dynamics such as non-linear outcomes; for example, when doubling the number of nurses doing medication passes from one to two improves nurses' efficiency by three or four times.

Simulations require input of detailed information about frequency and duration for licensed nurses to perform various clinical care tasks on a typical shift. Licensed nurses can spend time providing direct clinical care to residents, such as completing a medication pass, or performing indirect clinical care tasks while physically separated from residents, such as filling out paperwork. Existing literature lacks such information at the required levels of granularity, which required the study team to collect primary data through direct observation of licensed nurses performing common clinical care tasks.

Exhibit 4.15: Simulation Modeling Overview

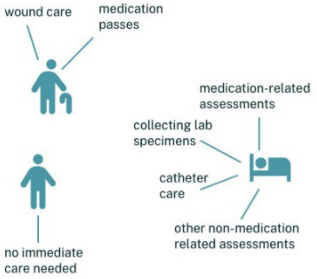
Nursing Home Staffing Study

Overview of Simulation Modeling

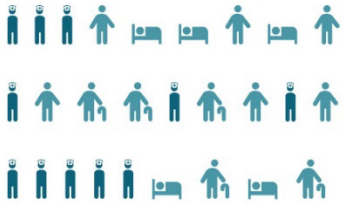
The Setup

In the real world, licensed nursing staff (RNs and LPNs) have many tasks and limited time to complete them. Nursing homes often have varying numbers of licensed nursing staff.

Likewise, a resident in the real world might experience one care need at a given time, numerous needs, or none at all. At the resident population level, the level of care needed is called "acuity."



Real-world nursing homes have varying combinations of licensed nursing staff, residents, acuity, and other factors that affect the quality of care they provide. In the simulation, each of these different combinations is called a "scenario." Here are three possible scenarios, as examples:



The Simulation

With these real-world factors as inputs, the study team uses a computer simulation to predict the quality of care (measured as omitted care) in a nursing home for numerous different scenarios.

For example, the study team runs an experiment with 5 licensed nursing staff and 70 residents with varying combinations of needs.

Scenario 1

x5 x50 x10 x10

= **22**% of residents encounter omitted care

The outcome of this experiment shows many of those residents encounter omitted care.

Then, the team runs the same experiment, this time increasing the number of licensed nursing staff to 10.

Scenario 2

x10 x50 x10 x10

= **4**% of residents encounter omitted care

The team also runs experiments where the care needs of the resident population are increased or decreased while keeping their number and the number of licensed nursing staff constant.

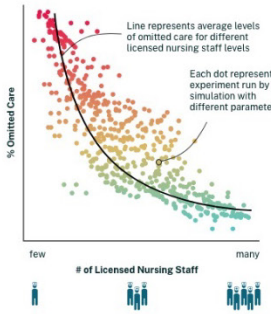
Scenario 100

x10 x10 x35 x25

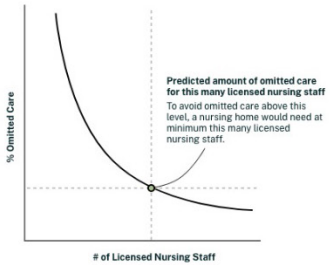
= **6**% of residents encounter omitted care

Each time, the study team notes what happens to the percentage of omitted care in that scenario.

By running these experiments over and over (thousands of times), sometimes varying the number of licensed nursing staff and sometimes varying the number and kinds of care needs, the study team lets the simulation help predict what would happen on average in nursing homes with different numbers of licensed nursing staff.



These averages can then be used to understand the minimum number of licensed nursing staff necessary for a nursing home to avoid a particular level of omitted care.



Background Info

What is a simulation?
A simulation is a computer model that imitates the real world: it represents real-world factors and behaviors — in this case, things such as licensed nursing staff levels, time spent with a resident, and care needs inside a nursing home. Running a simulation makes observing the effects of different scenarios — combinations of these factors — over numerous experiments faster than would be possible in the real world.

Why use a simulation?
A simulation study provides an opportunity to artificially manipulate variables while holding others constant without the concerns of a real-world experiment. In the context of nursing homes and licensed nursing staff, such an experiment conducted in the real world would be unethical, resource prohibitive, and infeasible. Nursing homes participating in such a study would need to randomize licensed nursing staff levels in a way that could potentially compromise resident care.

How are simulation results validated?
In order to validate the results of a simulation, the study team compares the simulation's predictions about levels of omitted care for hypothetical licensed nursing staff levels to real data about levels of omitted care. That is, when the simulation is given real-life licensed nursing staff levels at a nursing home for which the level of omitted care is known and then told to make a prediction about what that level will be, it produces the expected answer.

Note: All values (both inputs and results) shown in this infographic are hypothetical and do not represent results of any analysis.

4.2.2 Methods

This section focuses on methods for the observational data collection, the secondary data sources used, and the overall simulation approach to measure clinical care task frequency and duration.

Observational Data Collection

The study team partnered with two Quality Improvement Network–Quality Improvement Organizations (QIN-QIOs)—Alliant Health Solutions and TMF Health Quality Institute—to identify nursing homes for observational data collection, which resulted in a purposive sample of 20 nursing homes from seven different states in the Northeast, South, and West U.S. Census regions.

The sample was intentionally restricted to include nursing homes with an overall four- or five-star rating in the Five-Star Quality Rating System in September 2022.[7] This ensured that observed times for typical care tasks would reflect time needed to deliver high-quality resident care. In addition, high-quality nursing homes typically have sufficient staffing of nurse aides (Hyer et al., 2011), reducing the likelihood that licensed nurses would be interrupted or required to assist with ADL care during observations. The goal of restricting data collection to high-quality nursing homes is to focus observational data collected to reflect acceptable care quality for residents' clinical care needs.

The Staffing Study's QIN-QIO partners provided trained clinicians to observe and document duration of time for providing specific clinical care tasks. All clinician-observers underwent a three-hour training on hardware, software, and the clinical protocol, as well as on best practices to avoid disrupting resident care while conducting observations. The study team obtained informed consent from all residents and nurse staff to be observed. The Abt Associates Institutional Review Board[8] reviewed and approved consent and data collection materials for observations.

Observations focused on the time it took for licensed nurse staff to perform six types of core clinical tasks (**Exhibit 4.16**). In consultation with four licensed nurses and physicians with experience in nursing homes and/or acute care settings, the study team developed clinical protocols with definitions for each of these care types. These detailed protocols ensured consistency during observational data collection, such as excluding instances when care tasks were performed by non-licensed nurse staff such as phlebotomists. The study team also measured preparation time for each task. For instance, licensed nurses often prepare a cart for a medication pass for their residents in advance.

Exhibit 4.16: Number and Percentage of Licensed Nurse Staff Clinical Care Task Observations (N=8,249)

Clinical Care Task	Type	Number of Observations	Percentage of Observations
Medication pass	Direct care	2,989	36.2%
	Preparation	2,715	32.9%
Resident assessment	Direct care	1,177	14.2%
	Preparation	577	7.0%
Wound care	Direct care	265	3.2%
	Preparation	230	2.8%
Catheter/device care	Direct care	119	1.4%
	Preparation	77	0.9%

[7] See https://www.medicare.gov/care-compare/?providerType=NursingHome&redirect=true

[8] https://abtimpact.com/mission-impact-2020/ethics-and-governance/

Clinical Care Task	Type	Number of Observations	Percentage of Observations
Collecting lab specimen	Direct care	54	0.7%
	Preparation	42	0.5%
Ventilator management	Direct care	1	0.01%
	Preparation	3	0.04%

The trained data collectors observed 8,249 unique care tasks across the 20 nursing homes participating in the observations over a six-week period in September and October of 2022. At each nursing home, two observers spent five days on site collecting data. Each day, observers shadowed a single nurse on an 8- to 12-hour shift. For the first week of observations, both observers shadowed the same nurse, enabling calculation of interrater reliability between observers.

Data were collected on a mix of weekdays and weekends, but ultimately only weekday data were used in the simulation, based on expert input. While observed care duration on weekends did differ for some care tasks, these differences were likely not because of differences in care needs and thus were not reliable inputs for simulations seeking to establish ideal staffing levels. Observers shadowed nurses during different shifts, except for night shifts when residents were presumably asleep. More than two-thirds of observed care tasks (n=5,624, or 68 percent) were conducted during day shifts. Data collectors used iPads with a stopwatch-type data collection software tool called TimerPro, with Excel as a backup. Ultimately, 7,932 observations were collected with the TimerPro stopwatch software, with an additional 317 observations collected via the Excel backup system.

As a separate validation step, the Staffing Study team solicited feedback via videoconference from nurses at the participating facilities, including some nurses who were observed during the data collection. Nurse feedback confirmed that minimum, maximum, and mode duration values from the observation data were representative of their own professional experience and in turn reasonable for use to inform simulation parameters.

In addition to direct clinical care, licensed nurses perform many indirect care tasks that require advanced training, such as care planning, nutritional planning, and care coordination with doctors and other providers. These are additional tasks that licensed nurses must complete on behalf of residents during their shift, while they are physically away from the resident. The Staffing Study team elected not to measure indirect care via observation, given the ambiguity of defining indirect care tasks, concerns over interrater reliability, and concerns that frequent task switching could affect data quality. Instead, the study assumes that any time that licensed nurse staff were not providing direct care; preparation time; within-building travel between tasks; or nurse breaks constituted time spent on providing indirect care. As-needed (PRN) medications were not included in the medication pass task. Unless PRN medications were administered as part of wound care, this activity was considered indirect care.

Secondary Data Sources

In addition to the primary observation data described above, the simulation used parameters from several secondary data sources. The study team set the nursing home census parameter at 70 residents based on the median MDS daily average resident census as reported in the PBJ system for January 1, 2021, to March 31, 2022.

The team used MDS Active Resident Episode Table data for 2012 through 2021 to construct resident acuity classes. Resident acuity for the population of residents within the simulated nursing homes in this study mimics acuity in the population of residents within U.S.-based nursing homes, as in prior work by Schnelle et al. (2016). First, the Staffing Study team identified four mutually exclusive acuity classes that could influence the intensity of care provided by licensed nurses and that could be approximated with

items from the MDS data. Then the team used the MDS data for 2012 through 2021 to find the proportion of U.S. nursing home residents in each category (**Exhibit 4.17**).

Exhibit 4.17: Acuity Class Membership of U.S. Nursing Home Residents, 2012–2021

		Medication Pass (MP) and Resident Assessment (RA)	
		Low	High
Catheter Device Care (CDC) and Wound Care (WC)	Low	49.3%	27.6%
	High	14.9%	8.2%

The simulation applies observed acuity class proportions to the 70-resident census. In other words, a simulation mimicking median resident acuity for the population of U.S. nursing home residents as described in **Exhibit 4.17** would include four types of residents by acuity class: 35 "low-low" (low MP and RA and low CDC and WC) residents, 10 low-high residents, 19 high-low residents, and 6 high-high residents. The simulations consider acuity proportions for three different acuity mix scenarios based on the 25th, 50th, and 75th percentile acuity mixes in the MDS data. The numbers of nursing home residents in each of the four acuity classes are shown below in **Exhibit 4.18** for the three different acuity mixes.

Exhibit 4.18: Number of Simulation Nursing Home Residents by Acuity Class for Each Percentile

Percentile	High MP and RA High CDC and WC	High MP and RA Low CDC and WC	Low MP and RA High CDC and WC	Low MP and RA Low CDC and WC
25th	4	20	8	38
50th	5	21	9	35
75th	6	20	11	33

Notes: CDC= Catheter Device Care, MP = Medication Pass, RA = Resident Assessment, WC = Wound Care.

Finally, the team reviewed state-level regulations on nursing home staffing standards (Consumer Voice, 2021) to inform initial staffing parameters. Regulatory information was also the source of assumptions on nurse break times, such as the minimum length of a meal period, as required under state law for adult employees in the private sector (Wage and Hour Division, 2022).

Simulation Software and Services

The Staffing Study team conducted analyses using two commercially available simulation software packages, ProModel and Simul8. The team considered software speed, parallelization capability, availability of documentation, reputation, quality assurance, cost, and direct applicability to the nursing home staffing use in selecting these software packages. The team selected two simulation software packages rather than one to allow comparison and cross-validation of results between different approaches for quality assurance purposes.

As an additional quality assurance step, the Staffing Study procured the services of MOSIMTEC, a professional simulation modeling consulting firm. MOSIMTEC built a third simulation, also using ProModel software, so that its output could be compared to the two simulations that the Staffing Study team built, to verify robustness of results. In addition, the study team consulted with an academic expert on simulation methods, Dr. Nan Kong (Purdue University), to discuss the validity of simulations for estimating the association between staffing levels and the quantity of care provided, as well as the limitations of this methodological approach detailed below.

Simulation Approach

Broadly, each simulation approach followed a similar design: simulations of randomly generated tasks needing to be performed by nurses, the number of whom was set in staffing parameters prior to the start

of each simulation run. Tasks generated by the simulation included direct clinical care tasks (including preparation time), indirect care tasks, travel time, and nurse breaks. Scheduling for each type of task was governed by a combination of rules and random processes. For example, nurse break times were given highest priority in the queue; this ensured that in every simulation, each nurse was taking their mandated break time in compliance with relevant workplace regulations. As another example, the number of needed medication passes for a resident on a given day was drawn from a Poisson distribution, with each medication pass occurring at randomized points within scheduled windows. This ensured the simulation would vary the precise timing and order of events while still spacing medication passes throughout the day.

The simulations defined each instance of direct care as the time a licensed nurse spent on a single clinical care task, including preparation time and travel time. The Staffing Study team specified requirements for five out of the six observed direct clinical care tasks listed in **Exhibit 4.16**. Ventilator care was excluded from the simulation models because of the very low number of observations in the data (n=4). When the scheduled time for a care task arrived, a brief period of travel time would elapse, after which a nurse would perform the care task, including time for preparation. This was represented in the simulations by the nurse remaining in one place for the length of time required to perform care. The duration of each direct care instance was drawn randomly from a triangular distribution informed by the observational data collection results. Nurses could perform only one task at a time.

Delays and omissions of care were determined based on input parameters called "care windows." Each care task was assigned a care window during which the care would ideally be performed. For example, medication passes had a care window of two hours, so if a resident had medication due at 4 p.m., then the care would be considered completed on time if it began between 4 p.m. and 6 p.m. Care begun after 6 p.m. in this example would be considered delayed; if not begun within an additional two hours, by 8 p.m., the care would be considered omitted.

Simulation parameters also included assumptions for time spent on tasks not related to direct clinical care, including travel time, nurse breaks, and indirect care. The team used a series of informed assumptions to allocate time not spent on direct clinical care into these three categories.

- First, the team noted that time in between direct clinical care tasks took two forms: short intervals and long intervals:
  - On average a short interval approximated about 28 seconds. Short intervals were assumed to be travel time, the time spent walking from one resident room to another or from one resident to task preparations. Over the course of a shift, our data suggest that a licensed nurse spends 10 minutes per shift traveling (walking) between direct clinical care tasks. Based on differences in software, the team used slightly different approaches to travel time in the ProModel and Simul8 simulations.
  - Long intervals were assumed to be either indirect care or nurse breaks, and the team further assumed that breaks consisted of two 15-minute breaks and one 30-minute mealtime break, based on break times required under state law for adult employees in the private sector (Wage and Hour Division, 2022).
- For each shift, time assumed to be spent on indirect care was then defined as the total shift time not spent in direct care minus the sum of travel time and 60 minutes of breaks.

Simulation Scenarios and Replications

A "scenario" here refers to a simulation with a fixed set of parameters characterizing residents and licensed nurse staff. The Staffing Study simulation scenarios considered three different resident acuity

mixes (25th, 50th, and 75th percentiles of the MDS data) and 10 possible licensed nurse staffing levels (1 to 10 nurses on duty each simulated day), for a total of 30 distinct scenarios.

A "replication" refers to a single run of a specific scenario's simulated day. The study team conducted two analyses with each simulation running a minimum of 3,996 replications per scenario.

4.2.3 Results

The Staffing Study simulations focused on a single simulated day in a hypothetical nursing home serving 70 residents across two licensed nurse shifts with equal staffing levels, to identify minimal levels of licensed nurse staffing needed for timely completion of common clinical care tasks.

Results for three percentage outcome metrics are reported:

- Percentage of requested clinical care that was delayed
- Percentage of requested clinical care that was omitted
- Percentage of requested clinical care that was either delayed or omitted (which is the sum of the first and second percentages)

Because results across simulation models were broadly similar, this section presents pooled results from the ProModel and Simul8 simulations conducted by the Staffing Study team. (Full results for all three simulation models, including the MOSIMTEC ProModel simulation, are reported in **Appendix F.2**.)

Though the simulations used integer staff levels (e.g., 1, 2, 3) as inputs, the tables below additionally convert simulated staffing level scenarios to HPRD. This facilitates comparison with prior literature and consistency with standard conventions for existing state minimum staffing requirements. In particular, the HPRD equivalent is calculated as the number of licensed nurses multiplied by total hours per day (24) and divided by the number of nursing home residents (70) in the simulation model.

The two software packages produced slightly different values for the metrics by scenario and staffing level because of differences in their capabilities and simulation decisions. Pooled results were averaged across both sets of simulation findings. As the final number of replications varied between the two sets of simulations, the team weighted a replication so that exactly half the weight was assigned to each software package, thus providing an average that is the midpoint of the software-specific results.[9]

Average Rates of Delayed and Omitted Care

Exhibit 4.19 provides the estimated percentage of delayed or omitted care from the ProModel and Simul8 simulations as well as the pooled average across the two simulations for an acuity mix at the 50th percentile for licensed nurse staffing levels ranging from 1 to 10.

Exhibit 4.19: Percentage of Delayed or Omitted Care, 50th Percentile Acuity, by Number of Licensed Nurse Staff

Licensed Nurse Staffing Level	ProModel (6,993 replications)	Simul8 (6,000 replications)	Pooled (weighted average)
1 licensed nurse (0.3 HPRD)	86.5	85.1	85.8
2 licensed nurses (0.7 HPRD)	58.6	65.6	62.1

[9] In this instance, ProModel had 6,993 replications, so each ProModel replication has a weight of 1/6,993 = 0.000143. Simul8 had 6,000 replications, so each Simul8 replication has a weight of 1/6,000 = 0.000167. Simul8 replications have 16.55 percent more weight, which is why the pooled average is the midpoint, even though ProModel contributed more data.

Licensed Nurse Staffing Level	ProModel (6,993 replications)	Simul8 (6,000 replications)	Pooled (weighted average)
3 licensed nurses (1.0 HPRD)	13.4	24.6	19.0
4 licensed nurses (1.4 HPRD)	1.7	3.27	2.5
5 licensed nurses (1.7 HPRD)	0.2	0.3	0.2
6 licensed nurses (2.1 HPRD)	0	0.03	0.01
7–10 licensed nurses (2.4–3.4 HPRD)	0	0	0

Results from the ProModel simulation suggest somewhat lower levels of delayed and omitted care than do results from the Simul8 simulations. However, both models suggest that the level of delayed and omitted care falls below 5 percent at a staffing level between three and four licensed nurses, or 1.0 to 1.4 licensed nurse HPRD. Delayed and omitted care reaches 0 percent in all simulation scenarios at a staffing level of seven or more licensed nurses, or 2.4 HPRD. The results from MOSIMTEC's simulations follow a similar pattern, although they suggest a more gradual decline than the results from the ProModel and Simul8 simulations, with fewer delays and omissions at lower staffing levels but more delays and omissions at higher staffing levels.

Exhibit 4.20 expands the previous table to provide the observed pooled average of percentages of delayed, omitted, and delayed or omitted care by acuity level for staffing levels of 1 to 10 licensed nurses. The variation between acuity levels is relatively small. Between four and five licensed nurses, the rates of delayed, omitted, and either delayed or omitted care fall below 1 percent even for the highest acuity mix considered. Between one and two licensed nurses, omitted care decreases but delayed care simultaneously increases. This is because while more care is completed when two licensed nurses are completing tasks, a greater proportion of that care shifts from omitted (more than two hours after the care window) to delayed (0-2 hours after the care window). However, as shown in the final column, the proportion of care that is delayed *or* omitted falls when the number of licensed nurses increases from one to two.

Exhibit 4.20: Pooled Simulation Averages for Percentage of Delayed, Omitted, and Either Delayed or Omitted Care for Three Acuity Percentiles, by Number of Licensed Nurse Staff

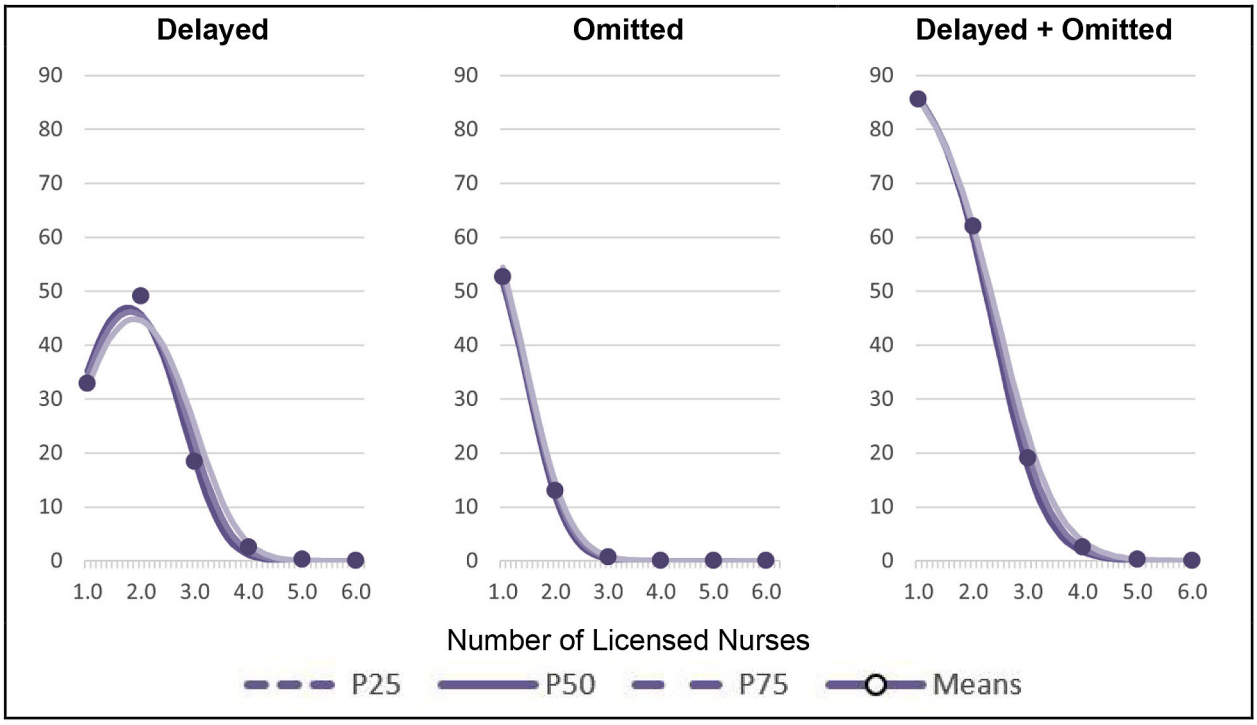
	Delayed Care Percentage			Omitted Care Percentage			Delayed or Omitted Care Percentage		
Licensed Nurse Staffing Level	25th	50th	75th	25th	50th	75th	25th	50th	75th
1 licensed nurse (0.3 HPRD)	34.4%	32.9%	30.7%	51.5%	52.6%	54.4%	85.8%	85.8%	85.1%
2 licensed nurses (0.7 HPRD)	48.1%	49.1%	48.6%	11.6%	13.0%	14.2%	59.7%	62.1%	62.8%
3 licensed nurses (1.0 HPRD)	16.1%	18.4%	21.5%	0.38%	0.62%	0.86%	16.5%	19.0%	22.4%
4 licensed nurses (1.4 HPRD)	1.70%	2.50%	3.70%	<0.01%	<0.01%	0.03%	1.71%	2.50%	03.8%
5 licensed nurses (1.7 HPRD)	0.07%	0.21%	0.34%	0%	0%	0%	0.07%	0.21%	0.34%
6 licensed nurses (2.1 HPRD)	0.01%	0.01%	0.03%	0%	0%	<0.01%	0.01%	0.01%	0.03%
7 licensed nurses (2.4 HPRD)	0%	0%	<.01%	0%	0%	0%	0%	0%	<0.01%
8–10 licensed nurses (2.7–3.4 HPRD)	0%	0%	0%	0%	0%	0%	0%	0%	0%

Smoothing Estimates

Results in the previous section showed percentages of delayed and omitted care associated with exact integer licensed nurse staffing levels, since simulation models by design cannot accommodate "fractional" nurses. Although integer values can be converted to HPRD staffing levels using simple arithmetic as shown in the tables, additional assumptions are needed to estimate delayed or omitted care at intermediate HPRD levels falling in between the levels shown (e.g., 1.15 licensed nurse HPRD).

To meet this need, the study team fit a function to the simulation data to produce a smoothing estimate. This allows estimating delayed and omitted care metrics associated with any value associated with a fraction of licensed nurses. **Exhibit 4.21** shows these values and how closely aligned the results are for the three acuity mix percentiles. Plots are restricted to up to 6 licensed nurses; however, models were based on the full 1–10 licensed nurse range.

Exhibit 4.21: Estimated Percentage Delayed, Omitted, and Delayed or Omitted Care (y-axis), for Three Acuity Mix Percentiles (line type), by Number of Licensed Nurse Staff (x-axis) From Pooled Simulation Smoothing Parameters



Each point on the lines in **Exhibit 4.21** above represents a predicted percentage of delayed or omitted care associated with a particular staffing level. To estimate the current expected rate of delayed and omitted care in U.S. nursing homes, the study team used the predicted percentages from the 50th percentile acuity mix scenario in combination with data on existing licensed nurse staffing levels for 2022Q2 from the PBJ system. These calculations suggest current U.S. licensed nurse staffing levels are associated with a 5.6 percent rate of delayed clinical care and a 0.4 percent rate of omitted clinical care, on average.

In addition, the team produced estimates of expected delayed and omitted clinical care that would be associated with the federal minimum staffing requirements incorporating licensed nurse staffing thresholds shown earlier in **Exhibit 4.10**. These estimates (**Exhibit 4.22**) assume that nursing homes with licensed nurse staffing levels currently below these thresholds will increase their staffing up to the threshold, while nursing homes currently staffing at or above those levels will neither increase nor decrease their licensed nurse staffing.

Exhibit 4.22: Predicted Delayed or Omitted Care Percentages in U.S. Nursing Homes Under Minimum Staffing Requirement Thresholds for Licensed Nurses

Staffing Level	Delayed Care Percentage	Omitted Care Percentage	Delayed or Omitted Care Percentage
1.15 licensed nurse HPRD	3.30%	0.04%	3.34%
1.23 licensed nurse HPRD	2.30%	0.02%	2.32%

Staffing Level	Delayed Care Percentage	Omitted Care Percentage	Delayed or Omitted Care Percentage
1.32 licensed nurse HPRD	1.40%	0.01%	1.41%
1.43 licensed nurse HPRD	0.60%	0.00%	0.60%

4.2.4 Discussion

The Staffing Study team collected more than 8,000 observations of common clinical care tasks in 20 high-quality nursing homes across the country to inform simulation parameters. Applying this novel data collection, the simulation model then artificially varied levels of licensed nurse staffing across three different hypothetical resident acuity mixes to provide evidence about expected rates of delayed or omitted clinical care under each scenario over a 24-hour period across two shifts. The simulation software completed on average 6,664 replications across the 30 scenarios considered, resulting in more than 339,840 replications total. This approach mimics conditions of a randomized experiment where key parameters of interest (licensed nurse staffing level and resident acuity mix) vary across scenarios while all other conditions are held constant, reducing concerns about unobserved factors influencing findings.

The Staffing Study simulation model results presented in this section suggest that a staffing level of five licensed nurses (RNs, LPNs) is adequate to virtually eliminate delayed and omitted clinical care in a 70-resident nursing home, even one with a relatively high acuity resident population. A staffing level of four licensed nurses in this setting was sufficient to reduce the simulated level of delayed and omitted care below 5 percent. These staffing levels correspond to approximately 1.4 to 1.7 licensed nurse HPRD, as compared to a current national median staffing level for licensed nurses of 1.45 HPRD. Approximately 38 percent of U.S. nursing homes would need to increase licensed nurse staffing to reach a threshold of 1.4 HPRD; 71 percent would need to increase licensed nurse staffing to reach a threshold of 1.7 HPRD.

Schnelle et al. (2016) previously suggested minimum nurse aide staffing between 2.8 HPRD and 3.6 HPRD, depending on resident acuity, to maintain rates of omitted ADL care below 10 percent. Using a parallel benchmark for the Staffing Study model, 1.0 licensed nurse HPRD (three licensed nurses) would be sufficient to maintain a rate of omitted clinical care below 10 percent for all resident acuity mixes examined. In combination, the Staffing Study results and the Schnelle et al. findings suggest that a total nurse staffing level between 3.8 HPRD and 4.6 HPRD would be adequate to keep rates of both omitted ADL and omitted clinical care below 10 percent. Most U.S. nursing homes would need to increase staffing levels to reach these total nurse staffing thresholds. Only 42 percent of nursing homes currently maintain total nurse staffing above 3.8 HPRD; just 13 percent maintain staffing above 4.6 HPRD.

Findings were validated using two different simulation software tools commonly used in health care research, ProModel and Simul8, with two different simulation teams from different organizations independently implementing ProModel simulations as an additional quality assurance check. Similarity of results across different teams and software tools generates additional confidence in the findings. The simulations incorporated a small number of rules. Regardless, they were able to produce complex patterns, such as a reduction in omitted care paired with an increase in completed but delayed care when staffing levels rise from one to two licensed nurses.

Despite these strengths, it is also important to acknowledge that, by definition, any simulation is a simplification of the social and health care interaction of thousands of rich human experiences. As such, the Staffing Study simulation analyses have several limitations. First, the simulations use rates of delayed or omitted care as a proxy for quality and safety; this single, simple metric cannot capture all dimensions of nursing home quality and safety that could be important to residents, families, and other stakeholders. Second, logistical and computational limitations dictated inclusion of duration and frequency parameters for only five types of direct clinical care tasks in the simulations. These five do not fully capture the universe of clinical care needs in nursing homes that licensed nurses meet.

Third, the simulation studies did not incorporate any patient-level data or facility-level data from site observations. Instead, simulations estimated patient acuity using MDS data. Therefore, patient acuity in simulations were based on population-level estimates, rather than estimates at the nursing-home level or the individual patient level. Because the simulation does not use actual patient- or facility-level data, a limitation of this study is that facilities specializing in treatment of high- or low-acuity residents may not be properly represented in the staffing simulation. For example, different staffing needs may arise in facilities specializing in care for persons experiencing disabilities resulting in paraplegia/quadriplegia or in facilities specializing in persons experiencing advanced cognitive impairment. Analysis of specialized care facilities was outside of the scope of this simulation research. Fourth, the observations did not differentiate between RN and LPN tasks. Simulation output therefore groups RNs and LPNs into a single aggregate licensed nurse category. Output thus cannot support separate estimates of potential delayed or omitted care for these two staff types. Fifth, because Staffing Study observation data collection was intentionally limited to high-quality nursing homes, observed duration and frequency of direct care tasks in the resulting data—and, therefore, the simulation estimates of delayed and omitted care building on those observations—might not generalize to lower-quality nursing home settings.

4.3 Analysis of State Staffing Requirements

Key Takeaways

- A state-level minimum staffing requirement introduced in Massachusetts in 2020 penalizes its nursing homes with total nurse staffing below 3.58 HPRD with a 2 percent reduction in their quarterly Medicaid payments.
  - The new minimum staffing requirement increased total nurse staffing levels among low-staffed nursing homes with a high Medicaid resident share, facilities that would otherwise be subject to penalties for noncompliance.
  - The observed staffing increase was most pronounced for nurse aides.
  - Despite the increase in staffing, the new staffing requirement had no measurable effect on defined quality and safety measure scores.
- These findings demonstrate that a minimum staffing requirement incorporating a high HPRD threshold and a material penalty for noncompliance can successfully induce nursing homes to increase total nurse staffing levels.

This section focuses on examining the impact of a 2020 Massachusetts minimum staffing requirement on staffing levels and quality of care in nursing homes. Specifically, analyses examine the impact of a minimum nursing home staffing requirement defined in terms of HPRD, coupled with a penalty for noncompliance, on nurse staffing levels and quality.

4.3.1 Overview

Success of a minimum staffing requirement at the state level implies similar success might be achieved through a federal requirement with similar features. Although some previous literature has demonstrated the effectiveness of state-level staffing requirements in increasing staffing levels (Chen & Grabowski, 2014), no recent studies have examined effectiveness of state-level requirements since the beginning of the COVID-19 public health emergency (PHE). It is possible that the relationship among state staffing requirements, staffing levels, and quality outcomes has changed during this timeframe because of

COVID-related staffing issues (Gasdaska et al., 2022; AHCA/NCAL, 2022). The Staffing Study analysis of state staffing requirements is intended to fill this evidence gap.

To support this analysis, the Staffing Study team therefore first conducted an extensive search to identify all states that have changed their nursing home minimum staffing requirements since the beginning of the COVID-19 PHE. The team then conducted a descriptive analysis to examine trends in nurse staffing levels before and after the states' policy changes versus trends in states in the rest of the country.

The second part of this section focuses on a recent Massachusetts policy change with a relatively high staffing requirement and a robust penalty for noncompliance. Under Massachusetts state law, in effect as of January 1, 2022, its nursing homes with total nurse staffing below 3.58 HPRD are penalized with a 2 percent reduction in their quarterly Medicaid payments. The Staffing Study team estimated the causal effect of this policy change on nurse staffing levels and quality of care in Massachusetts using a quasi-experimental synthetic control approach. The analysis focuses on the subset of nursing homes with the strongest incentives to respond to the new policy: those with high Medicaid resident shares ($\geq 75^{th}$ percentile) and initial staffing levels below the new Massachusetts minimum staffing requirement (HPRD ≤ 3.58). Meeting these criteria are 1,617 out of 15,333 nursing homes nationally and 40 out of 373 nursing homes in Massachusetts. More-detailed methods and results are in **Appendix G.**

4.3.2 Methods

This section provides an overview of the data sources and statistical methods used in the descriptive and impact analyses of state staffing requirements.

Data

The Staffing Study team developed a state staffing requirement database based on several extant resources, augmented by independent research. To support the state staffing requirements analysis, these data are paired with extant data on nursing home staffing from the PBJ system, previous Certification and Survey Provider Enhanced Reports (CASPER) system, and quality measures from Nursing Home Care Compare. The remainder of this section provides additional detail on each of these data sources.

State Staffing Requirement Data

The Staffing Study team assembled a database of information on states that had changed their minimum staffing requirements since the beginning of the COVID-19 PHE. For each minimum staffing requirement policy change, the database includes the date of the change (e.g., enactment, made effective) and its legal specifics (e.g., former/current HPRD minimums by nurse staff category, penalty for noncompliance).

The main resources for this information are the Kaiser Family Foundation (Musumeci et al., 2022), the National Consumer Voice for Quality Long-Term Care (2021), and the Medicaid and CHIP Payment and Access Commission (2022a, 2022b). The Staffing Study team also conducted extensive independent research using LexisNexis and corresponded with the Law Library Services for the state government of Massachusetts to validate the findings of these organizations.

Using this state staffing requirement database, the study team identified six states (Arkansas, Connecticut, Florida, Massachusetts, New Jersey, and New York) with minimum staffing requirement policy changes suitable for the descriptive analysis. For the impact analysis, however, the policy changes in Arkansas, Connecticut, Florida, New Jersey, and New York either were too recent, had new minimum staffing requirements that were too low, had changes in staffing requirements that were too small, or were paired with other confounding changes that made them inappropriate to include (e.g., changes in the types of staff that count towards the requirement).

For this reason, the impact analysis focused on a single state, Massachusetts, which had a minimum staffing requirement change that was both sufficiently mature and large enough in magnitude. In

particular, on October 5, 2020, Massachusetts enacted a new set of regulations via Emergency Adoption that increased the state's requirement for minimum nurse staffing levels from near-0 to 3.58 total nurse staff HPRD. The penalty for noncompliance with this new policy amounts to a 2 percent reduction of the nursing home's quarterly Medicaid payments. Enforcement of this penalty began on January 1, 2021, but nursing homes were required to begin submitting information on their staffing levels biweekly immediately. Later, on April 1, 2021, Massachusetts introduced an additional minimum staffing requirement of 0.508 HPRD for RNs, but this requirement is not enforced by Medicaid payment reductions.

Staffing Data

The descriptive analysis relied on data on nurse staffing levels from the near-universe of nursing homes in the United States (50 states plus the District of Columbia) between 2015Q3 and 2022Q2. These data were compiled from two different sources depending on time period.

Since 2017Q4, the primary method of collecting nursing home staffing data has been the CMS PBJ system. The PBJ data are derived from payroll information submitted quarterly by each CMS-certified nursing home. However, between 2015Q3 and 2017Q3, nursing homes self-reported staffing data through the CASPER system. During this period, each nursing home would report its average quarterly staffing levels for various nurse staff types approximately once every four quarters.

The Staffing Study team elected to include self-reported CASPER staffing data in the analysis along with the more reliable PBJ data for two reasons. First, adding additional quarters of historical data prior to each policy change improves trend comparisons between policy changers and comparison states. Although the self-reported CASPER data potentially are biased, there is no known reason to believe the degree or direction of bias systematically differs by state. Therefore, inclusion of these data should not materially affect comparisons among states. Second, the longer sample period afforded by the CASPER data aids in constructing a better synthetic control for Massachusetts (see Abadie, 2021). It also allows the implementation of a validation test of the control group.

Both the PBJ and CASPER data break down staffing levels by staff type: RN, LPN, and nurse aide. HPRD is calculated as the average number of daily nurse staff hours, in total and by staff type, divided by the daily resident census from the MDS, by quarter.

Quality Measures

Quality is measured by a subset of CMS Five-Star Quality Rating System QMs, aggregated into long-stay, short-stay, and total (long and short combined) QM scores. Examples of these QMs include, but are not limited to, resident hospitalizations, pressure ulcers, and functional improvements (see **Appendix G.1** for full description of QM score construction).

QMs are made available quarterly, and each quarterly data point is based on information with look-back periods of five quarters (e.g., the most recent quarter of data available uses information between 2021Q2 and 2022Q2, inclusive). Each quarterly refresh of QM data is categorized by the most recent quarter of information that contributes to it (e.g., the 2022Q2 QMs use data between 2021Q2 and 2022Q2).

For all analyses, the pre-policy change quality data begin in 2018Q4. The end of the pre-period for each analysis depends on the individual state's policy enactment date. All quality analyses include only one post-period data point, 2022Q2, to avoid using post-period observations that overlap with pre-period observations.

Safety Measures

The Staffing Study team measured safety using health inspection data collected periodically from nursing homes during on-site inspection surveys. Under typical circumstances, these surveys occur approximately annually for all nursing homes that participate in the Medicare and/or Medicaid programs. The inspections assess several aspects of resident health including resident rights, quality of life, medication

management, skin care, resident assessment, nursing home administration, environment, and kitchen/food services (CMS, 2022a).

Outside of the COVID-19 PHE, the duration between surveys generally does not exceed 15 months. Given the near-annual frequency with which these surveys are administered, the Staffing Study team elected to analyze safety outcomes at the yearly, rather than quarterly, frequency. However, it should be noted that many of these surveys were delayed during the COVID-19 PHE. As of December 2021, about 34% of facilities had not received a survey within the past two years. This had decreased to approximately 16% by December 2022.

One challenge to using health inspection data for safety outcomes is that health inspection surveys are not uniformly implemented across states. Therefore, all measures of health inspection performance must be converted into a form that allows comparison of nursing homes in different states. The Staffing Study team's main method for this is modeled after CMS's Five-Star Quality Rating System, in which nursing homes are ranked according to their health inspection performance within a given state each year. This allows the creation of an outcome measure called the "5-Star Score," in which each facility is assigned between 1 and 5 "stars" based on their within-state rank. The details of this approach, along with an alternative outcome used as a robustness check called the "Normalized Score," are described in **Appendix G.1**.

Other Nursing Home Characteristics

Data on residents' Medicaid payment status and the count of total residents are obtained from the CASPER survey. Since this information is collected only once every one to two years per nursing home, each nursing home's Medicaid share of residents is set to reflect its most recent survey value as of 2020Q3.

Descriptive Analysis

The descriptive analysis of state staffing requirements compares trends in staffing and quality for all states with permanent policy changes during the COVID-19 PHE versus trends for states that did not change their minimum staffing requirements during this period. This analysis provides visual evidence on changes in nursing home staffing and quality trends after state minimum staffing requirement changes, relative to trends in the rest of the country.

The Staffing Study team conducted analysis separately for each of the six states that changed their nursing home minimum staffing requirement during the COVID-19 PHE (Arkansas, Connecticut, Florida, Massachusetts, New Jersey, and New York).

Impact Analysis

The impact analysis estimates the causal effect of Massachusetts's new minimum staffing requirement on nurse staffing levels (HPRD) and quality outcomes. In Massachusetts, as in the US as a whole (see **Section 4.1**), there is a positive correlation between RN and nurse aide staffing levels and quality and safety. More detail is in **Appendix G.3**. The Staffing Study team chose to study the Massachusetts policy change in greater depth in part because the state's staffing minimum is similar in magnitude to the minimum staffing requirement threshold levels examined in **Section 4.1**.

Estimating the unbiased impact of the Massachusetts minimum staffing requirement on its nursing home staffing and quality requires a valid counterfactual (i.e., how Massachusetts outcome trends would have evolved over time in the absence of such a requirement). This is challenging because Massachusetts and its nursing homes have many idiosyncratic features, such as unique local labor market conditions and regulatory environment, making it difficult to find an appropriate point of comparison.

The Staffing Study team addresses this issue using a *synthetic control* approach to construct a suitable control group for Massachusetts (see Abadie, 2021). This approach produces a counterfactual estimate comprising a weighted combination of other ("donor") states' outcome trends. Weights are optimally selected so that the synthetic control group's pre-period outcome trends most closely match those of Massachusetts. In this case, the pool of potential donor states for the synthetic control group consists of every non-Massachusetts state with at least 10 nursing homes operating in every quarter.

Treatment effects in the synthetic control framework were calculated by subtracting the average difference for a given outcome between Massachusetts and the synthetic control group in the period prior to the policy change from the average difference for that outcome in the period after the policy change. This approach is also known as the *difference-in-differences* estimator. Assuming the synthetic control group is a good counterfactual for Massachusetts, the calculated treatment effect will be an unbiased estimate of the *average treatment effect on the treated* (ATT).

The Staffing Study team used a permutation test for statistical inference where the treatment effect for Massachusetts is compared to fake ("placebo") treatment effects estimated for each non-Massachusetts state, one at a time. This test models as if the other state had had a policy change instead of Massachusetts (Abadie, 2021). The *p*-value is then assigned as the relative ranking of the absolute value of Massachusetts's treatment effect relative to all of the placebo effects. For example, if Massachusetts had the largest treatment effect of 50 states, then the *p*-value would equal 1/50, or .02.

The exact synthetic control group selected depends both on the length of the pre-policy change period and on the specific time periods used to match outcome trends to the treatment state (Massachusetts). The nurse staffing models are matched on the third quarter of every year before the policy change (2020Q3, 2019Q3, and so on), which, because the study period is 2015Q3–2022Q2, produces seven matching periods. Because the QM scores are available only for 2018Q4–2022Q2, the models match on every other quarter before the policy change (2020Q3, 2020Q1, and so on), producing four matching periods. Although some of these data points comprise overlapping sets of information, the impact analysis takes advantage of the quarterly updates to better match pre-trends of QM scores.

Given the large number of pre-period observations for the staffing outcomes, the Staffing Study team was able to conduct a validation exercise recommended by Abadie (2021). In this exercise, the pre-period is divided into training and validation periods. The Staffing Study team then analyzed whether the synthetic control trends continued to follow Massachusetts's trends throughout the validation period and still diverged during the post-policy change period.

4.3.3 Results

This section begins by describing nursing home minimum staffing requirements across states, focusing on the states that have introduced or expanded requirements since the start of the COVID-19 PHE. It then provides results of a descriptive analysis of trends in staffing levels in those states versus trends in other U.S. states before and after the policy changes. The section concludes by describing results from a synthetic control analysis estimating the causal impact of the new Massachusetts nursing home minimum staffing requirement on staffing and quality outcomes.

States with Changes in Staffing Requirements

Exhibit 4.23 shows the 33 states with a direct care staff minimum requirement at the time of data collection. Direct care laws appear to be widespread across the country, as opposed to being confined to any specific region.

Exhibit 4.23: State Laws Specifying a Direct Care Nursing Staff Minimum in Nursing Homes

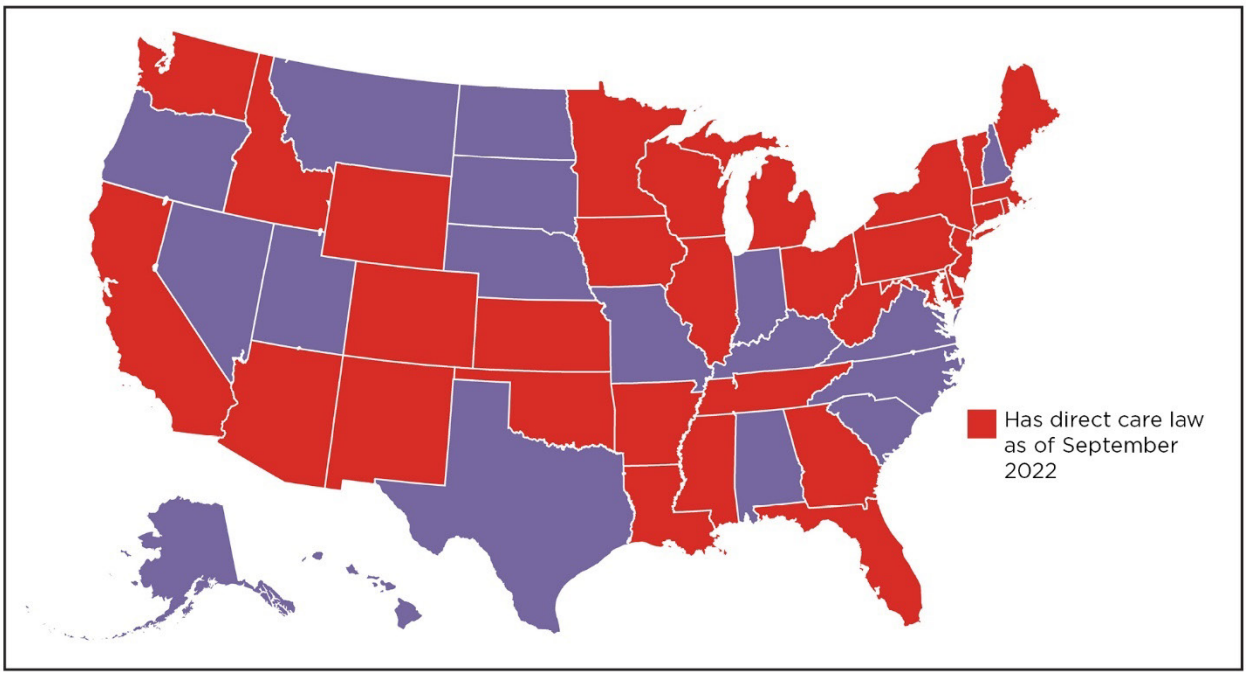
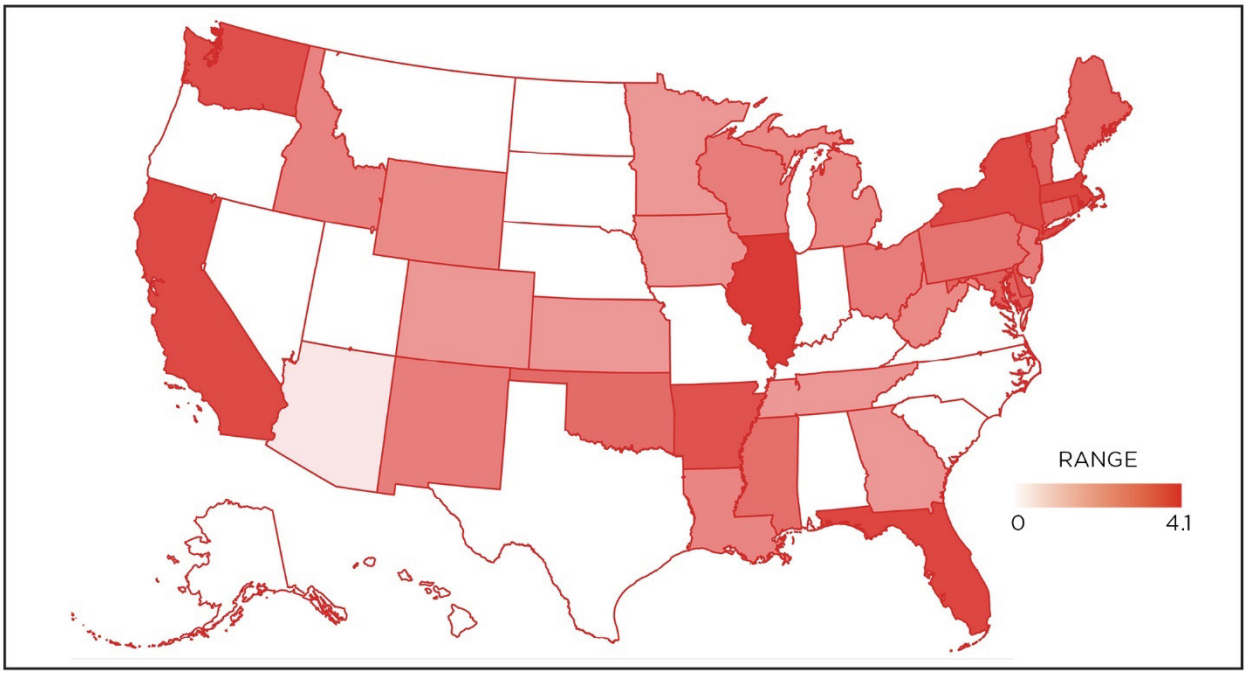


Exhibit 4.24 shows the magnitude of total direct care minimum requirements for each state with a direct care law. Note that in some states, non-nurse staff can count towards the requirement along with total nurse staff, so these might not be directly comparable to a total nurse HPRD requirement.

From this map, geographic patterns are more apparent, with the highest requirements primarily although not exclusively concentrated in the Northeast and on the West Coast. Only eight states (and the District of Columbia) have direct care staffing requirements of 3.30 HPRD or above, suggesting that a new federal requirement for total nurse staffing at that level (consistent with the *Low* minimum staffing requirement threshold examined in **Section 4.1**) would exceed existing state-level requirements in the great majority of states. Only the District has a current total nurse staffing requirement (4.1 HPRD) exceeding the *Highest* minimum staffing requirement threshold examined (3.88 HPRD).

Exhibit 4.24: State Minimum Staffing Requirement (Total Nurse Staffing Hours per Resident Day) as Specified by Direct Care Law



Notes: In this exhibit, states with no explicit direct care law are treated as having zero minimum direct care staffing requirement.

As noted above, of the 33 states identified as having a direct care minimum, nine states added or expanded minimum staffing requirements since the PHE began: Arkansas, Connecticut, Florida, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and South Carolina. Of this list, the Staffing Study team excluded Oregon and South Carolina from the descriptive analyses because those policy changes were temporary. Oregon's change lasted less than five months; South Carolina's change lasted one year. The Staffing Study team also excluded Rhode Island because political circumstances prevented full implementation of the new minimum staffing requirement until July 2022, which did not allow a sufficient post-implementation study period to support analysis.

The remaining six states (Arkansas, Connecticut, Florida, Massachusetts, New Jersey, and New York) were included in the descriptive analyses that follow. **Exhibit 4.25** provides a brief synopsis of policy changes in these six states, including the date the policy change was enacted, the later of the policy's effective date or the designated start date, and relevant policy details.

Exhibit 4.25: Post–COVID-19 Public Health Emergency Policy Change Summary

State	Enacted	On or Before/ Effective	Policy Change
Arkansas	4/14/2021	7/14/2021	Total HPRD requirement increased from 2.79 to 3.36. New policy allows for non-nurse staff to count towards requirement.
Connecticut	7/13/2021	1/1/2022	Total HPRD requirement increased from 2.54 to 3. Nurse aide requirement reduced from 1.9 to 0.
Florida	7/13/2021	4/6/2022	No change to total HPRD requirement, which is 3.6. Licensed nurse requirement increased from 0.94 to 1.0. Nurse aide requirement decreased from 2.5 to 2.0. However, certain non-nurse staff are now allowed to count towards the HPRD requirement.
Massachusetts	10/5/2020	1/1/2021	Total HPRD requirement increased from 0.24 to 3.58. RN requirement increased from 0 to 0.508. However, penalty for noncompliance only enforces total HPRD requirement, not RN requirement.
New Jersey	10/23/2020	2/1/2021	No change to total HPRD requirement. Nurse aide requirement increased from 0 to 1.4.
New York	6/18/2021	4/1/2022	Total HPRD requirement increased from 0.24 to 3.56. Licensed nurse requirement increased from 0.24 to 1.1. Nurse aide requirement increased from 0 to 2.2.

Descriptive Findings

Exhibits below display quarterly staffing and QM score means for each of the six states versus means for the rest of the country not enacting a new direct care law. The quarterly outcome means for the rest of the country are calculated by averaging together outcomes for all nursing homes in the 41 states that did not change their policy (plus the District of Columbia). The red vertical lines demarcate when a state's policy change was enacted; the green vertical lines demarcate when the policy became effective.

Exhibit 4.26 displays trends in total nurse staff HPRD. These figures do not reveal any apparent sizable changes in total nurse HPRD relative to the rest of the country following states' policy changes. However, some figures suggest potential smaller effects. Staffing levels in Arkansas appear to have declined following enactment of its new policy, which increased the total HPRD requirement while simultaneously allowing non-nurse staff to count towards the requirement. Similarly, Florida's policy change, which allowed some non-nurse staff to count towards the requirement along with shifts in required staff mix (increasing licensed nurse staff requirements while reducing nurse aide requirements), also appears to have been followed by a decline in total nurse staffing.

Exhibit 4.26: Total Nursing Staff Trend Comparisons: 2015Q3–2022Q2

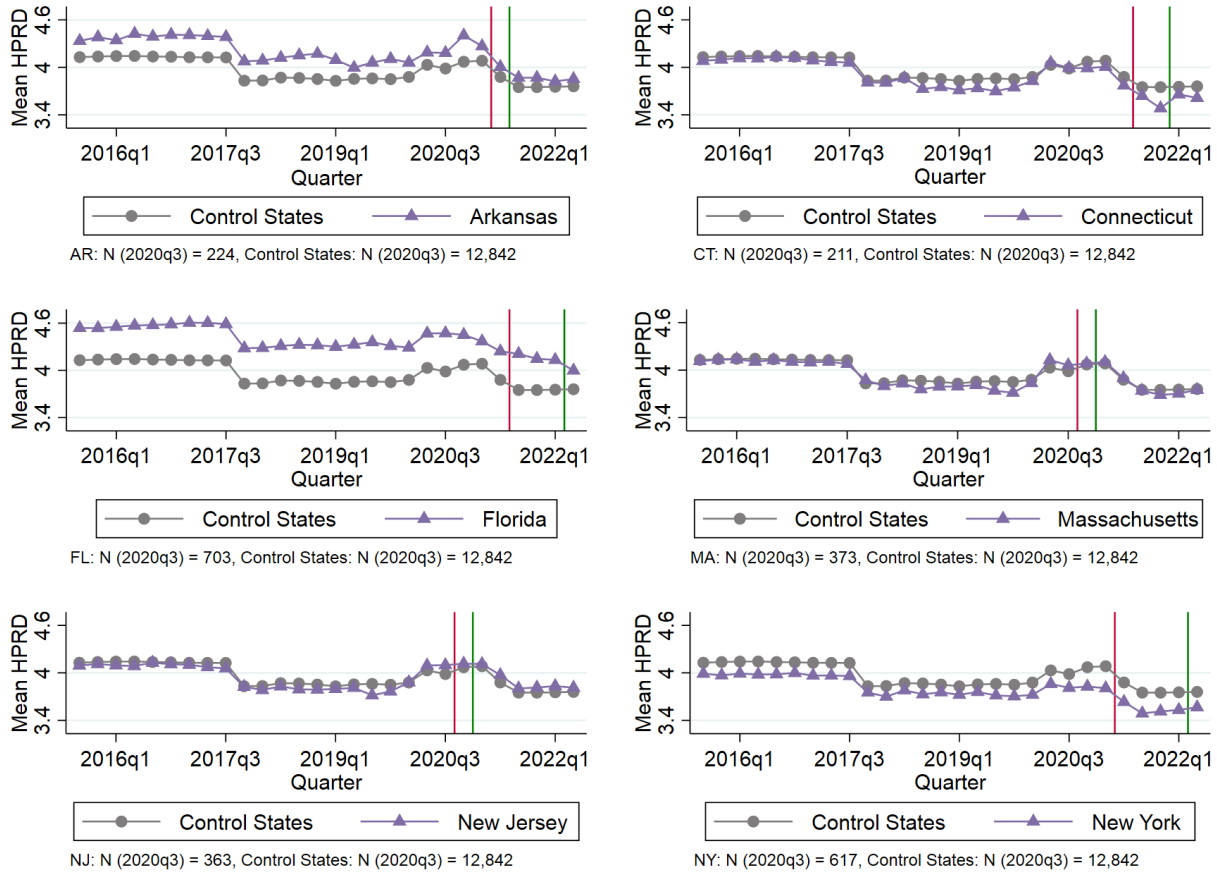
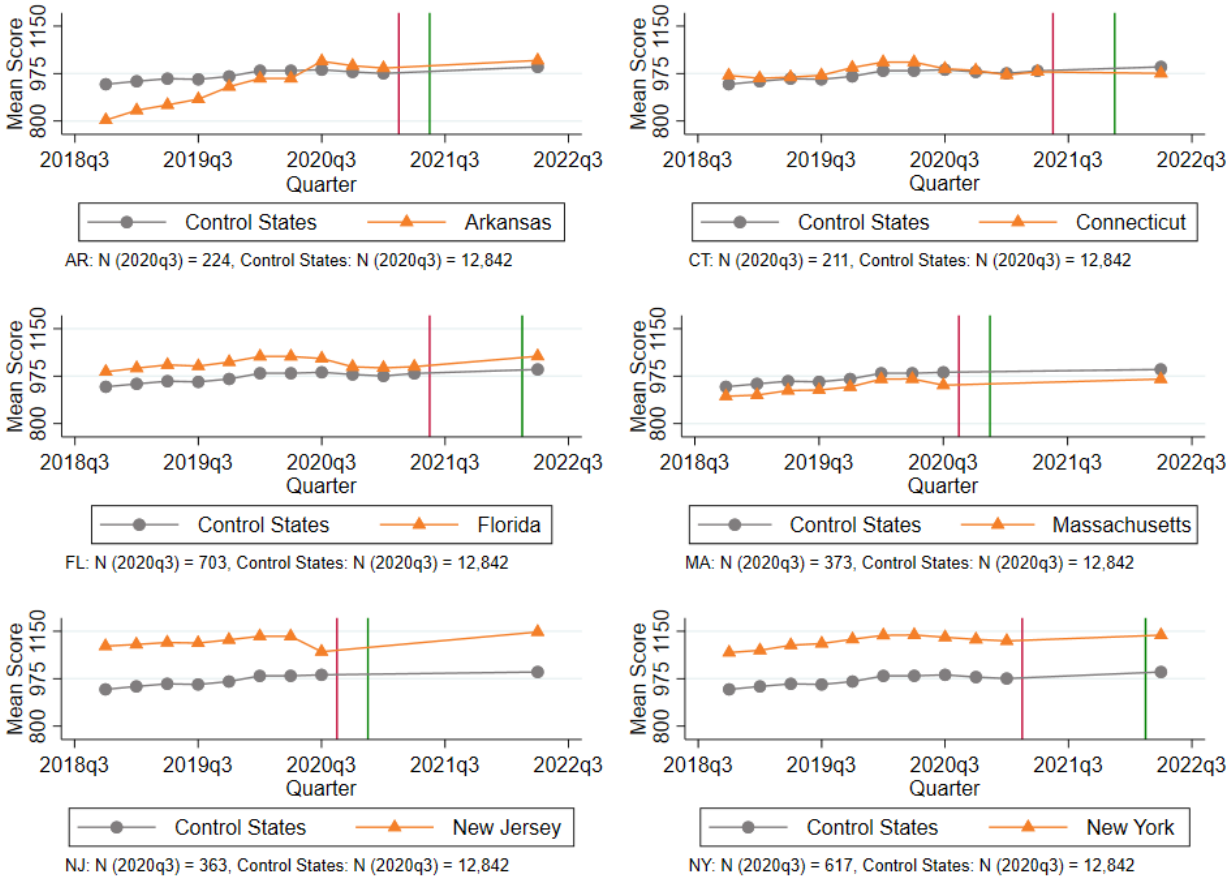


Exhibit 4.27 displays trends in total QM scores for the same six states over this interval. As discussed above, this analysis uses only one quarter of post-period data (2022Q2) because of the long look-back period and data availability. This means that states enacting their new policies in 2021Q3 or later have overlapping quality data between their pre-periods and post-periods in the 2022Q2 observation. For this reason, results for Connecticut and Florida in particular should be interpreted with caution.

While New York's trends prior to the policy change ("pre-trends") closely mirror those of the rest of the country, the state does not experience any notable post-policy effect on QM scores. Arkansas's pre-trends are very different from the rest of the county's pre-trends, making it difficult to draw any conclusions about the post–policy change effect relative to the comparison. The remaining states (Connecticut, Florida, Massachusetts, and New Jersey) display similar pre-trends to the rest of the country earlier in the period, but then experience declines in QM scores leading up to their policy changes. This suggests policy adoption in these states might have been driven by declining quality, and post-period effects in these graphs might not be attributable to the policy changes.

Exhibit 4.27: Total Quality Measure Score Trend Comparisons: 2018Q4–2020Q3, 2022Q2



Overall, it is difficult to draw definitive conclusions about the effects of these recent policy changes from these findings. As noted above, other than for New York, pre-trends in the quality metric do not closely mirror trends in the states with policy changes in most cases (no "parallel trends"). This suggests that the large and diverse group of 41 states with no recent direct care law change might not provide an appropriate point of comparison.

In addition, nuances in implementation, such as changes in types of staff that can count towards a minimum staffing requirement, as described for Florida and Arkansas above, pose challenges for interpretation in some states. The specific nature of the policy changes in other states suggests potential impacts might be limited. For example, New Jersey increased its nurse aide requirement, but, because its licensed nurse requirement remained low while its total nurse staff requirement did not change, there might not have been much of an impact of the increased nurse aide requirement in practice. Furthermore, Connecticut's new nurse staff requirement affected only a handful of nursing homes; and New York's new requirement became effective only on April 12, 2021, which did not allow a sufficient post-implementation study period for analysis.

In contrast, Massachusetts introduced a new minimum staffing requirement in 2020 at a relatively high level, increasing required staffing levels from near-0 to 3.58 total nurse staff HPRD, and incorporated a penalty of a 2 percent reduction in Medicaid payments. Among all states considered with a recent new minimum staffing requirement, Massachusetts appears to be the most appropriate candidate for impact analyses. The following section further explores causal impacts of the Massachusetts minimum staffing requirement on staffing and quality outcomes.

Impact Analysis (Massachusetts only) Findings

The study team hypothesized that Massachusetts nursing homes that will most likely increase nurse staff because of the new requirement are those (1) with pre-policy nurse staffing levels below 3.58 HPRD and (2) with high shares of Medicaid residents. These are the nursing homes that would be subject to the most substantial financial penalty for noncompliance in the absence of staffing increases.

The synthetic control models analyzed trends in nurse staff before and after the Massachusetts policy change. Outcomes were matched on the third quarter of every year between 2015Q3 and 2020Q3, and the post-treatment period was defined as 2020Q4–2022Q2.[10]

The synthetic control model was then run separately for four subsamples of nursing homes (**Exhibit 4.28**). Each panel of the exhibit displays total direct care nurse staff trends for Massachusetts nursing homes juxtaposed with trends for the synthetic control group.[11] The ATTs and their associated *p*-values are also displayed in each panel. The red vertical lines demarcate when the new regulation was enacted via emergency adoption; the green lines demarcate when the minimum staffing requirement became effective (i.e., when penalties for noncompliance began).

Panel (a) shows results for nursing homes with high shares of residents whose stay was paid by Medicaid ("high" defined as 75th percentile or above) and with low staffing levels immediately before the policy change ("low" defined as below 3.58 HPRD total nurse staffing in 2020Q3). This is the subset of nursing homes expected to experience the largest impact of Massachusetts's minimum staffing requirement, as described above. The team also ran the synthetic control model on three other subsets of nursing homes, shown in panels (b) through (d): low-Medicaid and low-staffing, high-Medicaid and high-staffing, and low-Medicaid and high-staffing nursing homes. The new staffing requirement was expected to have a lesser impact on these groups.

As hypothesized, the staffing requirement had a positive effect on staffing for nursing homes with a high percentage of Medicaid residents and low staffing. The model estimates a difference of 0.246 HPRD in total nurse staffing between Massachusetts and "synthetic Massachusetts" in the post–policy change period relative to the pre-period. This treatment effect is equivalent to an 8.0 percent increase relative to the post-period mean HPRD for synthetic Massachusetts. Furthermore, this effect translates into an increase in full-time equivalent (FTE) nursing staff of 111 nurse staff per quarter, on average (see **Appendix G.3** for further details on calculation of FTE staff).

The permutation test for statistical inference determined that the size of Massachusetts's ATT for this group of nursing homes is the largest in magnitude across all 31 placebo effects.[12] This test yielded a *p*-value of 1/32, or .031, which is statistically significant at a .05 significance level. The study team plotted the synthetic control estimates for Massachusetts alongside the estimates for every potential donor state meeting the sample restriction criteria.[13] The study team found that Massachusetts's pre-period match is exceptionally good, and its post-period effect is exceptionally large compared to the pre-period

---

[10] Massachusetts had a previous minimum nurse staffing requirement of 2.0 HPRD for direct care nurse staff. However, at the time of its removal (March 23, 2018), no Massachusetts nursing homes had staffing levels below this minimum.

[11] Donor states and weights for each model's synthetic control group are displayed in **Exhibits G.10–G.13** of **Appendix G.4.**

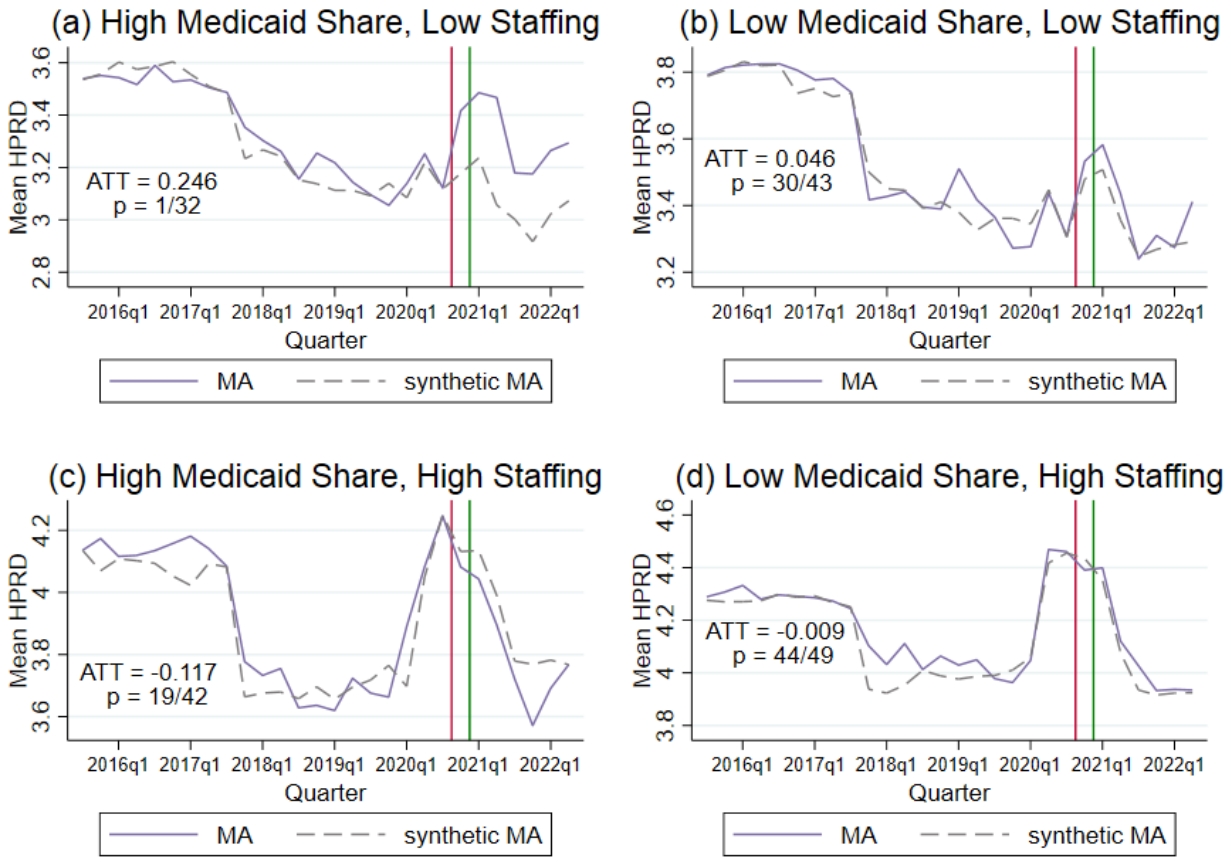
[12] The number of placebo effects varies by subsample depending on the number of non-Massachusetts states with at least 10 facilities meeting the sample restriction criteria each quarter. In this model, that number is 31.

[13] See **Exhibit G.5 in Appendix G.3**.

matches and post-period effects of the other states. Effects of the minimum staffing requirement in the other three groups of nursing homes were not statistically significant according to these criteria.

The Staffing Study team also performed a validation test of the synthetic control match for the high-Medicaid and low-staffing group. This test compares the synthetic control estimates derived from matching only on the three quarters prior to 2017Q4 (i.e., 2015Q3, 2016Q3, and 2017Q3) versus the main estimates derived from matching on Q3 of every year through 2020 (i.e., 2015Q3, 2016Q3, 2017Q3, 2018Q3, 2019Q3, 2020Q3). Juxtaposing the results of the synthetic control model matched on this restricted pre-period with the main results matched on the full pre-period showed that even when matching on only the three quarters prior to 2017Q4, the synthetic control trend still follows Massachusetts's trend through 2020Q3 and separates afterwards.[14] This test implies that the synthetic control estimator is producing a good match for Massachusetts's counterfactual staffing outcome.

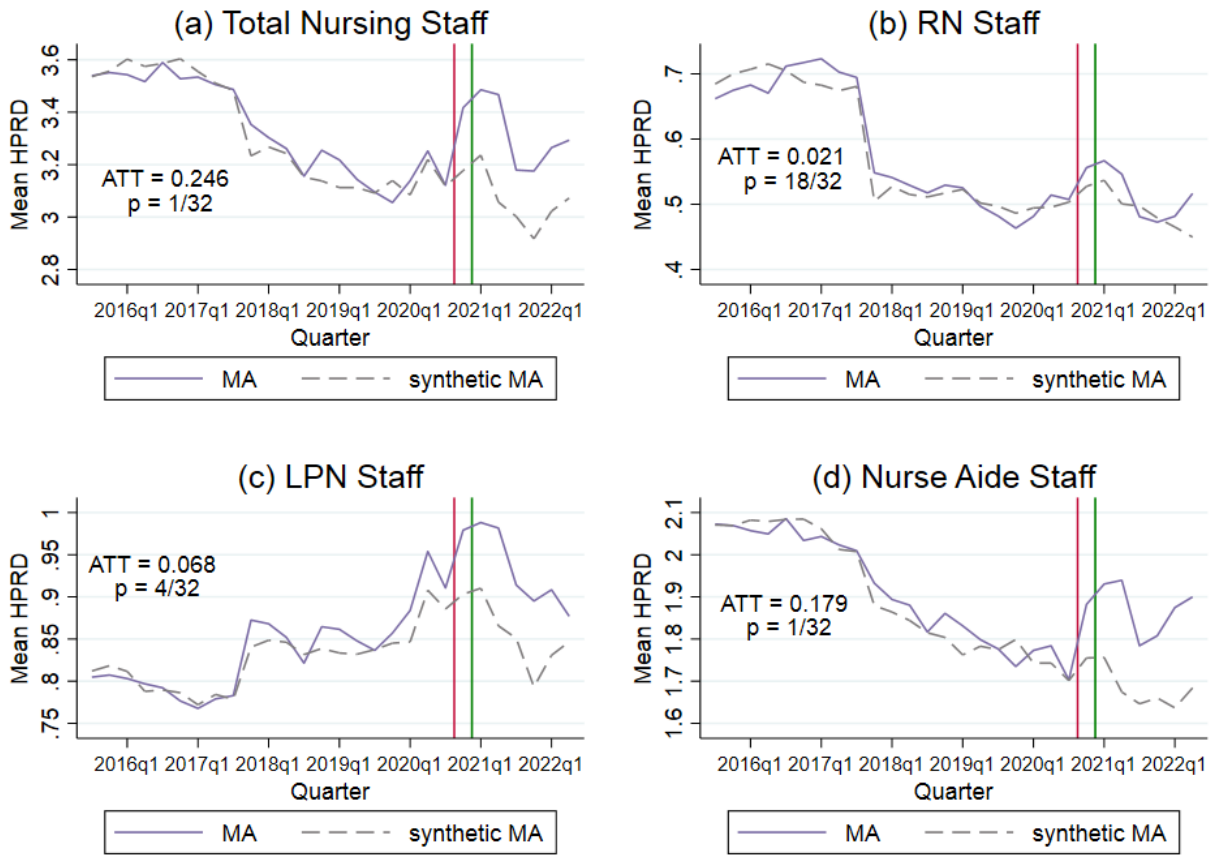
Exhibit 4.28: Synthetic Control Estimates (Massachusetts)—Total Nursing Staff: 2015Q3–2022Q2



[14] See **Exhibit G.6 in Appendix G.3**.

Exhibit 4.29 provides results of the synthetic control model separately for each nurse staff type within the low-Medicaid and low-staff nursing homes with a significant impact as described above.[15] The model's effect among nurse aides in Massachusetts is larger than all the placebo effects, with a treatment effect of 0.179 and a *p*-value of 1/32, or .031, which is statistically significant when $\alpha = 0.05$. This is equivalent to an increase in HPRD of 10.6 percent and an increase in FTE nursing staff by 81.1 nurse aides compared to post-period synthetic Massachusetts. The estimated increases in RNs and LPNs of 0.021 HPRD (4.2 percent, 9.3 FTE nurses) and 0.068 HPRD (7.9 percent, 30.5 FTE nurses), respectively, are not statistically significant.

Exhibit 4.29: Synthetic Control Estimates (Massachusetts)—Effects by Nursing Staff Type: 2015Q3–2022Q2



In addition to analyzing nurse staffing levels, the Staffing Study team also examined the effect of Massachusetts's new minimum staffing requirement on quality of care. All quality analyses are conducted on the subsample of nursing homes with high Medicaid shares (75th percentile and above) with low prior staffing (below 3.58 HPRD total nurse staff in 2020Q3), the group for which impacts on staffing levels were found to be statistically significant as shown above.

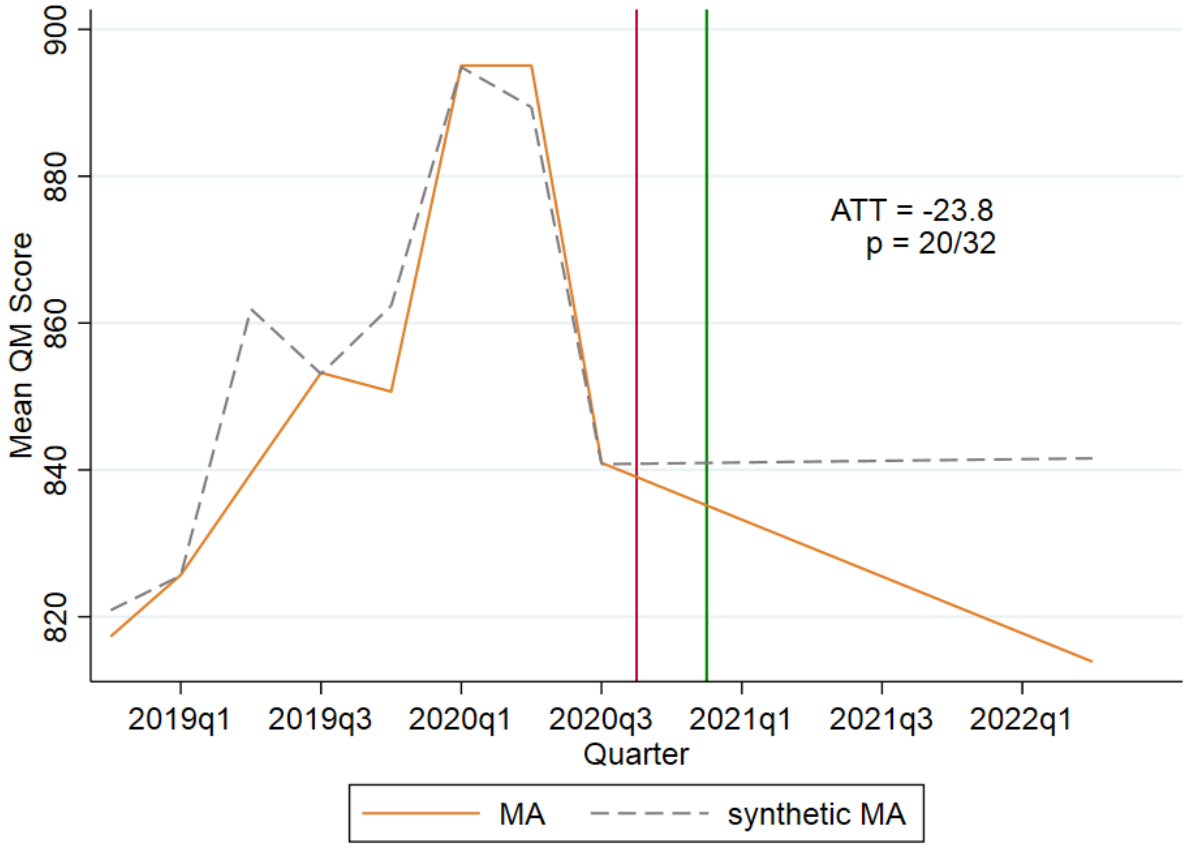
As discussed in **Section 4.3.2** (**Methods**), the limitations of the QM score data mean that the pre–policy change period can extend only from 2018Q4 to 2020Q3. The only post–policy change quarter analyzed is

[15] Donor states and weights for the synthetic control groups in panels (b)–(d) are displayed in **Exhibits G.14–G.16** of **Appendix G.4**.

2022Q2, to avoid overlapping pre-period and post-period data. The models match on every other quarter throughout the pre-period, beginning with 2020Q3.

Exhibit 4.30 shows the results of the synthetic control model for Massachusetts using total QM score as the outcome.[16] Although the estimated ATT is -23.8, the effect is only the twentieth largest in magnitude compared to the placebo effects. This ranking is equivalent to a p-value of p = .625, implying the estimated effect is statistically insignificant at the conventional level (α = 0.05). Additional specifications looking only at long-stay and short-stay QM scores produce similarly insignificant findings.

Exhibit 4.30: Synthetic Control Estimates (Massachusetts)—Total QM Score: 2018Q4–2020Q3, 2022Q2

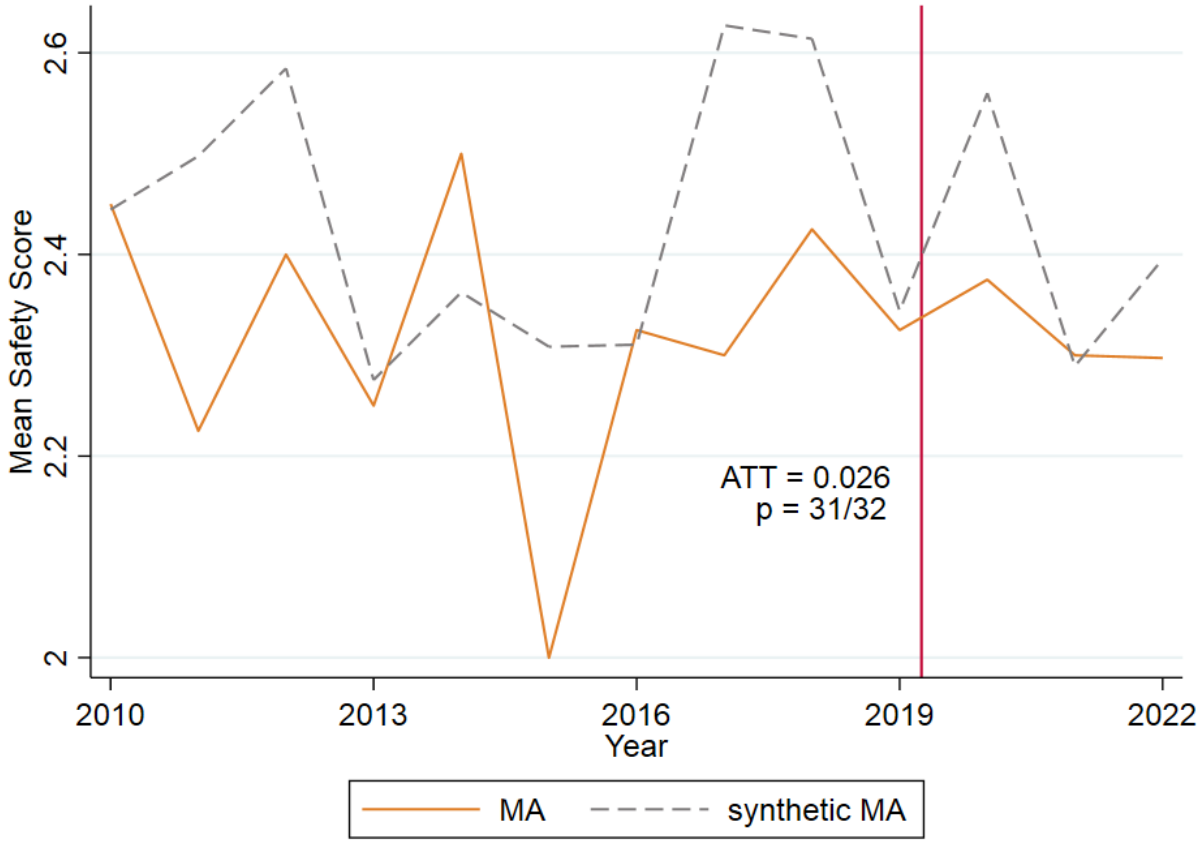


Lastly, the Staffing Study team examined how Massachusetts's new policy affected safety outcomes. Once again, these analyses only used nursing homes with high Medicaid shares and low prior staffing, as defined above. The team estimated synthetic control models using the two alternative measures of safety described in **Section 4.3.2** (**Methods**), which are the 5-Star Score and the Normalized Score. The models match on every third year of data in the pre-policy change period, which begins with 2019 and extends back through 2010. The year 2020 is considered the first post-policy change year since the new staffing requirement was enacted in October of that year.

[16] Donor states and weights for the synthetic control group are displayed in **Exhibit G.17** of **Appendix G.4**.

Exhibit 4.31 displays the synthetic control and treatment effect estimates for Massachusetts using the 5-Star Score safety outcome. The ATT is estimated to be 0.026, which ranks as the 31st largest in magnitude compared to the placebo effects. This corresponds to a *p*-value of $p = .969$, which is not statistically significant at the conventional level ($\alpha = 0.05$). For robustness, the Staffing Study team also ran synthetic control models using the Normalized Score instead of the 5-Star Score (results in **Exhibit G.9** of **Appendix G.3**) instead and models using an average of the past three health inspection scores, rather than only the most recent score, for both outcomes (results not displayed). Results in all cases were found to be substantively comparable to those in **Exhibit 4.31**.

Exhibit 4.31: Synthetic Control Estimates (Massachusetts)—5-Star Safety Score: 2010–2022



4.3.4 Discussion

Potential gains in quality and safety from introduction of a new federal minimum staffing requirement depend on whether such a requirement can successfully encourage nursing homes to increase nurse staffing hours, particularly given workforce constraints and other potential barriers to implementation.

The best existing source of evidence on this question is an examination of state staffing requirements. Currently 38 states and the District of Columbia have enacted minimum staffing requirements for nursing homes that would exceed what would be required for a 100-bed facility to comply with the current federal nursing home staffing regulations, though required levels and other details of implementation vary considerably (MACPAC, 2022a, 2022b; Consumer Voice, 2021). The Staffing Study team found that 33 of the 38 states and the District of Columbia have explicit minimum requirements for direct care nurse staff.

Nursing home responses to new minimum staffing requirements in each state can provide a model for how similar nursing homes nationwide might be expected to respond to the enactment of a similar requirement at the federal level. Particularly given changes in the care quality and workforce landscape since the onset of the COVID-19 PHE (Gasdaska et al., 2022; AHCA/NCAL, 2022), recent state-level policy changes are especially relevant to the current context.

To the knowledge of the Staffing Study team, the analysis presented in this section is the first to estimate the effects of minimum staffing requirements implemented during the COVID-19 PHE, and the first to study staffing requirements implemented since the early 2000s. Nine states have introduced new or increased nursing home nurse staffing requirements since the start of the COVID-19 PHE, six of which had implemented permanent changes prior to the end of the study period (2022Q3). However, many of the details in these states' policy changes, with the exception of Massachusetts, suggest they may not produce pronounced changes in nurse staffing levels or quality or both.

Descriptive analyses of trends in nursing home staffing and quality of care in these states did not identify any substantial increases relative to trends in other states not implementing such requirements over this period. It is unclear whether this stems from specific features of the new requirements in these states (e.g., small changes to requirements, very lenient requirements, or allowing nursing homes to use non-nurse staff to meet a newly increased requirement), from methodological challenges and data limitations, or from some combination. The new Massachusetts minimum staffing requirement contains language suggesting that nursing homes with low nurse staffing levels and high Medicaid resident shares are the most likely to be induced to increase their staffing levels in response to the requirement. Specifically, the new regulation states that, as of January 1, 2021, nursing homes reporting less than 3.58 total HPRD were to receive quarterly reductions in Medicaid payments by 2 percent.

An impact analysis using synthetic control methods to focus specifically on Massachusetts—a single state introducing a robust new minimum staffing requirement with a substantial penalty for noncompliance—found statistically significant increases in staffing levels in response to the new requirement, with the effect concentrated among nurse aides. This Staffing Study finding is consistent with previous literature describing the disproportionate hiring of less expensive nurse types (i.e., nurse aides, LPNs) to reach increased minimum staffing requirements in California and Ohio (Chen & Grabowski, 2014).

These findings demonstrate that a minimum staffing requirement incorporating a high HPRD threshold and a material penalty for noncompliance can induce nursing homes to increase total nurse staffing levels. These results are particularly encouraging given the recency of the Massachusetts policy change, especially in view of recent concerns over staffing shortages and the undersupply of nurses in the workforce in the wake of the COVID-19 PHE (Gasdaska et al., 2022; AHCA/NCAL, 2022). Effects on staffing were concentrated among high-Medicaid-share, low-staffed nursing homes in Massachusetts in response to the penalty on Medicaid payments, which further suggests that the specific structure and targeting of enforcement could be important for inducing desired effects. If a federal requirement imposed financial penalties for noncompliance that did not penalize Medicaid payments specifically, the effects would not necessarily be concentrated in the same types of nursing homes as in the Massachusetts case.

Despite the increase in total nurse staffing in response to the requirement, the impact analysis found no detectable impact on quality of care or safety as measured by QM scores and health survey inspections survey scores. Chen and Grabowski (2014) similarly found no effect of the California and Ohio reforms on pressure ulcers or use of psychoactive medications, which are components of the total QM score, despite the increase in nurse aide staffing. However, they did find effects on frequency of contractures among residents, which the Staffing Study's analysis cannot measure. Lin (2014) found that minimum staffing requirements for nurse aides had no significant impact on quality of care, though that analysis, which exploited state-by-year variation in staffing requirements for individual staff types, did find significant effects for RN staffing requirements. Both Chen and Grabowski (2014) and Lin (2014) are

able to estimate improvements in health inspection outcomes caused by the interventions they study. Importantly, though, Lin (2014) only finds significant improvements in safety measures from increases in RN and LPN staffing, but not because of increase in nurse aide staffing. Furthermore, the intervention studied in Chen and Grabowski (2014) increased both LPN and nurse aide staffing simultaneously, making it difficult to tease out the independent effects of each staff type. These prior findings suggest that increases in nurse aide staffing induced by the new Massachusetts requirement could similarly have been insufficient to induce substantial improvements in quality of care and safety, as defined by the metrics in this analysis, in the absence of increases in staffing for RNs or other staff types. However, other quality dimensions, such as quality of life and timely ADL care, could be positively affected. Additionally, the widespread delays in health inspection surveys during the COVID-19 PHE may have hindered the Staffing Study team's ability to detect effects on safety outcomes using longitudinal analysis. A literature review found no articles in the peer-review or gray literature examining the impact of the new Massachusetts staffing requirement on quality, safety, or nursing home closures.

The Staffing Study team acknowledges several limitations of the impact analysis. First, the analysis is limited to a single policy change in Massachusetts, so findings might not generalize to other states or alternative minimum staffing requirement policy changes (e.g., with different required staffing levels, or different penalty sizes or structures). Second, the new Massachusetts minimum staffing requirement was enacted contemporaneously with several other provisions affecting nursing homes. These provisions included a requirement that nursing homes invest 75 percent of their revenue towards direct care staffing costs, an elimination of three- and four-bed rooms, an increase in minimum square footage in two-bed rooms, and contingency of COVID relief funding on compliance with these new policies. These additional provisions may have had independent effects on quality of care and safety, potentially obscuring the effect of increased staffing on these outcomes. Finally, analysis of quality of care and safety outcomes was further limited because of the short time that has elapsed since Massachusetts's policy change, the subset of quality measures examined, and the delay in the administration of health inspection surveys during the COVID-19 PHE.

4.4 Cost and Savings Analyses

Key Takeaways

- The total salary costs of increasing staffing levels for nursing homes to meet a minimum staffing requirement for total nurse hours, total licensed nurse hours, and total RN hours range from $1.5 to $5.3 billion for four options ranging from low (below the current median) to high total nurse staffing.
- A requirement that includes minimum staffing levels for each nurse staff type (RN, LPN, nurse aide, and all nurse staff) at equivalent implied HPRD is estimated to cost $2.9 to $6.8 billion for the same four options. Minimum requirements for RNs and nurse aides only are estimated to cost $2.2 to $6.0 billion across four options.
- Minimum quantifiable savings to the Medicare program, because of decreased use of acute care services and increased community discharge, range from $187 to $465 million.

The first two sections of this chapter focused on potential implications of a federal minimum staffing requirement for nursing home quality and safety, while **Section 4.3** considered feasibility, confirming that implementation of a state-level minimum staffing requirement successfully increased total nurse staffing

levels among low-staffed nursing homes most incentivized to respond. This section rounds out the discussion of feasibility and cost by investigating estimated *staffing salary costs to nursing homes* that would be associated with implementation of a federal minimum staffing requirement and the minimum quantifiable *savings to Medicare* associated with avoided hospitalizations and emergency department visits and increased community discharge at higher staffing levels.

4.4.1 Cost Analyses

The section begins with a consideration of nurse staff salary costs associated with potential federal minimum staffing requirements to achieve acceptable quality care and patient safety outcomes.

Overview

Section 4.1 presented analyses of the relationship of staffing with acceptable quality and safety at different staffing levels for RNs, licensed nurses (RNs, LPNs), LPNs, nurse aides, and total nurse staff (RNs, LPNs, nurse aides) that could be potential federal minimum staffing requirements. Staffing thresholds in HPRD for each of four minimum staffing requirement options (*Low, Medium, Higher, Highest*) previously presented in **Exhibit 4.10** are repeated below in **Exhibit 4.32** for convenience.

Exhibit 4.32: Four Potential Minimum Staffing Requirement Options

Decile (Total Nurse and RN)	Minimum Required Staffing Level (in HPRD)				
	Registered Nurses (RNs)	LPNs	Nurse Aide	Licensed Nurses (RNs and LPNs)	Total Nurse Staff (RNs, LPNs, and Nurse Aides)
Low/4th	0.45	0.70	2.15	1.15	3.30
Medium/5th	0.52	0.71	2.25	1.23	3.48
Higher/6th	0.60	0.72	2.35	1.32	3.67
Highest/7th	0.70	0.73	2.45	1.43	3.88

As described in earlier sections, low-staffed nursing homes with existing RN, licensed nurse, or total nurse staffing levels below the threshold specified by a new federal minimum staffing requirement would need to increase staffing levels to comply. The Staffing Study uses data from fiscal year 2021 Medicare cost reports for skilled nursing facilities (SNFs)[17] and the October 2021 refresh of Nursing Home Care Compare to estimate additional nurse staff salary costs to nursing homes that would be associated with implementation of each of the staffing levels in **Exhibit 4.32**. When considered alongside potential benefits in quality and safety improvements, and potential associated savings to Medicare as described in the following section (**Section 4.4.2**), these cost estimates support a clearer understanding of expected trade-offs of potential federal minimum staffing requirement options.

In addition to estimating additional nurse staff salary costs in total and per nursing home, the analysis stratifies estimated salary costs by selected nursing home characteristics, such as Five-Star Quality Rating System staffing star rating, ownership, payer mix, and location, to support an understanding of which types of nursing homes would bear the largest cost burden of a new federal minimum staffing requirement. More detailed results are available in **Appendix H.**

[17] The cost report data were released on October 18, 2022, and are available at https://www.cms.gov/httpswwwcmsgovresearch-statistics-data-and-systemsdownloadable-public-use-filescost-reportscost/2021-1.

Methods

The methods section begins with a brief description of data sources used in the cost analyses, followed by a description of methods used to impute hourly wages. This is followed by a summary of assumptions on how nursing homes will respond to implementation of a federal minimum staffing requirement; these assumptions are necessary to support development of cost estimates. The section concludes with a description of how annual salary costs are estimated using the wage data and assumed staffing increases.

Data

To estimate additional nurse staff salary costs required for increasing nurse staffing levels, the study team uses information about hourly wages for nurse staff, current nurse staffing levels, resident census, and nursing home characteristics at the nursing home level. The discussion below briefly describes data sources for these components.

Medicare cost reports for SNFs. Fiscal year 2021 Medicare cost reports for SNFs were used to estimate hourly wages for nursing homes. Specifically, hourly wages (including fringe benefits where applicable) for RNs, LPNs, and nurse aides were extracted from Worksheet S-3, Part V of the cost reports. For each nurse type, the hourly wage was calculated as the sum of reported salaries for nurse staff (Column 3[18] in Worksheet S-3, Part V; including both employees and contract/agency staff) divided by the sum of reported paid hours for nurse staff (Column 4[19] in Worksheet S-3, Part V). A small portion of nursing homes (n=534) had more than one cost report. For them, the study team selected the cost report with the reporting period covering the highest number of days during calendar year 2021. This resulted in a sample of 12,066 nursing homes reporting any hourly wage information for nurse staff.

Nursing Home Care Compare. Reported nurse staffing levels (for RNs, LPNs, nurse aides, and total nurse staff), average daily resident census, and selected nursing home characteristics (ownership, bed size, Five-Star Quality Rating System staffing ratings, etc.) were extracted from the files that the Staffing Study team previously produced for the October 2021 refresh of Nursing Home Care Compare. Nurse staffing levels reported on Nursing Home Care Compare were calculated based on the PBJ system data for 2021Q2. There are 15,270 nursing homes included in the October 2021 refresh. Excluding nursing homes with missing values in reported HPRD for total nurse staff or in average daily resident census (n=582), the remaining sample included 14,688 nursing homes across 50 states plus the District of Columbia and Puerto Rico.

Imputation of Hourly Wages

Two types of nursing homes were assigned imputed hourly wages:

- Nursing homes with extreme values (greater than 1.5 times the interquartile range from the first and third quartiles) in hourly wages for a given type of nurse staff (RN, LPN, nurse aide, or total nurse staff) (N=592)
- Nursing homes without Medicare cost report data (N=3,265)

For these nursing homes, the team imputed hourly wages for each nurse type using the loaded hourly wage for the corresponding nurse type in non-outlier nursing homes within the same state with the same

---

[18] The amount reported in Column 3 is the sum of amounts reported in Column 1 (total of paid wages and salaries for the specified category of skilled nursing facility employees including overtime, vacation, holiday, sick, lunch, and other paid time off; severance; and bonuses) + amounts reported in Column 2 (the appropriate portion of fringe benefits corresponding to paid wages and salaries reported in Column 1).

[19] The amount reported in Column 4 is the number of paid hours corresponding to the amount reported in Column 3.

Five-Star Quality Rating System staffing rating, weighted by the number of certified beds per nursing home. For nursing homes with missing or extreme values for hourly wages or no staffing rating, the team assigned the imputed wage as the state-level weighted hourly wages of non-outlier nursing homes within that state. Actual and imputed wages were then merged with the Nursing Home Care Compare data, resulting in a final analytic sample of 14,688 nursing homes.

Behavioral Assumptions for Nursing Homes under Minimum Staffing Requirements

For potential federal minimum staffing requirements implemented for RNs, licensed nurses (RNs, LPNs), and total nurse staff, nurse staff salary cost estimates assume that nursing homes will respond as follows:

1. First, each nursing home will increase its RN staffing level to meet the minimum requirement for RNs.
2. After accounting for the increase in RN staffing level, if the licensed nurse staffing level is still lower than the minimum requirement for licensed nurses, nursing homes will increase their LPN staffing levels to meet the minimum requirement for licensed nurse staff.
3. After accounting for the increase in licensed nurse staffing level, if the total nurse staffing level is still lower than the minimum requirement for total nurse staff, nursing homes will increase their nurse aide staffing levels to meet the minimum requirement for total nurse staff.
4. Nursing homes that are at or above the minimum staffing requirements for RNs, licensed nurses, or total nurses will not decrease their current staffing levels.

For potential federal minimum staffing requirements implemented separately for RNs, LPNs, nurse aides, and total nurse staff, nurse staff salary cost estimates assume that nursing homes will respond as follows:

1. First, nursing homes will increase their nurse staffing levels to meet the individual minimum requirements for RNs, LPNs, and nurse aides.
2. After accounting for the increase in RN, LPN, and nurse aide staffing levels, if the total nurse staffing level is still lower than the minimum requirement for total nurse staff, nursing homes will increase their nurse aide staffing levels to meet the minimum requirement for total nurse staff.
3. Nursing homes that are at or above the minimum staffing requirements for RNs, LPNs, nurse aides, or total nurses will not decrease their current staffing levels.

For potential federal minimum staffing requirements implemented separately for RNs and nurse aides, nurse staff salary cost estimates assume that nursing homes will respond as follows:

1. Nursing homes will increase their nurse staffing levels to meet the individual minimum requirements for RNs and nurse aides, respectively.
2. Nursing homes that are at or above the minimum staffing requirements for RNs and nurse aides will not decrease their current staffing levels for RNs and nurse aides.
3. Nursing homes will not decrease their current staffing levels for LPNs.

Estimation of Annual Salary Costs

Finally, for each nursing home, the study team estimated total annual salary costs for a given nurse type (RN, LPN, nurse aide) as follows: type-specific hourly wage × type-specific reported HPRD × facility-level average daily resident census × 365. For example, if a nursing home reported an average hourly wage of $44 for its RNs, an average of 0.4 RN HPRD, and an average daily resident census of 100, its estimated annual salary costs for RNs would be calculated as: $44 × 0.4 × 100 × 365 = $642,400.

Total annual salary costs for increasing staffing levels to meet minimum staffing requirements were estimated in a similar way: type-specific hourly wage × type-specific *additional* reported HPRD required × facility-level average daily resident census × 365. Using the same hypothetical nursing home above as an example, under the *Low* option, that nursing home would need to increase its RN HPRD from 0.4 to 0.45. Therefore, total annual salary costs for increasing its RN staffing level to meet the minimum requirement would be calculated as: $44 × (0.45 − 0.4) × 100 × 365 = $80,300.

Results

As shown in **Exhibit 4.33**, estimated average hourly wages were about $44 for RNs, $35 for LPNs, and $21 for nurse aides. Accounting for the number of certified beds per nursing home, estimated annual average salary costs for total nurse staff per nursing home were about $3.9 million.[20] In total, estimated annual salary costs for nurse staff were at about $43 billion[21] for all nursing homes included in the analysis.

Exhibit 4.33: Estimated Current Hourly Wages and Annual Salary Costs for RNs, LPNs, Nurse Aides, and Total Nurse Staff

Type of Nurse Staff	Average Hourly Wage	Weighted Annual Salary Costs per Nursing Home	Total Annual Salary Costs for All Nursing Homes
RNs	$43.92	$1,048,873	$11,869,882,947
LPNs	$34.64	$1,126,334	$12,654,050,278
Nurse Aides	$20.96	$1,707,142	$18,911,155,788
Total nurse staff	$27.61	$3,882,349	$43,435,089,012

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census. Because of imputations and outlier values in hourly wages by nurse type, the sum of annual salary costs across RNs, LPNs, and nurse aides is close but not exactly equal to the annual salary costs for total nurse staff.

The percentage of nursing homes below the potential minimum requirement for RNs ranged from 28 percent for the *Low* option to 60 percent for the *Highest* option. Accounting for three requirements (RNs, licensed nurses, total nurse staff), the percentage of nursing homes not meeting at least one requirement is estimated to be 43 percent under the *Low* option and about 76 percent under the *Highest* option (**Exhibit 4.34**). Accounting for potential federal minimum requirements for all four staff types (RNs, LPNs, nurse aides, total nurse staff), the percentage of nursing homes not meeting the requirement for at least one staff type is estimated to be 73 percent under the *Low* option and about 90 percent under the *Highest* option (**Exhibit 4.35**). Under a two-requirement structure (RNs and nurse aides) the percentage of nursing homes not meeting the requirement for at least one staff type is estimated to be 59 percent under the *Low* option and about 82 percent under the *Highest* option (**Exhibit 4.36**).

---

[20] Calculated as the sum of bed size–weighted salary costs for total nurse staff across all nursing homes in the study sample. More specifically, $Weighted\ annual\ salary\ costs\ per\ nursing\ home\ = \sum_{i=1}^{14,688}[(Annual\ salary\ costs\ for\ RNs_i + Annual\ salary\ costs\ for\ LPNs_i + Annual\ salary\ costs\ for\ nurse\ aides_i) \times \frac{Number\ of\ certified\ beds_i}{Total\ number\ of\ certified\ beds\ for\ all\ nursing\ homes}]$.

[21] Calculated as the sum of reported salary costs for total nurse staff across all nursing homes in the study sample. More specifically, $Total\ annual\ salary\ costs\ for\ all\ nursing\ homes\ = \sum_{i=1}^{14,688}(Annual\ salary\ costs\ for\ RNs_i + Annual\ salary\ costs\ for\ LPNs_i + Annual\ salary\ costs\ for\ nurse\ aides_i)$.

Exhibit 4.34: Percentage of Nursing Homes Below Potential Minimum Staffing Requirements (Three Requirements for RNs, Licensed Nurses, and Total Nurse Staff)

Option	RNs	Licensed Nurses (RNs + LPNs)	Total Nurse Staff	RNs, Licensed Nurses, or Total Nurse Staff
Low	27.8%	11.1%	26.4%	42.9%
Medium	37.1%	17.2%	36.6%	54.7%
Higher	48.0%	26.0%	47.6%	66.1%
Highest	60.0%	39.0%	59.0%	76.4%

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census.

Exhibit 4.35: Percentage of Nursing Homes Below Potential Minimum Staffing Requirements (Four Requirements for RNs, LPNs, Nurse Aides, and Total Nurse Staff)

Option	RNs	LPNs	Nurse Aides	Total Nurse Staff	RNs, LPNs, Nurse Aides, or Total Nurse Staff
Low	27.8%	28.3%	48.4%	26.4%	73.2%
Medium	37.1%	29.2%	55.5%	36.6%	79.7%
Higher	48.0%	30.2%	62.0%	47.6%	85.3%
Highest	60.0%	31.2%	68.1%	59.0%	90.1%

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census.

Exhibit 4.36: Percentage of Nursing Homes Below Potential Minimum Staffing Requirements (Two Requirements for RNs and Nurse Aides)

Option	RNs	Nurse Aides	RNs or Nurse Aides
Low	27.8%	48.4%	59.3%
Medium	37.1%	55.5%	67.6%
Higher	48.0%	62.0%	75.2%
Highest	60.0%	68.1%	81.8%

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census.

Exhibit 4.37 shows the additional full-time equivalent (FTE) nursing staff required to meet minimum staffing requirements under the four-requirement structure, by option (*Low, Medium, Higher,* and *Highest*) and nurse staff type.

Exhibit 4.37: Number of Additional Full-time Equivalent Staff Needed to Meet Potential Minimum Staffing Requirements

	RNs		LPNs		Nurse Aides	
Option	HPRD	Additional FTEs	HPRD	Additional FTEs	HPRD	Additional FTEs
Low	0.45	5,527	0.70	7,437	2.15	26,974
Medium	0.52	9,184	0.71	7,840	2.25	35,128
Higher	0.60	14,678	0.72	8,258	2.35	44,302
Highest	0.70	23,300	0.73	8,690	2.45	54,405

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census. Estimates assume that a given staff member works 7.5 hours a day, allowing for a 30-minute meal break, to meet the HRPD requirements.

On average, estimated salary costs per nursing home for increasing nurse staffing levels to meet potential staffing requirements for three staff type groups (RNs, licensed nurses, total nurse staff) range from about $147,000 per year under the *Low* option to slightly more than $504,000 per year under the *Highest* option (**Exhibit 4.38**).[22] Across all four options, estimated increases in salary costs for licensed nurses consistently account for more than half of the estimated additional annual salary costs required for total nurse staff. Similarly, as shown in **Exhibit 4.39**, to meet potential staffing requirements for all four staff types (RNs, LPNs, nurse aides, total nurse staff), estimated weighted annual salary costs per nursing home would be appreciably higher, ranging from nearly $276,000 (*Low* option) to $637,000 (*Highest* option). For a two-requirement structure (RNs and nurse aides), estimated weighted annual salary costs per nursing home range from about $205,000 to nearly $554,000 (**Exhibit 4.40).**

Exhibit 4.38: Estimated Weighted Annual Salary Costs per Nursing Home for Meeting Potential Minimum Staffing Requirements, All U.S. Nursing Homes (Three Requirements for RNs, Licensed Nurses, and Total Nurse Staff)

Option	RNs	Licensed Nurses (RNs + LPNs)	Total Nurse Staff
Low	$59,831	$76,810	$146,915
Medium	$100,314	$124,451	$229,256
Higher	$161,493	$195,000	$342,935
Highest	$257,529	$303,767	$504,219

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census. For each option, estimated salary costs for a given nurse type were weighted by the number of certified beds across all nursing homes in the sample.

Exhibit 4.39: Estimated Weighted Annual Salary Costs per Nursing Home for Meeting Potential Minimum Staffing Requirements, All U.S. Nursing Homes (Four Requirements for RNs, LPNs, Nurse Aides, and Total Nurse Staff)

Option	RNs	LPNs	Nurse Aides	Total Nurse Staff
Low	$59,831	$71,053	$144,676	$275,560
Medium	$100,314	$74,902	$189,775	$364,990
Higher	$161,493	$78,869	$240,437	$480,799
Highest	$257,529	$82,978	$296,054	$636,561

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census. For each option, estimated salary costs for a given nurse type were weighted by the number of certified beds across all nursing homes in the sample.

[22] Calculated as the sum of bed size–weighted additional salary costs for total nurse staff required for meeting the minimum requirement across all nursing homes in the study sample. More specifically, $Weighted\ additional\ annual\ salary\ costs\ per\ nursing\ home\ = \sum_{i=1}^{14,688}(Additional\ annual\ salary\ costs\ for\ total\ nurse\ staff\ needed_i \times \frac{Number\ of\ certified\ beds_i}{Total\ number\ of\ certified\ beds\ for\ all\ nursing\ homes})$.

Exhibit 4.40: Estimated Weighted Annual Salary Costs per Nursing Home for Meeting Potential Minimum Staffing Requirements, All U.S. Nursing Homes (Two Requirements for RNs and Nurse Aides)

Option	RNs	Nurse Aides	RNs and Nurse Aides
Low	$59,831	$144,676	$204,507
Medium	$100,314	$189,775	$290,089
Higher	$161,493	$240,437	$401,930
Highest	$257,529	$296,054	$553,583

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census. For each option, estimated salary costs for a given nurse type were weighted by the number of certified beds across all nursing homes in the sample.

For potential federal minimum requirements for three staff types (RNs, licensed nurses, and total nurse staff), among nursing homes that would need to increase staffing levels for at least one of the three types, the estimated total additional annual salary costs per nursing home would be even higher, ranging from about $316,000 per nursing home under the *Low* option to nearly $627,000 under the *Highest* option (**Exhibit 4.41**).[23] Correspondingly, under potential minimum requirements for four staff types (RNs, LPNs, nurse aides, and total nurse staff), the estimated additional annual salary costs per nursing home not meeting requirements for at least one of the four types would range from $367,000 (*Low* option) to $693,000 (*Highest* option), shown in **Exhibit 4.42**. The corresponding values under a two-requirement structure (RNs and nurse aides) in **Exhibit 4.43** range from $323,000 (*Low* option) to $649,000 (*Highest* option).

Exhibit 4.41: Estimated Weighted Annual Salary Costs per Nursing Home for Meeting Potential Minimum Staffing Requirements, Nursing Homes Not Meeting At Least One Requirement (Three Requirements for RNs, Licensed Nurses, and Total Nurse Staff)

Option	RNs	Licensed Nurses (RNs + LPNs)	Total Nurse Staff
Low	$128,798	$165,347	$316,261
Medium	$171,408	$212,652	$391,734
Higher	$230,001	$277,724	$488,416
Highest	$320,132	$377,610	$626,790

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census. For each option, estimated salary costs for a given nurse type were weighted by the number of certified beds across nursing homes not meeting at least one of the three requirements.

[23] Calculated as the sum of bed size–weighted additional salary costs for total nurse staff required for meeting the minimum requirement across nursing homes currently not meeting minimum requirements for at least one nurse type. More specifically, $Weighted\ additional\ annual\ salary\ costs\ per\ nursing\ home\ = \sum_{i=1}^{number\ of\ nursing\ homes\ not\ meeting\ at\ least\ one\ requirement} (Additional\ annual\ salary\ costs\ for\ total\ nurse\ staff\ needed_i \times \frac{Number\ of\ certified\ beds_i}{Total\ number\ of\ certified\ beds\ for\ nursing\ homes\ not\ meeting\ at\ least\ one\ requirement})$.

Exhibit 4.42: Estimated Weighted Annual Salary Costs per Nursing Home for Meeting Potential Minimum Staffing Requirements, Nursing Homes Not Meeting At Least One Requirement (Four Requirements for RNs, LPNs, Nurse Aides, and Total Nurse Staff)

Option	RNs	LPNs	Nurse Aides	Total Nurse Staff
Low	$79,709	$94,659	$192,742	$367,109
Medium	$122,774	$91,672	$232,265	$446,710
Higher	$185,084	$90,391	$275,561	$551,037
Highest	$280,544	$90,394	$322,513	$693,451

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census. For each option, estimated salary costs for a given nurse type were weighted by the number of certified beds across nursing homes not meeting at least one of the four requirements.

Exhibit 4.43: Estimated Weighted Annual Salary Costs per Nursing Home for Meeting Potential Minimum Staffing Requirements, Nursing Homes Not Meeting At Least One Requirement (Two Requirements for RNs and Nurse Aides)

Option	RNs	Nurse Aides	RNs and Nurse Aides
Low	$94,509	$228,531	$323,040
Medium	$139,702	$264,291	$403,993
Higher	$204,202	$304,025	$508,228
Highest	$302,054	$347,240	$649,294

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census. For each option, estimated salary costs for a given nurse type were weighted by the number of certified beds across nursing homes not meeting at least one of the two requirements.

Exhibit 4.44 shows total annual salary cost estimates for nurse staff across the four options of potential minimum staffing requirements for three staff type groups (RNs, licensed nurses, and total nurse staff). For all nursing homes included in the analysis (*N*=14,688), additional nurse staff salary costs required for meeting potential minimum staffing requirements range from about $1.5 billion per year for meeting the *Low* option to about $5.3 billion per year for meeting the *Highest* option.[24]

Exhibit 4.44: Estimated Total Salary Costs per Year for Meeting Potential Minimum Staffing Requirements (Three Requirements for RNs, Licensed Nurses, and Total Nurse Staff)

Option	RNs	Licensed Nurses (RNs + LPNs)	Total Nurse Staff
Low	$658,828,845	$810,265,841	$1,511,756,853
Medium	$1,099,376,826	$1,313,431,886	$2,371,723,898
Higher	$1,764,670,990	$2,064,761,018	$3,574,332,757
Highest	$2,810,217,927	$3,230,794,412	$5,286,503,456

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census.

[24] Calculated as the sum of estimated additional salary costs for total nurse staff that are needed to meet the minimum requirements across all nursing homes in the study sample. More specifically,
$Total\ additional\ annual\ salary\ costs\ for\ all\ nursing\ homes\ = \sum_{i=1}^{14,688} Additional\ annual\ salary\ costs\ for\ total\ nurse\ staff_i$

Similarly, **Exhibit 4.45** shows total annual salary cost estimates for nurse staff across the four options of potential minimum staffing requirements for four staff type groups (RNs, LPNs, nurse aides, and total nurse staff). The estimated additional nurse staff salary costs required for four staff type groups would range from about $2.9 billion per year (*Low* option) to about $6.8 billion per year for meeting the *Highest* option. **Exhibit 4.46** shows these total annual salary cost estimates for a two-requirement structure (RNs and nurse aides), which range from around $2.2 billion to nearly $6 billion.

Exhibit 4.45: Estimated Total Salary Costs per Year for Meeting Potential Minimum Staffing Requirements (Four Requirements for RNs, LPNs, Nurse Aides, and Total Nurse Staff)

Option	RNs	LPNs	Nurse Aides	Total Nurse Staff
Low	$658,828,845	$731,179,839	$1,550,576,464	$2,940,585,147
Medium	$1,099,376,826	$770,811,045	$2,022,636,552	$3,892,824,424
Higher	$1,764,670,990	$811,841,563	$2,554,574,101	$5,131,086,654
Highest	$2,810,217,927	$854,311,075	$3,141,364,635	$6,805,893,638

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census.

Exhibit 4.46: Estimated Total Salary Costs per Year for Meeting Potential Minimum Staffing Requirements (Two Requirements for RNs and Nurse Aides)

Option	RNs	Nurse Aides	RNs and Nurse Aides
Low	$658,828,845	$1,550,576,464	$2,209,405,309
Medium	$1,099,376,826	$2,022,636,552	$3,122,013,378
Higher	$1,764,670,990	$2,554,574,101	$4,319,245,091
Highest	$2,810,217,927	$3,141,364,635	$5,951,582,563

Notes: *N*=14,688. Abt analysis based on 2021 Skilled Nursing Facility Medicare cost reports and October 2021 refresh of Nursing Home Care Compare. Nursing homes not included in the analysis (*N*=582) had missing values in reported total nurse hours per resident day or average Minimum Data Set census.

The study team additionally estimated additional nurse staff salary costs for meeting potential minimum staffing requirements stratified by selected nursing home characteristics. In general, the analysis finds that nursing homes with higher staffing ratings (vs. lower staffing ratings), lower share of Medicaid residents (vs. higher share of Medicaid residents), or lower number of beds (vs. higher number of beds) would have lower additional nurse staff salary costs for meeting the requirements. For-profit nursing homes would have higher additional nurse staff salary costs than would their government-owned or non-profit counterparts. Similarly, nursing homes that are in urban areas would have higher additional nurse staff salary costs for meeting the requirements compared to rural nursing homes.

Discussion

This section estimated additional nurse staff salary costs per year that would be associated with implementing potential federal minimum staffing requirement options for RNs, licensed nurses, and total nurse staff. Total annual salary costs for increasing nurse staffing levels range from $1.5 billion for the option with the lowest requirements (RN HPRD=0.45, licensed nurse HPRD=1.15, total nurse staff HPRD=3.30) to $5.3 billion for the option with the highest requirements (RN HPRD=0.70, licensed nurse HPRD=1.43, total nurse staff HPRD=3.88). If minimum requirements were specified for all four staff types (RN, LPN, nurse aide, and total nurse staff) under the same total HPRD, these costs are estimated to range from $2.9 to $6.8 billion. For a two-requirement structure, with HPRD minimums for RNs and nurse aides only, estimated annual costs range from $2.2 to $6.0 billion. The percentage of nursing homes

needing to increase staffing ranges from a low of 43 percent to a high of 90 percent, depending on the option (*Low, Medium, Higher, Highest)* and the number of requirements by staff type.

These analyses suggest that implementing a minimum staffing requirement has the potential to affect a significant portion of nursing homes nationwide. Anywhere from two-fifths to nearly all nursing homes would need to increase nurse staffing depending on the minimum requirement, which could in turn favorably affect care quality and safety for many residents. At the same time, the cost implications to meet a new federal minimum requirement are appreciable, with annual increased salary costs in nursing homes needing to increase staffing ranging from a low of $316,000 to a high of $693,000. These costs could be a barrier to compliance with a new federal requirement. If nursing homes currently above a new requirement reduce staffing, costs would be lower but with potential unintended consequences for care quality and safety.

A few recent studies (Hawk et al., 2022; CLA, 2022; Bowblis, 2022) estimated additional costs associated with the proposed minimum levels included in the bills introduced in the U.S. House of Representatives (H.R. 5216) and Senate (S. 2943) in 2019 of 0.75 HPRD for RNs, 0.55 HPRD for LPNs, 2.80 HPRD for nurse aides, and 4.10 for total nurse HPRD. The cost estimates among those studies range from $5 billion to $10 billion annually because of differences in data sources, methodology, and assumptions. Notably, they are based on a higher total nurse HPRD (4.1) than are the estimates included here and on higher RN and nurse aide HPRD.

The estimates in the Staffing Study are lower than estimates in prior studies for several reasons. First, one set of cost estimates presented here is based on potential minimum staffing requirements for three types of nurse staff (RNs, licensed nurses, total nurse staff), which are lower than estimates from this and other studies that are based on requirements for all four types of nurse staff (RNs, LPNs, nurse aides, total nurse staff). Second, as noted, potential minimum staffing levels considered in this study are lower than those used in prior studies.

Third, there are differences in data sources, time periods, and methodology across these studies. To test the robustness of the Staffing Study's cost estimation method, the study benchmarked estimates by applying the same minimum staffing levels to the types of nurse staff used in those studies and compared the estimates. For example, using the proposed minimum levels that were included in the Bills introduced in the Congress in 2019, the team estimated that total annual salary costs for increasing nurse staffing levels are about $9.3 billion a year among nursing homes in the United States. These estimates are comparable to findings from the other recent studies cited (Hawk et al., 2022; CLA, 2022).

The cost study has several limitations. First, a few data quality issues exist in Medicare cost reports for SNFs. As of November 2022, about 3,000 nursing homes had not yet submitted their 2021 cost report data. In addition, some nursing homes reported extremely high or low hourly wages in their cost reports. To address these data issues, hourly wage estimates for nursing homes without cost reports or with outlier values in hourly wages are imputed using nursing homes with hourly wage data that were considered reliable. Second, the Staffing Study estimates assume nursing homes that are currently at or above the potential minimum staffing levels do not decrease their current staffing levels. Given that no federal minimum staffing requirements exist, it is difficult to predict how nursing homes would respond if such requirements were implemented. If some nursing homes currently staffing above the proposed minimum levels did reduce staffing in a response to a new requirement, the increase in costs would be less than the estimates shown here. If some nursing homes currently staffing below proposed levels did not increase staffing to meet minimum requirements (e.g., because of workforce challenges or other barriers that impede increasing staffing levels), overall costs would also be reduced relative to these estimates. On the other hand, if some nursing homes increase staffing with a different staff type than assumed—for example, meeting the licensed nurse staffing requirement by increasing staffing of RNs rather than LPNs, or meeting the total nurse staffing requirement by increasing staffing of RNs or LPNs rather than nurse

aides—actual costs will tend to be higher than those shown here. Finally, Staffing Study costs notably include salary costs associated with additional staffing only; if hiring and training costs associated with onboarding new staff were included, costs would be higher than shown in this chapter.

4.4.2 Savings Analyses

In addition to costs to nursing homes for increased staffing as described in the prior section, a federal minimum staffing requirement is additionally expected to generate benefits including cost savings to Medicare associated with improved quality and safety. This section characterizes minimum Medicare savings in terms of anticipated reductions in hospitalizations and emergency department (ED) visits and anticipated increases in rates of community discharge. There are many additional potential benefits that cannot be easily costed out because of data and time limitations, including those related to other clinical outcomes, out-of-pocket savings for residents, and improved resident quality of life.

Overview

In general, high rates of hospitalizations or ED visits can indicate that a nursing home is not properly assessing or taking care of its residents. As reflected in the existing literature and corroborated by Staffing Study interviews with nursing home staff as reported in **Section 3.1**, short staffing can put residents at increased of risk of poor clinical outcomes, including falls and other conditions that could increase the risk of hospitalization or ED visits (Clemens et al., 2021; Wagner et al., 2021; Min & Hong, 2019). Discharge back to the community is the primary goal for most short-stay nursing home residents.

Section 4.1 quantitative findings confirm higher staffing, and particularly higher RN staffing, is associated with improved quality and safety outcomes. Those findings suggest that a federal minimum staffing requirement that successfully increases staffing levels would be associated with savings for the Medicare program through reduced hospitalizations and ED visits and increased community discharges. This section presents estimates of Medicare savings for four potential minimum staffing requirement options, focused specifically on expected savings because of an RN requirement.

Methods

The savings analyses relied on RN staffing data from the CMS PBJ system, adjusted for acuity using MDS data and coupled with claims-based QMs on hospitalizations, ED visits, and the Rate of Successful Return to Home or Community QM from Nursing Home Care Compare.

Data

The Staffing Study team created nursing home-level measures of case-mix–adjusted RN HPRD using 2022Q2 data from the PBJ system and the MDS. RN hours were defined to include RNs, RNs with administrative duties, and RN directors of nursing. The resident census is based on a daily resident census measure that is calculated by CMS using MDS assessments. (See **Appendix E** for more details on the methods used to create the measure of RN HPRD, including the acuity adjustment method and the exclusion criteria.)

Hospital and ED visit data were four claims-based quality measures from Nursing Home Care Compare for a 12-month period (2021Q2–2021Q1):[25] the Rate of Successful Return to Home or Community measure is for July–December 2019 and July 2020–June 2021:

- Short-stay readmission
- Short-stay ED visits

[25] See Abt Associates (2018) for complete specifications for these measures.

- Long-stay hospitalizations per 1,000 long-stay resident days
- Long-stay ED visits per 1,000 long-stay resident days
- Rate of Successful Return to Home or Community

The 12-month timeframe for the hospitalization and ED visit measures makes it possible to measure predicted annual savings. For the Rate of Successful Return to Home or Community measure, which covers 18 months, the study team adjusted the data to report annual savings. For each nursing home, the study team used data on the numerator and denominator for each measure. Note that these measures exclude Medicare Advantage patients, so the savings estimates are specific to fee-for-service beneficiaries, including dual eligibles. The hospitalization and ED visit analyses included 14,140 nursing facilities that had valid data for at least one claims-based measure. The analyses of Rate of Successful Return to Home or Community included 14,848 nursing homes.

Quality Outcomes Under Status Quo Scenario

Using the hospitalization and ED visit data linked to the PBJ RN staffing data, the Staffing Study team estimated a set of multivariate regression models that examined relationships between case-mix–adjusted RN staffing deciles and rates for each of the five claims-based measures. These models use case-mix–adjusted RN staffing levels and include the same covariates as used in the study's other analyses of staffing quality relationships described in **Section 4.1**.

In these models, nursing homes with staffing levels in the 1st and 2nd RN staffing deciles are the reference category. The models include covariates for the 3rd–10th deciles of RN staffing. Estimated model coefficients were used to generate adjusted mean outcomes associated with each RN staffing decile.

The expected number of annual long- and short-stay hospitalizations and ED visits was then predicted based on the nursing home's RN staffing decile, the adjusted mean outcomes associated with that staffing level from the regression models, and the nursing home's number of short-stay residents and long-stay resident days (the denominators for the claims-based measures).

Quality Outcomes Under Potential Minimum Staffing Requirement Options

For each nursing home, the team then measured the increase in RN staffing level, if any, required to staff at the level associated with each potential federal minimum staffing requirement option. Increased staffing depends on the nursing home's current staffing level and the required minimum level that is specified. Calculations assume that nursing homes increase RN staffing to the required level and that no nursing homes reduce staffing in response to the requirement.

For nursing homes that would need to increase staffing to be compliant with the minimum required level, the study team compared the adjusted mean outcome rate for the nursing home's current RN staffing decile to the adjusted mean outcome rate for the required RN staffing level. For nursing homes not needing to increase their staffing levels to be in compliance, the study team assumed no change in staffing levels and thus no change in number of expected hospitalizations and ED visits.

Savings for the Rate of Successful Return to Home or Community measure result from a reduction in Medicare-covered SNF days. Based on analysis of a data set that is created for the claims-based measures, the study team assumed that each community discharge resulted in 42 fewer Medicare-covered SNF stays—this figure is based on the difference in median length of stay for those with and without a community discharge.

Estimated Savings

Finally, for each nursing home, the change in Medicare costs associated with the change in the nursing home's expected rate for each of the five claims-based measures was computed.

For the hospitalization and ED visit measures, the projected change in costs depends on the change in the number of hospitalizations and ED visits and on the average Medicare cost for hospitalizations and ED visits. The average Medicare cost per hospitalization was assumed to be $20,400 (this includes both the costs associated with the hospitalization and the cost for the Medicare-covered nursing home stay that a hospitalization can trigger). The average Medicare cost for an ED visit was assumed to be $2,500.[26]

The average savings per community discharge was estimated based on the reduction in the number of Medicare-covered SNF days and the average daily payment amount. Per diem Medicare payment amounts were based on findings from a study conducted for MACPAC (Abt Associates, 2020) that has information on average Patient Driven Payment Model (PDPM) case-mix levels for residents with a Medicare-covered stay and base PDPM payment rates from the 2022 Federal Register (see Medicare Program, 2022). Note that the focus was on estimating savings to the Medicare program; therefore, the study team did not include savings to Medicare beneficiaries that would result from reduced Medicare beneficiary cost-sharing.

Finally, the study team summed the predicted change in Medicare costs across all nursing homes and all five of the claims-based measures to calculate the total predicted savings to Medicare associated with potential minimum RN staffing requirements based on RN staffing decile.

Results

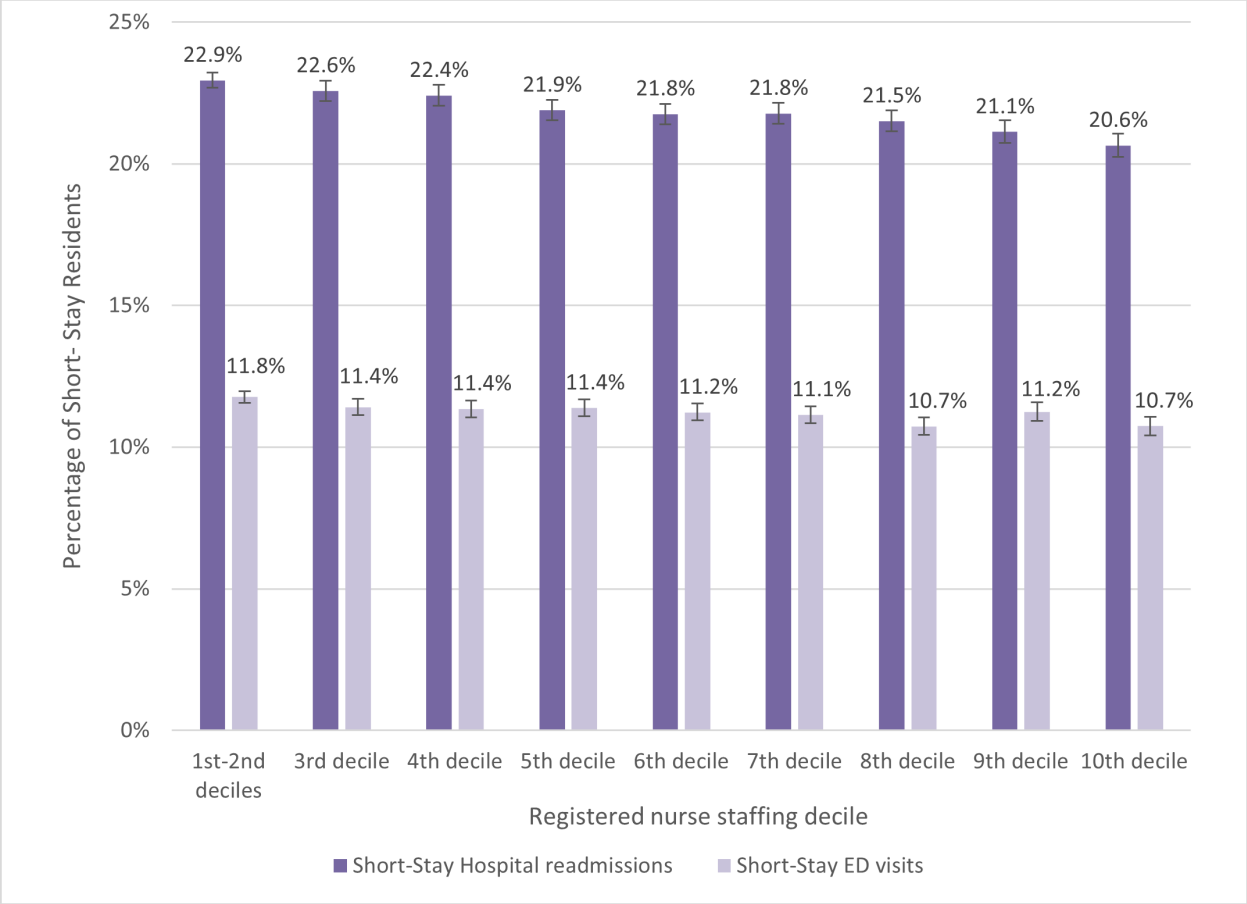
Exhibits 4.47–4.49 show adjusted mean outcomes for the RN staffing decile measures. (Full model results are provided in **Appendix H**.) The model results show consistent relationships between higher RN staffing and lower rates of hospitalizations and outpatient ED visits. They also show a consistent relationship between higher RN staffing and higher rates of successful return to home or community. These relationships underlie the savings estimates.

Short-Stay Measures

The percentage of short-stay residents with a readmission was 22.9 percent for nursing homes with less than 0.38 RN HPRD (the first two staffing deciles and the reference category in the models) (**Exhibit 4.47**). It decreased to 22.6 percent for nursing homes with 0.38–0.45 RN HPRD (3rd decile), 22.4 percent for nursing homes with 0.45–0.52 RN HPRD (5th decile), and around 21.8 percent for nursing homes with 0.60–0.82 RN HPRD (6th and 7th deciles).

[26] These figures are based on data from the Healthcare Cost & Utilization Project (https://www.hcup-us.ahrq.gov/reports/statbriefs/sb246-Geographic-Variation-Hospital-Stays.jsp). Average costs have been adjusted for inflation and include projected savings from Medicare-covered SNF stays that can follow hospitalizations.

Exhibit 4.47: Average Adjusted Mean Outcome of Short-Stay Claims-Based Measures of Readmissions and Emergency Department Visits, by RN Staffing Decile



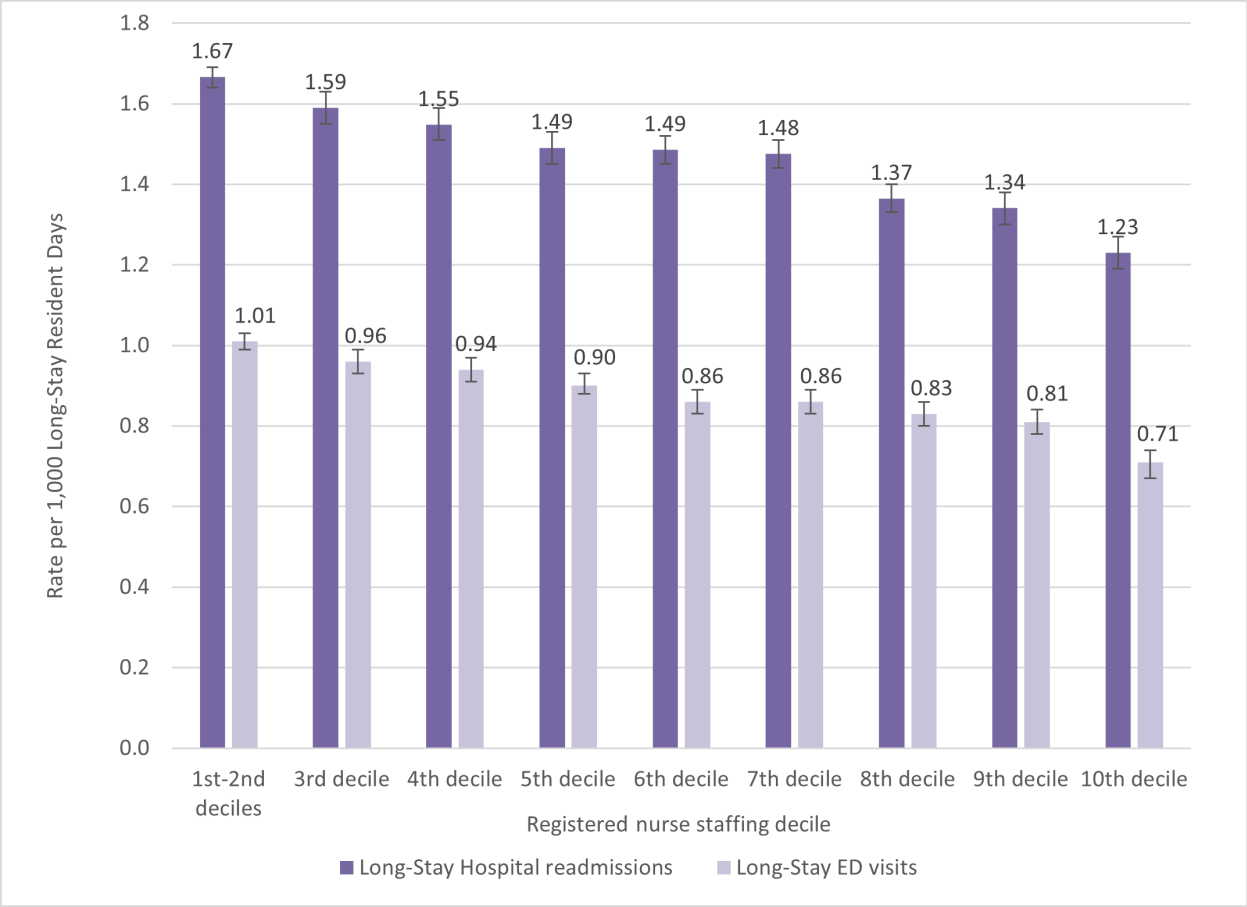
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care compare data.

The relationship between RN staffing levels and short-stay ED visits was similar. For nursing homes in the lowest two deciles of RN staffing, 11.8 percent of short-stay residents had an outpatient ED visit. This percentage decreased to about 11.4 percent for nursing homes with 0.38–0.60 RN HPRD (3rd–6th deciles), then to 11.1–11.2 percent for nursing homes with 0.60–0.82 RN HPRD (7th–8th deciles).

Long-Stay Measures

The relationship between RN staffing levels and hospitalization rates was stronger for long-stay residents than for short-stay residents. The rate of hospitalizations per 1,000 long-stay resident days was 1.67 for nursing homes with less than 0.38 RN HPRD (1st and 2nd deciles). This decreased to 1.59 for nursing homes with 0.38–0.45 RN HPRD (3rd decile), 1.55 for nursing homes with 0.45–0.52 RN HPRD (4th decile), 1.48–1.49 for nursing homes with 0.52–0.80 RN HPRD (5th–7th deciles), and 1.34–1.37 for nursing homes with 0.80–1.28 RN HPRD (8th–9th deciles) (**Exhibit 4.48**).

Exhibit 4.48: Average Adjusted Mean Outcome of Long-Stay Claims-Based Measures of Hospitalization and Emergency Department Visit Rates, by RN Staffing Decile (Rates per Long-Stay Resident Day)



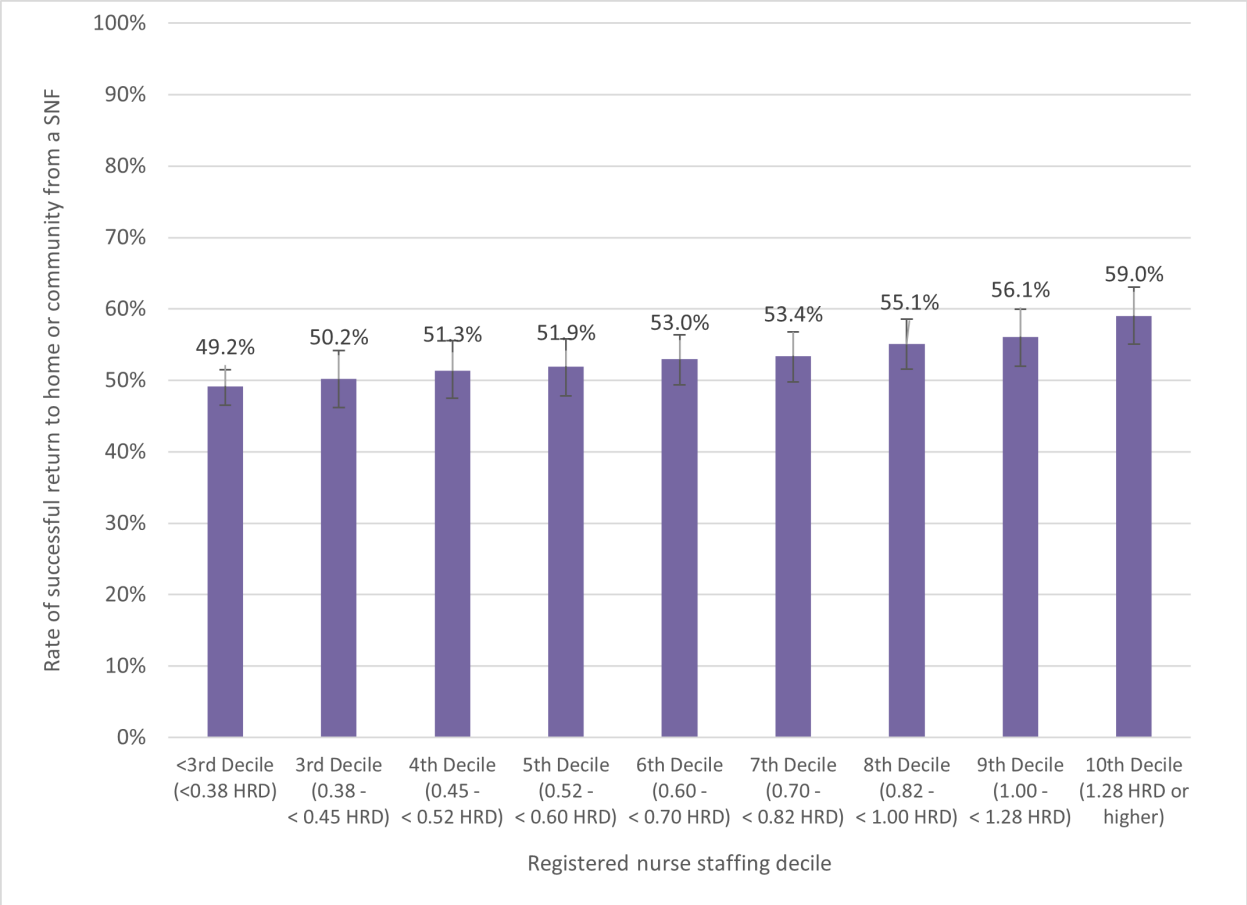
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care compare data.

As with short-stay residents, a consistent relationship between higher levels of RN staffing and lower ED visit rates was also observed. The rate of ED visits per 1,000 long-stay resident days was 1.01 for nursing homes with less than 0.38 RN HPRD (1st and 2nd deciles). This decreased to 0.94–0.96 for nursing homes with 0.45–0.52 RN HPRD (3rd and 4th deciles), 0.90 for nursing homes with 0.52–0.60 RN HPRD (5th decile), and 0.86 for nursing homes with 0.60–0.82 RN HPRD (6th and 7th deciles).

Rate of Successful Return to Home or Community

Results showed a consistent relationship between higher levels of RN staffing and higher rates of successful return to home or community (**Exhibit 4.49)**. The predicted rate of successful return to home or community was 49.2 percent for nursing homes with less than 0.38 RN HPRD (1st and 2nd deciles). The predicted rate increased to 51.3 percent for nursing homes with 0.45–0.52 RN HPRD (4th deciles), 51.9 percent for nursing homes with 0.52–0.60 RN HPRD (5th decile), and 53 percent for nursing homes with 0.60–0.82 RN HPRD (6th and 7th deciles).

Exhibit 4.49: Average Adjusted Mean Outcome of Rate of Successful Return to Home or Community, by RN Staffing Decile



Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care compare data

Predicted Medicare Savings for Potential Minimum RN Staffing Requirement Options

Because of the relationship of higher RN staffing with lower rates of hospitalizations and ED visits and higher rates of community discharge, predicted savings increase with higher RN staffing requirements (**Exhibit 4.50**). Predicted savings rise from $187.6 million under a minimum RN staffing requirement of 0.45–0.52 HPRD (4th decile) to $465.1 million for a requirement of 0.71–0.82 RN HPRD (7th decile).

A minimum RN staffing requirement between 0.71 and 0.82 HPRD is predicted to lead to 12,104 fewer hospitalizations, 14,803 fewer ED visits, and 12,164 more community discharges.

Exhibit 4.50: Predicted Medicare Savings and Changes in Utilization for Potential Minimum RN Staffing Options

RN Staffing Decile	Estimated Medicare Savings	Reduced Hospitalizations	Reduced ED Visits	Increased Community Discharges
0.45–0.52 (4th decile)	$187,640,568	5,781	4,466	3,930
0.52–0.60 (5th decile)	$318,259,715	10,445	7,525	5,798
0.60–0.71 (6th decile)	$409,580,973	11,066	13,790	10,027
0.71–0.82 (7th decile)	$465,111,388	12,104	14,803	12,164

The largest source of these predicted savings is reduced hospitalizations for long-stay residents. This reflects both the strong relationship between RN staffing levels and long-stay hospitalizations described above and the greater volume of long-stay residents.

Discussion

A minimum RN staffing requirement is predicted to produce savings for the Medicare program through reduced rates of hospitalization and ED visits and increased community discharges. This reduction is driven by the relationship between higher RN staffing levels and lower rates of hospitalizations and ED visits and higher rates of community discharge.

While these savings to Medicare are modest (compared with the costs to nursing homes associated with minimum nurse staffing requirements), it is important to note that these savings are only one of the benefits potentially associated with higher staffing. For example, the QM score that the study used in analyses of relationships of staffing with quality and safety (**Section 4.1**) includes the claims-based measures along with several MDS-based measures (short-stay functional improvement, long-stay ADL decline, long-stay antipsychotic medication use, long-stay mobility decline, long-stay high-risk pressure ulcers). It is more difficult to place a dollar value on the benefits of better performance on these measures. Other benefits of higher staffing levels could include reduced rates of delayed and omitted care (**Section 4.2**) and benefits related to quality of life for both residents and staff that were identified as part of the site visit interviews (**Section 3.1**).

Because it was not possible for the Staffing Study to use an experimental or quasi-experimental design, it is not possible to establish a causal relationship between RN staffing levels and rates of hospitalizations and ED visits or community discharges. It could be that the associations between RN staffing and measures of quality and resident safety identified in the study are because of other factors than staffing levels and the mix of staff types.

5. Discussion

The Nursing Home Staffing Study was conducted as part of CMS's multi-faceted approach to identify a minimum staffing requirement. The Staffing Study's goal is to identify the level and type of staffing needed to promote acceptable quality and safety, so that residents are not at substantially increased risk of not receiving safe and quality care. The study also explores potential implications for feasibility of increased staffing and costs to nursing homes, to inform CMS selection of a minimum requirement.

5.1 Evidence Summary

Staffing Study activities were designed to complement one another and build on existing literature to inform development of a minimum staffing requirement. The following sections summarize and synthesize key findings from the Staffing Study. The discussion begins with a description of the current nurse staffing and policy landscape in the United States. The next two sections summarize anticipated benefits of a potential minimum staffing requirement, first in terms of associated improvements in available quantitative quality and safety metrics, and then through a consideration of other potential benefits not readily quantified via existing measures. The next section turns to feasibility, including a discussion of barriers and challenges identified by nursing home leadership and staff via qualitative interviews, coupled with quantitative evidence on observed effects of a recently implemented state-level minimum staffing requirement on staffing levels in Massachusetts. Next, the section discusses costs to nursing homes associated with staffing increases that would be required under a minimum staffing requirement. Finally, the section concludes with a discussion of other considerations for CMS when establishing a minimum staffing requirement.

5.1.1 Current Nurse Staffing, Requirements, and Roles

Nurse staffing levels vary considerably across nursing homes, with 10 percent having fewer than 2.79 nursing hours per resident day (HPRD) and 10 percent with more than 4.88 HPRD. Staffing levels also vary by nursing home characteristics, such as size, geographic location, and profit status. Fewer than half of registered nurses (RNs) and licensed practical/vocational nurses (LPNs) interviewed as part of the Staffing Study's qualitative site visits stated that their typical assignment was reasonable to provide high-quality, safe care to assigned residents. Slightly more than half of nurse aide respondents agreed their typical assignment was reasonable. Most nurse staff respondents reported working short staffed multiple times a week.

As noted in the literature review, federal nursing home requirements do not currently specify the types of staff that must be employed or staffing levels required per resident, although they do require an RN on site eight hours each day and for licensed and other nurse staff to be available 24 hours a day. However, the literature suggests that these existing federal regulations are not always met (Office of the Inspector General, 2020). Thirty-eight states and the District of Columbia have a minimum nursing home staffing standard; these vary greatly in their requirements (Medicaid and CHIP Payment and Access Commission, 2022a, 2022b; Consumer Voice, 2021). Some stakeholders in the first listening session noted that current state staffing standards are not adequate, and there was consensus that a minimum requirement should be the same across the country. None of the studies reviewed as part of the literature review presented a specific evidence-based minimum staffing level.

Both the literature review and interviews with nurse staff highlighted the different roles and responsibilities of specific nurse staff types in nursing homes. RNs are more likely to be assigned administrative or supervisory roles (Bonner et al., 2022; Bakerjian et al., 2021) and play key roles in resident assessments and care planning (California Association of Long Term Care Medicine, n.d.). The role of nurse aides is typically to assist residents with activities of daily living (ADLs). Nurse aides spend the most time with residents (Bonner et al., 2022; Firnhaber et al., 2020). Nurse staff respondents described their respective roles. Licensed nurse (RN, LPN) responsibilities included medication passes

and wound and other clinical care; nurse aides provided ADL and other support directly to residents. Nurse staff frequently described collaborating with one another, but they emphasized the importance of separate staffing requirements for each type of direct care staff. They noted that nurse aides and licensed nurses constitute "two different worlds" given their unique sets of responsibilities.

5.1.2 Relationship of Staffing with Quality and Safety

The existing literature confirms a strong relationship between staffing levels and nursing home quality and safety across a variety of metrics. Specifically, studies found that higher staffing levels are associated with better resident care outcomes such as reductions in pressure ulcers, emergency department visits, rehospitalizations, and COVID-19 outbreaks (Clemens et al., 2021; Min & Hong, 2019; Wagner et al., 2021; Figueroa et al., 2020; Gorges & Konetzka, 2020; Snyder et al., 2021; Li et al., 2020; Gray-Miceli et al., 2021; Kingsley & Harrington, 2022); benefits to vulnerable sub-populations (e.g., residents with dementia or Alzheimer's disease); and specific quality outcomes, such as antipsychotic use (Orth et al., 2021; Rosenthal et al., 2022; Harris et al., 2020; Yuan et al., 2019).

The Staffing Study's multivariate models echoed these prior findings, showing that quality and safety—as measured using claims, resident assessments, and health inspection data—increase with staffing levels, with no obvious plateau at which quality and safety are maximized. The relationship of staffing with quality and safety varies by staff type. Quality and safety consistently increase with RN staffing levels, but only at the highest levels of nurse aide staffing. There is no consistent relationship of quality and safety with LPN staffing. The study examined two definitions of minimally acceptable care, set at the current 25th or 50th performance percentile for a subset of quality and safety measures. Based on observed associations from study models, after adjusting for nursing home characteristics, the predicted percentage of nursing homes exceeding these thresholds would increase between 1 percentage point and 8 percentage points across four potential minimum staffing requirement options ranging from low (below the current median) to high total nurse staffing, depending on the requirement structure.

Predicted improvements in selected care quality metrics can be quantified in terms of associated reductions in Medicare spending. The study team examined the minimum quantifiable savings to Medicare associated with avoided hospitalizations and emergency department visits and increased community discharge at higher staffing levels for a range of minimum staffing requirement options. Estimated savings range from $187 to $465 million per year, resulting from as many as 26,000 fewer annual hospital and emergency department visits and 12,000 more annual community discharges. In addition to reducing Medicare program costs, these utilization changes could also reflect improved care quality and could enhance resident experience. There are many additional potential benefits that cannot be easily costed out because of data and time limitations, including those related to other clinical outcomes, out-of-pocket savings for residents, and improved resident quality of life.

The qualitative site visit data also highlighted the relationship between staffing levels and care quality and safety. Nursing home staff, residents, and family members reported that quality of life, quality of care, and resident safety are adversely affected when nursing homes are short staffed. Personal hygiene, especially bathing, and mealtimes are often affected. Direct care staff reported full staffing increased efficiency, resident satisfaction, and person-centered care.

Survey data collected during the site visits found that missed care, for tasks such as timely medications, vital signs, wound care, and toileting assistance, is most common when staffing is reported to be adequate only 25 percent of the time. Simulation modeling results based on observation of licensed nurses reinforce the survey findings, showing that the percentage of clinical care either delayed or omitted decreases with greater licensed nurse staffing levels, falling below 10 percent at approximately 1.0 HPRD and approaching 0 percent at approximately 1.4 HPRD. Delays in timely completion of these tasks can compromise quality of care. Chronic delays and/or omission of critical clinical care tasks ultimately can compromise resident safety. In combination with previous findings from the literature (see Schnelle et al.,

2016), simulation results imply that a total nurse (RN, LPN, nurse aide) staffing level between 3.8 HPRD and 4.6 HPRD would be adequate to keep rates of both omitted ADL care and omitted clinical care below 10 percent.

Analysis of a 2020 Massachusetts minimum staffing requirement associated with a Medicaid payment penalty found that while the requirement increased nurse aide and total staffing levels in affected nursing homes, quality did not improve. This is consistent with results from two earlier studies that did not find increases in care quality associated with state-level minimum staffing requirements for nurse aides specifically (Chen & Grabowski, 2014; Lin, 2014). However, both the Staffing Study analysis of the Massachusetts requirement and these earlier studies focused specifically on clinical care measures, including quality measures based on the Minimum Data Set and Medicare claims. Particularly given the important role nurse aides play in providing ADL care and in face-to-face interactions with nursing home residents, it is possible that residents experienced improved care quality and quality of life in dimensions not captured by the limited available quantitative measures.

5.1.3 Other Benefits of a Minimum Staffing Requirement

Staffing Study interviews with nursing home staff, residents, and families indicated perceived improvements in resident-centered care and resident quality of life associated with higher staffing levels, beyond the clinical care metrics used in the Staffing Study quantitative analyses. Particularly for staff types besides RNs, these measures may not fully capture the benefits of increased staffing.

The Staffing Study additionally identified other potential benefits to a minimum staffing requirement beyond those for residents alone. Staff interview respondents noted that being fully staffed increased their ability to communicate and connect more with residents, which was an essential aspect of job satisfaction. Conversely, the overwhelming majority of nurse staff respondents reported physical, emotional, and mental burnout from working short staffed, as well as lasting impacts on their well-being. This implies that increased nursing home staffing under a minimum staffing requirement would benefit nursing home staff as well as residents and their families.

5.1.4 Feasibility of a Minimum Staffing Requirement

Potential gains in quality and safety from introduction of a new federal minimum staffing requirement depend on whether such a requirement can successfully encourage nursing homes to increase nurse staffing hours, particularly given workforce constraints and other potential barriers to implementation. Quantitative analyses found that between 42 and 90 percent of nursing homes would need to increase staffing under a federal minimum staffing requirement, depending on the requirement level and design.

The state-level minimum staffing requirement introduced in Massachusetts in 2020 penalized its nursing homes with total nurse staffing below 3.58 HPRD with a 2 percent reduction in their quarterly Medicaid payments. This requirement increased staffing levels among low-staffed nursing homes with a high Medicaid resident share, with the effect most pronounced for nurse aides. That is, a new state requirement, coupled with a financial penalty, successfully increased nursing home staffing levels. This finding is encouraging evidence from a feasibility perspective for implementation of a federal minimum staffing requirement, particularly given increased staffing challenges since the advent of the COVID-19 public health emergency (Gasdaska et al., 2022; AHCA/NCAL, 2022).

Findings from the qualitative components of the Staffing Study identified several additional feasibility considerations. Interview respondents described their difficulty keeping nursing homes adequately staffed currently and the day-to-day challenges of recruiting health care workers to long-term care that have contributed to staffing shortages. They described challenges to filling open positions, and high staff turnover, as well as the impact of COVID-19 on staffing and morale. The site visit findings additionally suggest that a minimum staffing requirement should consider nurse staff pay as well as the local area labor pool. Listening session participants shared concerns about the feasibility of increasing staffing given

workforce and cost considerations. They additionally commented that low Medicaid reimbursement levels and staff burnout/workforce shortages would present challenges for implementing a federal minimum staffing requirement.

5.1.5 Costs of a Minimum Staffing Requirement

Staffing costs are an additional consideration for the feasibility of a federal minimum requirement. Nursing home leadership respondents interviewed during the site visits voiced cost concerns as a potential challenge to implementation, citing the higher costs of using agency staffing to fill vacancies among other factors.

The Staffing Study estimated the total annual costs of additional staffing at $1.5 to $5.3 billion per year to meet a minimum staffing requirement for total RN hours, total licensed nurse hours, and total nurse staff hours for four options ranging from low (below the current median) to high total nurse staffing. Costs of a requirement that included minimum staffing levels for all four nurse staff types (RN, LPN, nurse aide, and total nurse staff) range from $2.9 to $6.8 billion per year, while costs for a requirement only including RNs and nurse aides range from $2.2 to $6.0 billion annually. Annual increased salary costs to comply among nursing homes needing to increase staffing range from a low of $316,000 per nursing home to a high of more than $693,000 per nursing home.

The literature review also found substantial costs for implementing a new requirement, but at a higher total nurse staffing level than examined in the Staffing Study. One report suggested that a 4.1 HPRD requirement, inclusive of RNs, LPNs, and nurse aides, would cost the long-term care industry more than $10 billion annually (CLA, 2022). Another report estimated the additional staffing costs of a 4.1 HPRD threshold, also inclusive of RNs, LPNs, and nurse aides, at $7.25 billion (Hawk et al., 2022). The Staffing Study found similar results when using the same staffing levels and assumptions as these reports.

5.1.6 Other Considerations

Staffing Study findings identified a few other considerations for establishing a federal minimum requirement. Some site visit respondents reported concerns about a potential minimum staffing requirement being set too low, fearing that some nursing homes would reduce staffing or that the minimum will become the maximum. Staffing study quantitative analysis assumed that nursing homes already above a minimum requirement would not decrease staffing, but this might not be the case in practice. Conversely, some respondents noted a potential for "overstaffing" if requirements were set too high.

Other respondents raised the potential for nursing home closures, reduced admissions, and a pivot towards lower-acuity admissions following implementation of a federal minimum staffing requirement. Finally, many respondents were concerned about using a "one-size-fits-all" approach for a federal staffing requirement. Both interview respondents and listening session participants cited resident acuity and staff competence as factors to consider in setting a minimum staffing requirement.

5.2 Minimum Staffing Requirement Options

Exhibit 5.1 presents four options—*Low, Medium, Higher, Highest*—based on collective Staffing Study findings, for CMS consideration as minimum staffing requirements to help ensure nursing home residents experience acceptable levels of care quality and safety.

Exhibit 5.1: Cost, Quality, and Safety Implications of Four Minimum Nurse Staffing Requirement Options

Minimum Staffing Requirement Scenario	Metrics						
	% NHs Needing to Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]	Minimum Projected Quantifiable Medicare Savings[6]	Predicted Delayed/ Omitted Care[7]	
Four Minimum Staffing Hours per Resident Day (HPRD) Requirement Threshold Options							**Contextual Evidence**
Low: • 3.30 total nurse staff HPRD[8] • 1.15 licensed nurse HPRD,[9] including at least 0.45 RN HPRD	43%	$1.5 billion/ year	Above lowest quartile: 76% Above median: 50%	Above lowest quartile: 77% Above median: 51%	$187 million/year from ~5,800 fewer hospitalizations ~4,500 fewer ED visits ~4,000 more community discharges	3.3% delayed care 0.04% omitted care	• Past literature has established strong evidence for a relationship between staffing and quality but has not identified a minimum staffing level to ensure safe and quality care. • Nurse staff types play different roles within nursing homes and so can influence different dimensions of quality and safety. • Analysis of a minimum total staffing requirement that Massachusetts introduced in 2020 found that staffing levels increased, driven by an increase in nurse aides. However, the impact on quality and safety was not significant. • Nursing home staff, residents, and family members reported many benefits to increased staffing, including better resident clinical and ADL care, improved resident quality of life, and decreased physical and mental burden on staff. • Not all Medicare savings can be readily quantified, including those related to better clinical care and improved quality of life. • Nursing staff reported they could provide more person-centered care when they supported fewer residents. • Resident personal hygiene including showers, meals, and timely response to call lights are adversely affected by low staffing. • Nursing homes face many barriers to hiring, primarily workforce shortages and competition from staffing agencies. • Stakeholders recommended CMS consider resident acuity when setting requirements; they also noted the importance of adequate training, and workforce and reimbursement barriers to meeting a requirement.
Medium: • 3.48 total nurse staff HPRD[8] • 1.23 licensed nurse HPRD,[9] including at least 0.52 RN HPRD	55%	$2.4 billion/ year	Above lowest quartile: 76% Above median: 49%	Above lowest quartile: 76% Above median: 51%	$318 million/year from ~10,400 fewer hospitalizations ~7,500 fewer ED visits ~5,800 more community discharges	2.3% delayed care 0.02% omitted care	
Higher: • 3.67 total nurse staff HPRD[8] • 1.32 licensed nurse HPRD,[9] including at least 0.60 RN HPRD	66%	$3.6 billion/ year	Above lowest quartile: 80% Above median: 54%	Above lowest quartile: 77% Above median: 53%	$410 million/year from ~11,000 fewer hospitalizations ~13,800 fewer ED visits ~10,000 more community discharges	1.4% delayed care 0.01% omitted care	
Highest: • 3.88 total nurse staff HPRD[8] • 1.43 licensed nurse HPRD,[9] including at least 0.70 RN HPRD	76%	$5.3 billion/ year	Above lowest quartile: 80% Above median: 56%	Above lowest quartile: 78% Above median: 53%	$465 million/year from ~12,100 fewer hospitalizations ~14,800 fewer ED visits ~12,000 more community discharges	0.6% delayed care 0.002% omitted care	

Minimum Staffing Requirement Scenario	Metrics						
	% NHs Needing to Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]	Minimum Projected Quantifiable Medicare Savings[6]	Predicted Delayed/ Omitted Care[7]	
Status Quo							**Current State**
No federal minimum staffing requirement[10]	0%	$0	Above lowest quartile:[11] 74% Above median:[11] 49%	Above lowest quartile: 75% Above median: 50%	$0	5.6% delayed care 0.4% omitted care	• There was support for a minimum staffing requirement in qualitative interviews and stakeholder listening sessions. • Nursing home staff, residents, and family members reported quality and safety risks when nursing homes are understaffed. • Nursing homes are experiencing challenges to filling existing staffing vacancies. • 38 states already have some type of minimum staffing requirement.

Abbreviations: ADL = activities of daily living, CMS = Centers for Medicare & Medicaid Services, ED = emergency department, HPRD = hours per 24-hour resident day, LPN = licensed practical nurse/licensed vocational nurse, NH = nursing home, QM = quality measure, RN = registered nurse

Notes:

[1] Calculated as the percentage of nursing homes below specified staffing levels in the second quarter of 2021 as reported on the October 2021 Nursing Home Care Compare update.

[2] Staffing costs include estimated wage and benefit costs for increasing staffing to the required levels and assume nursing homes currently above required staffing levels will not change staffing.

[3] Percentages indicate adjusted percentage of nursing homes above the current lowest quartile and median thresholds based on predicted probabilities from logistic regression models with nurse staffing deciles as the key predictors. Models are adjusted for measures of facility characteristics including ownership type (non-profit, government, or for-profit); size (number of certified beds); whether the nursing home is hospital-based; Medicaid quartile; whether the nursing home is in a rural location; whether the nursing home is part of a continuing care retirement community; and for nursing home quality outcomes, whether the nursing home is a Special Focus Facility or a Special Focus Facility candidate.

[4] Quality measure median and lowest quartile thresholds are based on total QM scores (50th and 25th percentiles) from the October 2022 Nursing Home Care Compare update.

[5] Safety median and lowest quartile thresholds are based on within-state health inspection scores (50th and 25th percentiles) from the October 2022 Nursing Home Care Compare update.

[6] Savings include estimated cost savings to Medicare from prevented hospitalizations and emergency department visits and increased community discharges, and are based on savings from the RN staffing requirement for the decile just above the RN requirement threshold.

[7] Predicted percentages are the percentage of resident care events that are delayed or omitted based on interpolated values from simulations of licensed nurses (RNs, LPNs) in an average-sized facility providing core clinical tasks to a resident population with acuity mix similar to the national median in the Minimum Data Set. Care is considered delayed if it occurs within 2 hours of need and omitted if it occurs more than 2 hours from the need.

[8] Total minimum staffing requirement includes combined HPRD for RNs, LPNs, and nurse aides.

[9] Licensed nurse minimum staffing requirement includes combined HPRD for RNs and LPNs.

[10] Median staffing levels in U.S. nursing homes based on CMS Payroll Based Journal system (2022Q2) data are currently 3.61 total nurse staff HPRD, 1.45 licensed nurse HPRD, and 0.56 RN HPRD.

[11] Estimated percentages of nursing homes above lowest quartile and median under the status quo scenario (no federal minimum staffing requirement) deviate from expected values of 75% and 50% because of inclusion of predicted values for nursing homes with complete data on covariates but missing values for the outcome measure (total QM score or within-state health inspection score).

Minimum staffing requirement options are expressed in terms of HPRD for RNs, licensed nurses (RNs, LPNs), and total nurse staff (RNs, LPNs, nurse aides). The options were informed by Staffing Study findings including a set of regression models that examined relationships between staffing deciles and nursing home quality and safety. Instead of continuous or more-granular staffing levels, the study used staffing deciles in these models to ensure adequate sample size in each staffing category and to facilitate interpretation.

Collectively, the Staffing Study findings support a minimum staffing requirement for RNs. Multivariate analyses indicated a strong positive correlation of RN staffing with quality and safety metrics, and earlier studies (Chen and Grabowski, 2014; Lin, 2014) have demonstrated improvements in quality and safety associated with implementation of minimum staffing requirements for RNs at the state level. RN staffing requirement thresholds considered range from the 4th decile threshold (0.45 RN HPRD; *Low*) up to the 7th decile threshold (0.70 RN HPRD; *Highest*).

In contrast to findings for RNs, multivariate analyses did not demonstrate a significant positive relationship of LPN staffing with quality and safety metrics. However, the simulation findings imply nursing homes need to maintain licensed nurse staffing levels above 1.0 licensed nurse HPRD to avoid unacceptable levels of delayed or omitted care, suggesting an RN requirement alone may not be sufficient. A total licensed nurse staffing threshold, as opposed to a separate LPN staffing threshold, would support adequate levels of licensed nurse staffing for timely completion of key clinical care tasks while allowing nursing homes flexibility to substitute RNs for LPNs.

A total nurse staffing requirement would support adequate overall staffing levels to meet clinical and activities of daily living (ADL) tasks while allowing nursing homes discretion in determining the staffing mix most appropriate for their population. Staffing Study findings suggest nurse aide staffing is associated with higher predicted quality and safety metrics only for the highest staffing deciles. However, the literature review and qualitative findings from site visits and stakeholder listening sessions emphasize the important role nurse aides play in improving resident quality of life, an aspect of quality that may not be captured by the quality and safety metrics considered in the quantitative analyses. Prior simulation evidence (Schnelle et al., 2016) corroborates the need for adequate nurse aide staffing to ensure timely completion of ADL care. Taken together, these findings support a requirement allowing nurse aide staffing to contribute towards a total nurse staffing requirement along with RN and LPN staffing.

For each minimum staffing requirement option, **Exhibit 5.1** presents associated implications in feasibility, cost, and potential improvements in quality and safety based on Staffing Study findings. The options presented are specific HRPD levels based on the decile start point, rather than the full decile ranges that were used in the regression models, to show the *minimum* staffing levels associated with potential quality and safety improvements. As a point of comparison, the exhibit also includes metrics associated with the *status quo* (no federal minimum staffing requirement). Staffing Study findings imply that anticipated benefits of a minimum staffing requirement threshold lower than the options presented in **Exhibit 5.1** would be minimal.

As shown in **Exhibit 5.1**, as minimum required nursing staff HPRD increase, there is a corresponding increase in potential quality and safety improvements, and a decrease in expected delayed and omitted care. Projected savings also increase with higher nursing staff HPRD, as do additional staffing costs. For example, moving from the *Low* (3.30 total nursing staff HPRD) to *Highest* (3.88 nursing staff HPRD) nursing staff HPRD is associated with a 6-percentage point increase in the percent of nursing homes predicted to exceed median quality levels. With an increase in licensed nurse (RN and LPN) staffing from 1.15 to 1.43 HPRD, omitted and delayed care is predicted to drop from over 3 percent to less than 1 percent. Moving from the *Low* to *Highest* minimum staffing requirement option, there is an increase of at least $278 million in projected Medicare savings, and an estimated $3.8 billion increase in staffing costs.

The Study Team also examined the cost, quality, and safety implications of minimum staffing requirements at equivalent staffing levels as for requirements presented in **Exhibit 5.1**, but not allowing substitution across staff types. Specifically, the Study Team considered separate requirements including RNs and nurse aides only (two-requirement structure), as well as separate requirements for RNs, LPNs, nurse aides, and total nursing staff (four-requirement structure). **Exhibit 5.2** shows predicted quality and safety and the estimated additional staffing costs for these two alternative staffing requirement structures.

Predicted quality and safety for these two alternatives is slightly higher than for the three-requirement structure described in **Exhibit 5.1** above. However, predicted quality and safety are similar across the two- and four-requirement structures, since LPN staffing levels were not statistically associated with the probability of exceeding minimum quality and safety thresholds in Staffing Study multivariate models.

The cost of the four-requirement structure is higher than for the two-requirement structure, since more nursing homes would need to add staff to comply. Under the two-requirement structure the implied total nurse staffing required level would be low (e.g., 2.77 HPRD for the *Medium* option, which is below the 3rd decile of total nurse staffing) if nursing homes only staffed to the specified minimums.

Exhibit 5.2: Cost, Quality, and Safety Implications: Two- vs. Four-Nurse Staffing Requirement Structures

	Two Requirements (RNs, Nurse Aides)					Four Requirements (Total Nurse Staff, RNs, LPNs, Nurse Aides)				
Option	Minimum Staffing Requirement (HPRD)	% NHs Needing to Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]	Minimum Staffing Requirement (HPRD)	% NHs Needing to Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]
Low	• 0.45 RN • 2.15 nurse aide	59%	$2.2 billion/year	Above lowest quartile: 78% Above median: 52%	Above lowest quartile: 77% Above median: 52%	• 3.30 total nurse staff • 0.45 RN • 0.70 LPN[6] • 2.15 nurse aide	73%	$2.9 billion/ year	Above lowest quartile: 78% Above median: 52%	Above lowest quartile: 77% Above median: 52%
Medium	• 0.52 RN • 2.25 nurse aide	68%	$3.1 billion/year	Above lowest quartile: 78% Above median: 52%	Above lowest quartile: 77% Above median: 52%	• 3.48 total nurse staff • 0.52 RN • 0.71 LPN[6] • 2.25 nurse aide	80%	$3.9 billion/ year	Above lowest quartile: 79% Above median: 52%	Above lowest quartile: 78% Above median: 52%
Higher	• 0.60 RN • 2.35 nurse aide	75%	$4.3 billion/year	Above lowest quartile: 79% Above median: 56%	Above lowest quartile: 79% Above median: 54%	• 3.67 total nurse staff • 0.60 RN • 0.72 LPN[6] • 2.35 nurse aide	85%	$5.1 billion/ year	Above lowest quartile: 80% Above median: 56%	Above lowest quartile: 79% Above median: 54%

Option	Two Requirements (RNs, Nurse Aides)					Four Requirements (Total Nurse Staff, RNs, LPNs, Nurse Aides)				
	Minimum Staffing Requirement (HPRD)	% NHs Needing to Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]	Minimum Staffing Requirement (HPRD)	% NHs Needing to Add Staff[1]	Additional Staffing Costs[2]	Predicted NH Quality[3,4]	Predicted NH Safety[3,5]
Highest	• 0.70 RN • 2.45 nurse aide	82%	$6.0 billion/year	Above lowest quartile: 81% Above median: 57%	Above lowest quartile: 77% Above median: 53%	• 3.88 total nurse staff • 0.70 RN • 0.73 LPN[6] • 2.45 nurse aide	90%	$6.8 billion/ year	Above lowest quartile: 82% Above median: 57%	Above lowest quartile: 78% Above median: 53%

Abbreviations: HPRD = hours per 24-hour resident day, LPN = licensed practical nurse/licensed vocational nurse, NH = nursing home, QM = quality measure, RN = registered nurse

[1]Calculated as the percentage of nursing homes below specified staffing levels in the second quarter of 2021 as reported on the October 2021 Nursing Home Care Compare update.

[2] Staffing costs include estimated wage and benefit costs for increasing staffing to the required levels and assume nursing homes currently above required staffing levels will not change staffing.

[3] Percentages indicate adjusted percentage of nursing homes above the current lowest quartile and median thresholds based on predicted probabilities from logistic regression models with nurse staffing deciles as the key predictors. Models are adjusted for measures of facility characteristics including ownership type (non-profit, government, or for-profit); size (number of certified beds); whether the nursing home is hospital-based; Medicaid quartile; whether the nursing home is in a rural location; whether the nursing home is part of a continuing care retirement community; and, for nursing home quality outcomes, whether the nursing home is a Special Focus Facility or a Special Focus Facility candidate.

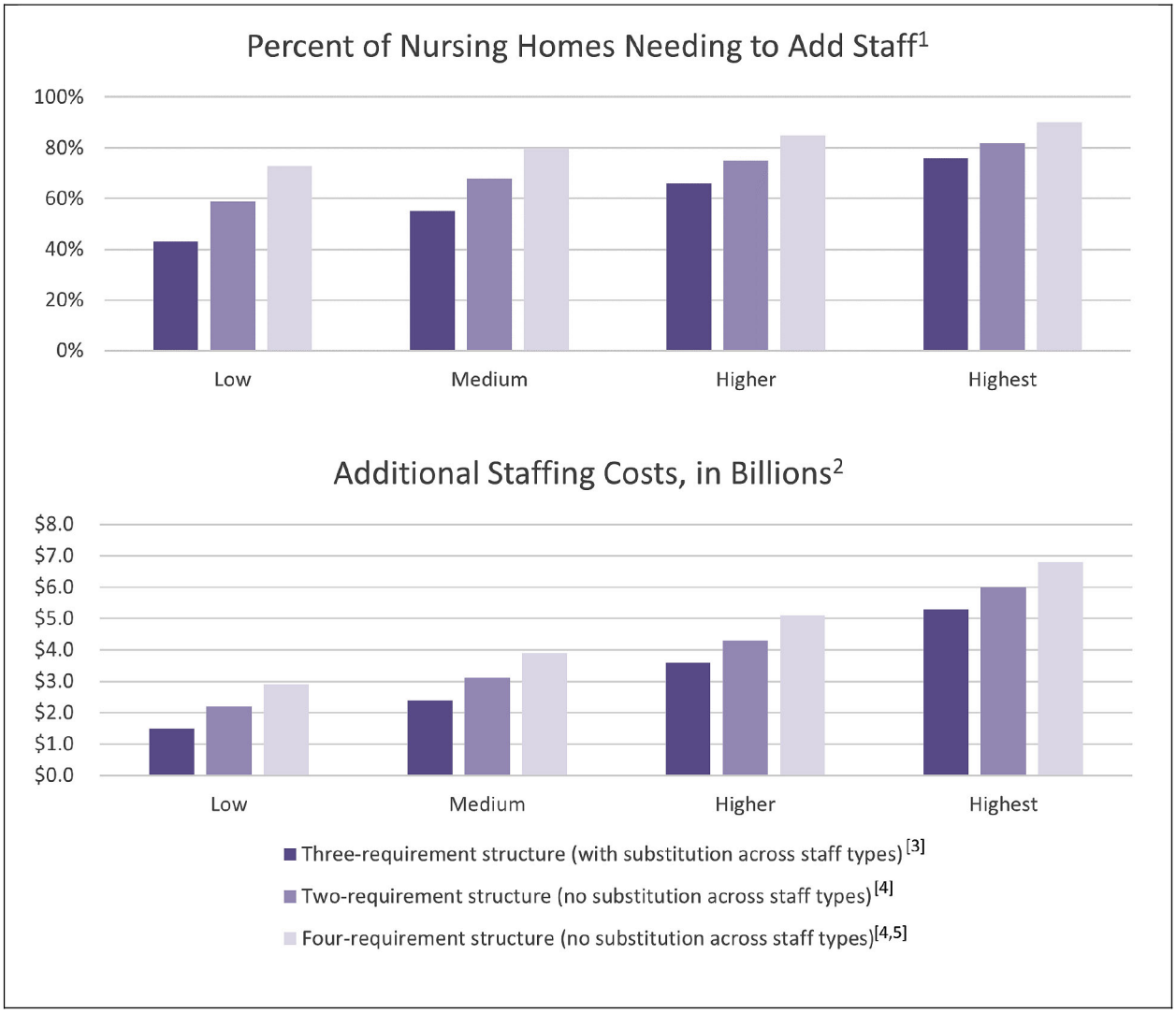
[4] Quality measure median and lowest quartile thresholds are based on total QM scores (50th and 25th percentiles) from the October 2022 Nursing Home Care Compare update.

[5] Safety median and lowest quartile thresholds are based on within-state health inspection scores (50th and 25th percentiles) from the October 2022 Nursing Home Care Compare update.

[6] Analyses found no significant relationship between LPN staffing levels and the probability of exceeding quality and safety thresholds after adjusting for RN and nurse aide staffing deciles.

Exhibit 5.3 compares the estimated costs to nursing homes, and the percentage of nursing homes that would need to increase staffing between a three-requirement structure allowing substitution across staff types (total nurse staff, RNs, licensed nurses) and the two structures with identical RN and nurse aide HPRD requirements but not allowing substitution across staff types: a two-requirement structure (RNs and nurse aides only) and a four-requirement structure (total nurse staff, RNs, LPNs, nurse aides).

Exhibit 5.3: Estimated Percentage of Nursing Homes Needing To Add Staff and Estimated Additional Staffing Costs per Year to Meet Minimum Staffing Requirements



[1] Calculated as the percentage of nursing homes below specified staffing levels in the second quarter of 2021 as reported on the October 2021 Nursing Home Care Compare update.
[2] Staffing costs include estimated wage and benefit costs for increasing staffing to the required levels and assume nursing homes currently above required staffing levels will not change staffing.
[3] Under three-requirement structure, nursing homes may substitute across RNs, LPNs, and nurse aides to meet aggregate requirements for licensed nursing and total nurse staffing.
[4] Nurse aide staffing levels under the two and four-requirement structures are derived from the difference between the total nurse and licensed nurse minimums under the three-requirement structure (e.g., 3.30 – 1.15 for the *Low* option).
[5] LPN staffing levels under the four-requirement structure are derived from the difference between the licensed nurse and RN HPRD minimums under the three-requirement structure (e.g., 1.15 – 0.45 for the *Low* option).

Costs are higher under requirement structures not allowing substitution across staff types as compared to structures allowing substitution because more nursing homes would need to increase staffing to meet separate requirements. By design, implicit licensed and total nurse staffing thresholds are the same under the under the three- and four-requirement structures, but costs differ. For example, a nursing home with 3.30 total nurse HPRD including 0.65 RN HPRD, 0.60 LPN HPRD, and 2.05 nurse aide HPRD would be compliant with the *Low* three-requirement structure, but would need to increase nurse aide staffing to meet the *Low* two-requirement structure, and would need to increase both LPN and nurse aide staffing to meet the *Low* four-requirement structure. Unless this nursing home concurrently reduced RN staffing levels, the needed increase in LPN and nurse aide staffing to meet the four-requirement structure would cause the nursing home to exceed total nurse staffing minimum requirements of 3.30 HPRD.

5.3 Conclusions

Collectively, the Staffing Study provides evidence on both potential minimum staffing requirement benefits and potential barriers to and unintended consequences of implementation. It also offers considerations to CMS on the structure and level of a minimum requirement.

Both qualitative and quantitative findings from the Staffing Study indicated potential quality and safety benefits associated with increased nurse staffing. Nearly half of nurse staff interview respondents reported their current assignment was not reasonable to provide quality and safe care now. Multivariate models indicate higher staffing is associated with a higher probability of meeting acceptable quality and safety thresholds. Predicted quality improvements would generate Medicare savings through reduced hospitalizations and emergency department visits and increased community discharges. Staffing Study simulation models indicate higher nurse staffing is associated with substantial reductions in delayed and omitted clinical care, complementing existing simulation evidence indicating that higher nurse aide staffing is associated with reductions in delayed and omitted ADL care (Schnelle at al., 2016).

The Staffing Study team acknowledges that *quality* is a multi-dimensional construct; what is considered "high quality" can vary across observers and care recipients. The Staffing Study's quantitative analyses were limited to quality metrics for which there are extant secondary data or where it was possible to collect primary data within the brief study time period via direct observation. Staffing Study interviews with nursing home staff, residents, and families indicated perceived improvements in resident-centered care and resident quality of life associated with higher staffing levels, capturing dimensions of quality beyond what can be measured using existing quantitative data. Nurse staff could also benefit from increased staffing levels, as many staff interview respondents noted the adverse impact of short staffing on their physical and mental well-being. However, there are likely additional benefits to quality of care and life that cannot be fully identified through Staffing Study activities.

The different roles filled by staff can inform the design of a minimum requirement. Simulation findings in conjunction with analyses on the relationship of staffing with quality and safety suggest that a minimum staffing requirement should include a licensed nurse staffing requirement. While the regression model results suggest that RN staffing among staff types has the strongest relationship with care quality and safety metrics, simulations imply licensed nurse staffing needs exceed current RN staffing even among many higher-staffed nursing homes. Similarly, nurse aides provide more-direct support to residents, and respondents reported this ADL support is often delayed or missed when staffing is short.

Staffing Study findings additionally informed questions of feasibility and potential barriers to implementation. Ultimately, any realized improvements in quality and safety will depend on nursing home success in increasing staffing levels to comply with minimum staffing requirements. Analysis of a recent minimum staffing requirement in Massachusetts indicates that a new requirement, coupled with a financial penalty, can successfully increase staffing levels at the state level. Nonetheless, stakeholders participating in listening sessions and nursing home staff interviewees emphasized that workforce shortages and current hiring challenges could present barriers to nursing home compliance with a new

federal staffing requirement. Across potential minimum staffing requirements considered, between 43 and 90 percent of nursing homes would need to increase staffing relative to current levels. Interview respondents reported concerns that nursing homes may not be able to achieve required staffing levels, may reduce admissions to meet requirements, or may close entirely, thus potentially reducing access to care. However, the Staffing Study was not a workforce study and so does not comprehensively address the feasibility of implementing a minimum staffing requirement. The study also did not examine economic impacts of a staffing minimum beyond additional staffing costs; these could include higher nursing staff wages to reflect greater demand, lower profit margins, or competition against other long-term care options, among other impacts.

Additional staffing costs, estimated in the billions, could be a parallel barrier to implementation. Increased nursing home staffing costs would represent approximately $1.5 billion to $5.3 billion for the four potential minimum staffing requirement options under a three-requirement structure (requirements for RN, licensed nurse, and total nurse staffing). The design of a potential federal minimum staffing requirement has important cost implications, with costs ranging from $2.9 billion to $6.8 billion under a four-requirement structure (separate requirements for RN, LPN, nurse aide, and total nurse staffing) for the same implicit minimum staffing requirement levels. Under a minimum staffing requirement for RNs and nurse aides only, total estimated costs range from $2.2 to $6.0 billion annually.

The Staffing Study findings provide CMS options for setting a minimum staffing requirement and illustrate the trade-offs of these policy options, balancing cost and feasibility with implications for quality and safety. Some of the benefits of increased staffing are hard to quantify, such as improved resident quality of life or decreased staff burnout. Setting a lower requirement would likely achieve smaller gains in the quality and safety of resident care but would require fewer nursing homes to increase staffing levels. Conversely, a higher requirement would be associated with larger potential gains in quality and safety and a greater reduction in direct care staff burden if successfully implemented, but would be more costly and challenging to implement, particularly in the face of nursing workforce shortages. Ultimately, the realized improvements in quality and safety will depend on nursing home success in increasing staffing levels to comply with minimum staffing requirements.

Glossary

Activities of daily living (ADLs): Activities related to personal care. They include bathing or showering, dressing, getting in and out of bed or a chair, walking, using the toilet, and eating.

Acuity: Refers to the intensity of services a resident requires. Higher acuity residents require a higher level of care.

Administrator: A staff person responsible for supervising the clinical and administrative affairs of nursing homes and related facilities.

Avoidable hospitalizations: A hospitalization for a condition that could have been prevented or been treated outside of an inpatient hospital setting.

Behavioral health: field of medicine concerns with a person's activities or habits and how they affect physical, mental, and social well-being.

Care needs/resident care needs: The services a resident should receive to maintain a reasonable quality of life.

Certified nurse assistant (CNA): A person who has completed a state-approved training and competency evaluation program, who is providing nursing or nursing-related services to residents. In this report, the term *nurse aide* is inclusive of CNAs unless otherwise stated.

Civil monetary penalties: Financial penalties imposed on a person or entity that presents fraudulent claims to a federal or state agency.

Clinical outcomes: Measurable changes in symptoms, overall health, ability to function, quality of life, or survival outcomes that result from giving care to patients.

Continuing Care Retirement Community: A organization that offers a full range of housing, residential services, and health care to older residents as their needs change over time.

COVID-19 public health emergency (PHE): A national declaration that provided certain flexibilities to Medicare providers and other government-funded services in response to the COVID-19 pandemic.

Delayed care: Resident care that was not provided in a timely manner.

Direct care staff: Nursing home staff who directly interact with residents while providing care.

Director of nursing: A nursing home staff member, typically a registered nurse, responsible for and supervising a nursing unit, who is ultimately responsible for the nursing care received by residents. In this report, the term *registered nurse* is inclusive of directors of nursing unless otherwise stated.

Discrete Event Simulation (DES): A way to model the operation of a system in which each event occurs at a particular time and marks a change in the system's state.

Emergency department visits: A medical visit for an acute medical condition where the resident or their caregiver needs immediate care from a hospital. The staffing study analyses considers only emergency department visits that did not result in an inpatient admission.

Fee-for-service: A payment method in which doctors and other health care providers are paid for each service performed. Examples of services include tests and office visits. *Fee-for-service Medicare* refers to Medicare that is administered directly by CMS, rather than through a private supplemental or Medicare Advantage plan.

Gray literature: Literature that is neither peer-reviewed nor indexed on library databases.

Health inspections: A CMS-led on-site recertification component in which a team of health care professionals visit a facility and assess whether the facility complies with federal requirements.

Hours per resident day (HPRD): The total number of hours in a 24-hour period divided by the total number of residents. HPRD most typically refers to nurse staff hours per resident day. For example, 26 nurses each working for eight hours in a day (26 * 8 = 208 hours) in a nursing home with 50 residents would result in approximately 4.2 HPRD (208 / 50 = 4.16).

Indirect care: Care that supports residents but does not involve directly interacting with them (e.g., staff supervision, activity planning, cleaning).

Licensed nurse: A person to whom a licensure board has granted permission to engage in nursing practices after determining they have the skills necessary for the given level of licensure. Licensure requirements are determined by states. In this report's analyses, licensed nurses include RNs and LPNs.

Licensed practical/vocational nurse (LPN or LVN): A person licensed to practice as a licensed practical or vocational nurse in the state where the facility is located. For this report's quantitative analyses, LPNs include directors of LPNs, and LPNs with administrative duties (i.e., other than direct care functions).

Long-term care: Services that include medical and non-medical care provided to people who are unable to perform basic activities of daily living such as dressing or bathing.

Medicaid: An insurance program that provides free or low-cost health coverage to some low-income individuals, families and children, pregnant women, older people, and people with disabilities.

Medicare Advantage: A type of Medicare health plan offered by a private company that contracts with Medicare to provide all Part A and Part B benefits.

Medicare: A federal health insurance program for people age 65 and older and certain younger people with disabilities. It also covers people with end-stage renal disease (permanent kidney failure requiring dialysis or a transplant).

Mixed methods: A research method that integrates complementary qualitative and quantitative research activities.

Non-nurse staff: Nursing home staff who are not nurse aides or licensed nurses. Examples include orderlies, activities directors, therapists, and social workers.

Nurse: A person formally educated and trained in the care of people who are sick or infirm. Includes licensed practical nurses, licensed vocational nurses, registered nurses, nurse practitioners, advanced practice registered nurses, and nurse aides.

Nurse aide: An unlicensed nurse who typically assists residents with activities of daily living. After being trained, nurse aides typically take a certification exam and are thereafter referred to as *certified nurse aides*. In this report's quantitative analyses, nurse aides include nurse aides in training and medication aides/technicians. In this report, the term *nurse aide* is inclusive of CNAs unless otherwise stated.

Nurses staffing level: The total amount of nurses working at the nursing home in a given period.

Nursing home characteristics: The specific attributes of a specific nursing home, such as any specialized care provided, the types of insurance its beneficiaries are likely to have, its geographical location, or the number of beds it has.

Omitted care: Resident care that was not provided at all.

Patient-centeredness: The degree to which care is guided and informed by resident goals, preferences, and values.

Payer mix: The different insurers paying for resident care in given facility; for example, a mix of Medicare, Medicaid, and private insurance.

Personal care: Non-skilled care, such as help with activities of daily living (e.g., bathing and dressing).

Registered nurse: A person licensed to practice as a registered nurse in the state where the nursing home is located. The term includes geriatric nurse practitioners and clinical nurse specialists who primarily perform nursing, not physician-delegated, tasks. In this report's quantitative analyses, the term *registered nurse* is inclusive of directors of nursing and nurses with administrative duties (i.e., other than direct care functions).

Resident and family council: Nursing home residents and their family members who engage in activities intended to enhance the quality of life, quality of care, and safety of the residents.

Resident characteristics: Attributes of nursing homes residents such as their age, race/ethnicity, insurer, and medical conditions.

Resident safety outcomes: The results of efforts intended to prevent patients' experience of adverse events, such as falling or acquiring an infectious disease.

Scoping review: A literature review intended to better understand the depth and breadth of existing literature associated with a given topic; often conducted within a short timeframe.

Social deprivation index: A composite measure based on seven demographic characteristics collected in the American Community Survey that are used to quantify the socio-economic variation in health outcomes.

Special Focus Facility: A nursing home with a persistent record of noncompliance and substandard quality of care, which, as a result, receives an on-site inspection of all Medicare health and safety requirements every six months until the nursing home either satisfactorily resolves its deficiencies or is terminated from Medicare and Medicaid.

Staff-to-resident ratio: The number of staff members a nursing home must have for each resident.

Stepwise: Progressing in a series of distinct stages.

Synthetic control: A statistical control group created from a weighted combination of different groups that, when combined, is similar to the intervention group.

Systematic review: A literature review that identifies, selects, and critically appraises existing research to answer a research question.

References

Abadie, A. (2021). Using synthetic controls: Feasibility, data requirements, and methodological aspects. *Journal of Economic Literature, 59*(2), 391–425.

Abt Associates. (2001). *Appropriateness of minimum nurse staffing ratios in nursing homes. Report to Congress. Phase II final. Volume 1.* Report prepared for the Centers for Medicare and Medicaid Services.

Abt Associates. (2018). *Nursing Home Compare claims-based quality measure technical specifications.* Report prepared for the Centers for Medicare & Medicaid Services. https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/Downloads/Nursing-Home-Compare-Claims-based-Measures-Technical-Specifications.pdf

Abt Associates. (2020). *Comparison of nursing facility acuity adjustment methods*. Report prepared for the Medicaid Payment and Access Commission. https://www.macpac.gov/wp-content/uploads/2020/11/Comparison-of-Nursing-Facility-Acuity-Adjustment-Methods.pdf

AHCA/NCAL (American Health Care Association / National Center for Assisted Living). (2022). *BLS March 2022 jobs report.* https://www.ahcancal.org/News-and-Communications/Fact-Sheets/FactSheets/BLS-MARCH2022-JOBS-REPORT.pdf

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology, 8*(1), 19–32. https://doi.org/10.1080/1364557032000119616

Baker, A., Young, K., Potter, J., & Madan, I. (2010). A review of grading systems for evidence-based guidelines produced by medical specialties. *Clinical Medicine Journal, 10*(4), 358-363. https://doi.org/10.7861/clinmedicine.10-4-358

Bakerjian, D. (2022). The advanced practice registered nurse leadership role in nursing homes: Leading efforts toward high quality and safe care. *Nursing Clinics of North America, 57*(2), 245–258.

Bakerjian, D., Boltz, M., Bowers, B., Gray-Miceli, D., Harrington, C., Kolanowski, A., & Mueller, C. A. (2021). Expert nurse response to workforce recommendations made by the Coronavirus Commission for Safety and Quality in Nursing Homes. *Nursing Outlook, 69*(5), 735–743. https://doi.org/10.1016/j.outlook.2021.03.017

Banks, J., Carson, J. S., II, Nelson, B. L., & Nicol, D. M. (2005). *Discrete-event system simulation* (4th ed.). Pearson Education.

Bartko, J. J. (1966). The intraclass correlation coefficient as a measure of reliability. *Psychological Reports*, *19*(1), 3–11.

Bell, C. M., & Redelmeier, D. A. (2001). Mortality among patients admitted to hospitals on weekends as compared with weekdays. *New England Journal of Medicine*, *345*(9), 663–668.

Bonner, A., Fulmer, T., Pelton, L., & Renton, M. (2022). Age-friendly nursing homes: Opportunity for nurses to lead. *Nursing Clinics of North America, 57*(2), 191–206. https://doi.org/10.1016/j.cnur.2022.02.002

Bostick, J. E., Rantz, M. J., Flesner, M. K., & Riggs, C. J. (2006). Systematic review of studies of staffing and quality in nursing homes. *Journal of the American Medical Directors Association*, *7*(6)*,* 366–376.

Bourbonniere, M., Strumpf, N. E., Evans, L. K., & Maislin, G. (2003). Organizational characteristics and restraint use for hospitalized nursing home residents. *Journal of the American Geriatrics Society*, *51*(8), 1079–1084.

Bowblis, J. R. (2022). The need for economically feasible nursing home staffing regulation: Evaluating an acuity-based nursing staff benchmark. *Innovation in Aging, 6*(4), igac017. https://doi.org/10.1093/geroni/igac017

Bowblis, J. R., & Roberts, A. R. (2020). Cost-effective adjustments to nursing home staffing to improve quality. *Medical Care Research and Review, 77*(3), 274–284. https://doi.org/10.1177/1077558718778081

Boyd, C. M., Darer, J., Boult, C., Fried, L. P., Boult, L., & Wu, A. W. (2005). Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: Implications for pay for performance. *JAMA: Journal of the American Medical Association, 294*(6), 716–724. https://doi.org/10.1001/jama.294.6.716

Büchele, G., Becker, C., Cameron, I. D., König, H.-H., Robinovitch, S., & Rapp, K. (2014). Predictors of serious consequences of falls in residential aged care: Analysis of more than 70,000 falls from residents of Bavarian nursing homes. *Journal of the American Medical Directors Association*, *15*(8), 559–563.

Burt, S. C. (2019). Measuring preceptor selection in long-term care. *Journal of Continuing Education in Nursing, 50*(10), 455–462. https://doi.org/10.3928/00220124-20190917-07

Butler, D. C., Petterson, S., Phillips, R. L., & Bazemore, A. W. (2012). Measures of social deprivation that predict health care access and need within a rational area of primary care service delivery. Health Services Research. http://doi.org/10.1111/j.1475-6773.2012.01449.x

Cai, S., Yan, D., & Intrator, O. (2021). COVID-19 cases and death in nursing homes: The role of racial and ethnic composition of facilities and their communities. *Journal of the American Medical Directors Association, 22*(7), 1345–1351. https://doi.org/10.1016/j.jamda.2021.05.002

California Advocates for Nursing Home Reform, Center for Medicare Advocacy, Justice in Aging, Long Term Care Community Coalition, Michigan Elder Justice Initiative, and The National Consumer Voice for Quality Long-Term Care. (2021). *Framework for nursing home reform post COVID-19.* https://theconsumervoice.org/uploads/files/actions-and-news-updates/Framework_and_overview_FINAL.pdf

California Association of Long Term Care Medicine. (n.d.). CALTCM *white paper on nursing home staffing*. https://www.caltcm.org/assets/CALTCM%20White%20Paper%20on%20Nursing%20Home%20Staffing%20-%20FINAL.pdf

Castle, N. G., Engberg, J., & Men, A. (2008). Nurse aide agency staffing and quality of care in nursing homes. *Medical Care Research and Review*, *65*(2), 232–252.

Castle, N. G., Wagner L. M., Ferguson, J. C., & Handler, S. M. (2011). Nursing home deficiency citations for safety. *Journal of Aging & Social Policy, 23*(1)*,* 34–57.

Center for Clinical Standards and Quality/Quality Safety & Oversight Group. (n.d.). *Special Focus Facility (SFF) Program.* Centers for Medicare and Medicaid Services. https://www.cms.gov/Medicare/Provider-Enrollment-and-certification/CertificationandComplianc/downloads/sfflist.pdf

Centers for Medicare and Medicaid Services. (2022a). *Design for* Care Compare *Nursing Home Five-Star Quality Rating system: Technical users' guide.* (https://www.cms.gov/medicare/provider-enrollment-and-certification/certificationandcomplianc/downloads/usersguide.pdf

Centers for Medicare and Medicaid Services. (2022b). *Electronic staffing data submission Payroll-Based Journal: Long-term care facility policy manual* (Ver. 2.6). https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/Downloads/PBJ-Policy-Manual-Final-V25-11-19-2018.pdf

Chen, M. M., & Grabowski, D. C. (2014). Intended and unintended consequences of minimum staffing standards for nursing homes. *Health Economics, 24*(7), 822–839.

CLA (CliftonLarsonAllen, LLC). (2022). *Staffing mandate analysis. In-depth analysis on minimum nurse staffing levels and local impact.* American Health Care Association and the National Center for Assisted Living (AHCA/NCAL). https://www.ahcancal.org/News-and-Communications/Fact-Sheets/FactSheets/CLA-Staffing-Mandate-Analysis.pdf

Clarke, S. P., & Donaldson, N. E. (2008). Nurse staffing and patient care quality and safety. In R. G. Hughes (Ed.), *Patient safety and quality: an evidence-based handbook for nurses.* Agency for Healthcare Research and Quality (Ch. 25). https://www.ncbi.nlm.nih.gov/books/NBK2676/

Clemens, S., Wodchis, W., McGilton, K., McGrail, K., & McMahon, M. (2021). The relationship between quality and staffing in long-term care: A systematic review of the literature 2008–2020. *International Journal of Nursing Studies, 122*(October)*,* 104036. https://doi.org/10.1016/j.ijnurstu.2021.104036

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, *20*(1), 37–46.

Cohen, J. (1968). Weighted kappa: Nominal scale agreement provision for scaled disagreement or partial credit. *Psychological Bulletin*, *70*(4), 213–220.

Consumer Voice (The National Consumer Voice for Quality Long-Term Care). (2021). *State nursing home staffing standards: Summary report*. https://theconsumervoice.org/issues/other-issues-and-resources/staffing

Consumer Voice (The National Consumer Voice for Quality Long-Term Care). (2022). *High staff turnover: A job quality crisis in nursing homes*. https://theconsumervoice.org/uploads/files/issues/High_Staff_Turnover-A_Job_Quality_Crisis_in_Nursing_Homes.pdf

Dellefield, M. E., Castle, N. G., McGilton, K. S., & Spilsbury, K. (2015). The relationship between registered nurses and nursing home quality: An integrative review (2008–2014). *Nursing Economic$, 33*(2), 95–108, 116.

Denny-Brown, N., Stone, D., Hays, B., & Gallagher, D. (2020). *COVID-19 intensifies nursing home workforce challenges.* U.S. Department of Health and Human Services, Assistant Secretary for Planning and Evaluation, Behavioral Health, Disability, and Aging Policy.

DeRienzo, C. M., Shaw, R. J., Meanor, P., Lada, E., Ferranti, J., & Tanaka, D. (2017). A discrete event simulation tool to support and predict hospital and clinic staffing. *Health Informatics Journal*, *23*(2), 124–133.

Dys, S., & Carder, P. (2022). Beyond the medication pass: Attitudes, ethics, agency, and antipsychotic medications in assisted living/residential care. *Innovation in Aging.* https://doi.org/10.1093/geroni/igac052

Edelman, T. (2021). *What can and must be done about the staffing shortage in nursing homes.* Center for Medicare Advocacy. https://medicareadvocacy.org/wp-content/uploads/2021/08/Report-Staffing-Shortages-in-Nursing-Homes-07.2021.pdf

Edelman, T. (2022). *Improving nursing home staffing levels can and must be done.* Center for Medicare Advocacy. https://medicareadvocacy.org/nursing-home-staffing-levels/

El-Darzi, E., Vasilakis, C., Chaussalet, T., & Millard, P. (1998). A simulation modelling approach to evaluating length of stay, occupancy, emptiness, and bed blocking in a hospital geriatric department. *Health Care Management Science*, *1*(2), 143–149.

Evans, D. (2003). Hierarchy of evidence: A framework for ranking evidence evaluating healthcare interventions. *Journal of Clinical Nursing, 12*(1), 77–84.

Ferrin, D. M., Miller, M. J., & McBroom, D. L. (2007). Maximizing hospital financial impact and emergency department throughput with simulation. In *Proceedings of the 2007 Winter Simulation Conference* (pp. 1566–1573). IEEE. https://ieeexplore.ieee.org/document/4419774

Ferrin, D. M., Miller, M. J., Wininger, S., & Neuendorf, M. S. (2004). Analyzing incentives and scheduling in a major metropolitan hospital operating room through simulation. In *Proceedings of the 2004 Winter Simulation Conference* (Vol. 2, pp. 1975–1980). IEEE. https://doi.org/10.1109/WSC.2004.1371558

Figueroa, J. F., Wadhera, R. K., Papanicolas, I., Riley, K., Zheng, J., Orav, E. J., & Jha, A. K. (2020). Association of nursing home ratings on health inspections, quality of care, and nurse staffing with covid-19 cases. *JAMA: Journal of the American Medical Association, 324*(11), 1103–1105. https://doi.org/10.1001/jama.2020.14709

Firnhaber, G. C., Roberson, D. W., & Kolasa, K. M. (2020). Nursing staff participation in end-of-life nutrition and hydration decision-making in a nursing home: A qualitative study. *Journal of Advanced Nursing, 76*(11), 3059–3068. https://doi.org/10.1111/jan.14491

Fleiss, J. L., Cohen, J., & Everitt, B. S. (1969). Large sample standard errors of kappa and weighted kappa. *Psychological Bulletin*, *72*(5), 323–327.

Fone, D., Hollinghurst, S., Temple, M., Round, A., Lester, N., Weightman, A., Roberts, K., Coyle, E., Bevan, G., & Palmer, S. (2003). Systematic review of the use and value of computer simulation modelling in population health and health care delivery. *Journal of Public Health*, *25*(4), 325–335.

Gasdaska, A., Segelman, M., Porter, K. A., Huber, B., Feng, Z., Barch, D., Squillace, M., Dey, J., & Oliveira, I. (2022). *Nursing home staffing disparities were exacerbated during the COVID-19 pandemic in 2020*. Research Brief. Office of Behavioral Health, Disability, and Aging Policy, Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services. https://aspe.hhs.gov/sites/default/files/documents/e37945b7d88efb005839a876660a59fb/nh-staffing-disparities-brief.pdf

Geng, F., Stevenson, D. G., & Grabowski, D. C. (2019). Daily nursing home staffing levels highly variable, often below CMS expectations. *Health Affairs, 38*(7), 1095–1100. https://doi.org/10.1377/hlthaff.2018.05322

George, J., Phun, Y. T., Bailey, M. J., Kong, D. C., & Stewart, K. (2004). Development and validation of the medication regimen complexity index. *Annals of Pharmacotherapy, 38*(9), 1369–1376.

Gerber, D., & Nelb, R. (2022). *Principles for assessing Medicaid nursing facility payments relative to costs.* Medicaid and CHIP Payment and Access Commission (MACPAC). https://www.macpac.gov/wp-content/uploads/2022/09/05_Principles-for-Assessing-Medicaid-Nursing-Facility-Payment-Relative-to-Costs-Drew-Rob.pdf

Gorges, R. J., & Konetzka, R. T. (2020). Staffing levels and COVID-19 cases and outbreaks in US nursing homes. *Journal of the American Geriatrics Society, 68*(11), 2462–2466. https://doi.org/10.1111/jgs.16787

Grabowski, D. C., Stewart, K. A., Broderick, S. M., & Coots, L. A. (2008). Predictors of nursing home hospitalization: A review of the literature. *Medical Care Research and Review, 65*(1), 3–39.

Gray-Miceli, D., Rogowski, J., de Cordova, P. B., & Boltz, M. (2021). A framework for delivering nursing care to older adults with COVID-19 in nursing homes. *Public Health Nursing, 38*(4), 610–626. https://doi.org/10.1111/phn.12885

Günal, M. M., & Pidd, M. (2010). Discrete event simulation for performance modelling in health care: A review of the literature. *Journal of Simulation*, *4*(1), 42–51.

Harrington, C., Dellefield, M. E., Halifax, E., Fleming, M. L., & Bakerjian, D. (2020). Appropriate nurse staffing levels for US nursing homes. *Health Services Insights*, 13, 1–14. https://doi.org/10.1177/1178632920934785

Harrington, C., Zimmerman, D., Karon, S. L., Robinson, J., & Beutel, P. (2000). Nursing home staffing and its relationship to deficiencies. *Journal of Gerontology Series B: Psychological Science and Social Science, 55*(5), S278–S287.

Harris, J. A., Engberg, J., & Castle, N. G. (2020). Organizational and geographic nursing home characteristics associated with increasing prevalence of resident obesity in the United States. *Journal of Applied Gerontology, 39*(9), 991–999. https://doi.org/10.1177/0733464819843045

Harris, M., Kolanowski, A., & Greenberg, S. (2022). The making of nurse leaders in the nursing home. *Nursing Clinics of North America, 57*(2), 171–178. https://doi.org/10.1016/j.cnur.2022.02.010

Hawk, T., White, E. M., Bishnoi, C., Schwartz, L. B., Baier, R. R., & Gifford, D. R. (2022). Facility characteristics and costs associated with meeting proposed minimum staffing levels in skilled nursing facilities. *Journal of the American Geriatrics Society, 70*(4), 1198–1207. https://doi.org/10.1111/jgs.17678

Henning-Smith, C., Cross, D., & Rahman, A. (2021). Challenges to admitting residents: Perspectives from rural nursing home administrators and staff. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 58*. https://doi.org/10.1177/00469580211005191

Hyer, K., Thomas, K. S., Branch, L. G., Harman, J. S., Johnson, C. E., & Weech-Maldonado, R. (2011). The influence of nurse staffing levels on quality of care in nursing homes. *The Gerontologist*, *51*(5), 610–616.

Institute of Medicine, Committee on the Adequacy of Nursing Staff in Hospitals and Nursing Homes. (1996). *Nursing staff in hospitals and nursing homes: Is it adequate?* (G. S. Wunderlich, F. Sloan, & C. K. Davis, Eds.). The National Academies Press.

Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century.* The National Academies Press. https://doi.org/10.17226/10027

Jacobson, S. H., Hall, S. N., & Swisher, J. R. (2006). Discrete-event simulation of health care systems. In *Patient flow: Reducing delay in healthcare delivery* (pp. 211–252). Springer.

Jiménez-Buedo, M., & Russo, F. (2021). Experimental practices and objectivity in the social sciences: Re-embedding construct validity in the internal-external validity distinction. *Synthese, 199*(3), 9549–9579. https://doi.org/10.1007/s11229-021-03215-3

Kalish, B. J., & Williams, R. A. (2009). Development and psychometric testing of a tool to measure missed nursing care. *The Journal of Nursing Administration, 39*(5), 211–219. https://doi.org/10.1097/nna.0b013e3181a23cf5

Katz, P. R., Ryskina, K., Saliba, D., Costa, A., Jung, H.-Y., Wagner, L. M., Unruh, M. A., Smith, B. J., Moser, A., Spetz, J., Feldman, S., & Karuza, J. (2021). Medical care delivery in U.S. nursing homes: Current and future practice. *Gerontologist, 61*(4), 595–604. https://doi.org/10.1093/geront/gnaa141

Kennedy, K. A., Applebaum, R., & Bowblis, J. R. (2020). Facility-level factors associated with CNA turnover and retention: Lessons for the long-term services industry. *Gerontologist, 60*(8), 1436–1444. https://doi.org/10.1093/geront/gnaa098

Kingsley, D. E., & Harrington, C. (2022). Financial and quality metrics of a large, publicly traded U.S. nursing home chain in the age of Covid-19. *International Journal of Health Services, 52*(2), 212–224. https://doi.org/10.1177/00207314221077649

Kolanowski, A., Cortes, T. A., Mueller, C., Bowers, B., Boltz, M., Bakerjian, D., Harrington, C., Popejoy, L., Vogelsmeier, A., Wallhagen, M., Fick, D., Batchelor, M., Harris, M., Palan-Lopez, R., Dellefield, M., Mayo, A., Woods, D. L., Horgas, A., Cacchione, P. Z., & Carter, D. (2021). A call to the CMS: Mandate adequate professional nurse staffing in nursing homes. *AJN American Journal of Nursing, 121*(3), 24–27. https://doi.org/10.1097/01.naj.0000737292.96068.18

LeadingAge. 2022. *Nursing home caregivers see double digit pay increases in 2022.* https://leadingage.org/nursing-home-caregivers-see-double-digit-pay-increases-in-2022/

Lepore, M., Livingstone, I., Naden, D., Hatem, M., & Feng, Z. (2020). *Impacts of minimum wage increases on nursing homes: Final report.* Behavioral Health, Disability, and Aging Policy, Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services. https://aspe.hhs.gov/reports/impacts-minimum-wage-increases-nursing-homes-final-report

Li, Y., Temkin-Greener, H., Shan, G., & Cai, X. (2020). COVID-19 infections and deaths among Connecticut nursing home residents: Facility correlates. *Journal of American Geriatrics Society, 68*(9), 1899–1906. https://doi.org/10.1111/jgs.16689

Lin, H. (2014). Revisiting the relationship between nurse staffing and quality of care in nursing homes: An instrumental variables approach. *Journal of Health Economics, 37,* 13–24.

Livingstone, I., Hefele, J., Nadash, P., Barch, D., & Leland, N. (2019). The relationship between quality of care, physical therapy, and occupational therapy staffing levels in nursing homes in 4 years' follow-up. *Journal of the American Medical Directors Association, 20*(4), 462–469. https://doi.org/10.1016/j.jamda.2019.02.002

Long Term Care Community Coalition. (2021). *LTCCC Alert: 24-hour registered nurses in nursing homes: Essential & affordable.* http://nursinghome411.org/24-hour-rn/

Ma, D., Zhao, Y., Wan, Z., Sun, D., Li, H., Xie, Z., & Sun, J. (2020). Nurses' attitudes and views on the application of antipsychotics in patients with dementia: A systematic review of qualitative studies. *Geriatric Nursing, 41*(6), 669–676.

McCloskey, R., Donovan, C., Stewart, C., & Donovan, A. (2015). How registered nurses, licensed practical nurses, and resident aides spend time in nursing homes: An observational study. *International Journal of Nursing Studies*, *52*(9), 1475–1483.

McGarry, B. E., Gandhi, A. D., Grabowski, D. C., & Barnett, M. L. (2021). Larger nursing home staff size linked to higher number of COVID-19 cases in 2020. *Health Affairs, 40*(8), 1261–1269. https://doi.org/10.1377/hlthaff.2021.00323

McGraw, K. O., & Wong, S. P. (1996). Forming inferences about some intraclass correlation coefficients. *Psychological Methods*, *1*(1), 30–46.

Medicaid and CHIP Payment and Access Commission (MACPAC). (2022a). *Compendium: State policies related to nursing facility staffing.* https://www.macpac.gov/publication/state-policies-related-to-nursing-facility-staffing/

Medicaid and CHIP Payment and Access Commission (MACPAC). (2022b). *State policy levers to address nursing facility staffing issues.* https://www.macpac.gov/wp-content/uploads/2022/03/State-Policy-Levers-to-Address-Nursing-Facility-Staffing-Issues.pdf

Medicare Learning Network. (2019, October). *SNF PPS: Patient Driven Payment Model.* Centers for Medicare and Medicaid Services. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/SNFPPS/Downloads/MLN_CalL_PDPM_Presentation_508.pdf

Medicare Program; Prospective Payment System and Consolidated Billing for Skilled Nursing Facilities; Updates to the Quality Reporting Program and Value-Based Purchasing Program for Federal Fiscal Year 2023; Request for Information on Revising the Requirements for Long-Term Care Facilities to Establish Mandatory Minimum Staffing Levels, 87 F.R. (proposed April 15, 2022) (to be codified at 42 C.F.R. Part 413). https://www.govinfo.gov/content/pkg/FR-2022-04-15/pdf/2022-07906.pdf

Min, A., & Hong, H. C. (2019). Effect of nurse staffing on rehospitalizations and emergency department visits among short-stay nursing home residents: A cross-sectional study using the US Nursing Home Compare database. *Geriatric Nursing, 40*(2), 160–165. https://doi.org/10.1016/j.gerinurse.2018.09.010

Mollot, R. (2022, June 8). *Re: CMS-1765-P; Request for Information on Revising the Requirements for Long-Term Care Facilities To Establish Mandatory Minimum Staffing Levels.* (Comments to CMS on minimum staffing standard). Long Term Care Community Coalition. https://nursinghome411.org/cms-min-staffing/

Mueller, C., Duan, Y., Vogelsmeier, A., Anderson, R., McConnell, E., & Corazzini, K. (2018). Interchangeability of licensed nurses in nursing homes: Perspectives of directors of nursing. *Nursing Outlook*, *66*(6), 560–569.

Mukamel, D. B., Saliba, D., Ladd, H., & Konetzka, R. T. (2022). Daily variation in nursing home staffing and its association with quality measures. *JAMA Network Open*, *5*(3), e222051–e222051. https://doi.org/10.1001/jamanetworkopen.2022.2051

Mundform, D. J., Schaffer, J., Kim, M. J., Shaw, D., Thongteeraparp, A., & Supawan, P. (2011). Number of replications required in Monte Carlo simulation studies: A synthesis of four studies. *Journal of Modern Applied Statistical Methods, 10*(1), 4.

Musumeci, M., Childress, E., & Harris, B. (2022). *State actions to address nursing home staffing during COVID-19.* KFF [Kaiser Family Foundation]. https://www.kff.org/medicaid/issue-brief/state-actions-to-address-nursing-home-staffing-during-covid-19/

National Academies of Sciences, Engineering, and Medicine. (2022). *The national imperative to improve nursing home quality: Honoring our commitment to residents, families, and staff.* The National Academies Press. https://doi.org/10.17226/26526

NurseJournal. (2022). *NP vs. APRN: What's the difference?* https://nursejournal.org/resources/np-vs-aprn/

Nursing Services, 42 C.F.R. § 483.35 (1989). https://www.ecfr.gov/current/title-42/chapter-IV/subchapter-G/part-483/subpart-B/section-483.35

Office of the Inspector General, U.S. Department of Health and Human Services. (2020). *Some nursing homes' reported staffing levels in 2018 raise concerns; consumer transparency could be increased.* HHS OIG Data Brief OEI-04-18-00450. https://oig.hhs.gov/oei/reports/OEI-04-18-00450.pdf

Orth, J., Li, Y., Simning, A., Zimmerman, S., & Temkin-Greener, H. (2021). End-of-life care among nursing home residents with dementia varies by nursing home and market characteristics. *Journal of the American Medical Directors Association, 22*(2), 320–328.e324. https://doi.org/10.1016/j.jamda.2020.06.021

Peters, M. D. J., Marnie, C., & Butler, A. (2021). Delivering, funding, and rating safe staffing levels and skills mix in aged care. *International Journal of Nursing Studies. 119*(July), 103943. https://doi.org/10.1016/j.ijnurstu.2021.103943

Quality Care for Nursing Home Residents Act of 2019, H.R. 5216, 116th Congress (2019–2020). https://www.congress.gov/bill/116th-congress/house-bill/5216

Quality Care for Nursing Home Residents Act of 2019, S. 2943, 116th Congress (2019–2020). https://www.congress.gov/bill/116th-congress/senate-bill/2943

Rahman, M., White, E. M., McGarry, B. E., Santostefano, C., Shewmaker, P., Resnik, L., & Grabowski, D. C. (2022). Association between the Patient Driven Payment Model and therapy utilization and patient outcomes in US skilled nursing facilities. *JAMA Health Forum*, *3*(1), e214366. https://doi.org/10.1001/jamahealthforum.2021.4366

Reichardt, C. S. (2011). Criticisms of and an alternative to the Shadish, Cook, and Campbell validity typology. *New Directions for Evaluation*, no. 130, 43–53.Reinhard, S. C., & and Hado, E. (2021). LTSS choices: Small-house nursing homes. AARP Public Policy Institute. https://doi.org/10.26419/ppi.00126.001

Reinhard, S. C., & Hado, E. (2021). *LTSS choices: Small-house nursing homes.* AARP Public Policy Institute. https://doi.org/10.26419/ppi.00126.001

Rosenthal, M., Poling, J., Wec, A., Connolly, E., Angell, B., & Crystal, S. (2022). Medication is just one piece of the whole puzzle: How nursing homes change their use of antipsychotic medications. *Journal of Applied Gerontology, 41*(1), 62–72. https://doi.org/10.1177/0733464820958919

Schnelle, J. F., Schroyer, L. D., Saraf, A. A., & Simmons, S. F. (2016). Determining nurse aide staffing requirements to provide care based on resident workload: A discrete event simulation model. *Journal of the American Medical Directors Association*, *17*(11), 970–977. https://doi.org/10.1016/j.jamda.2016.08.006

Schnelle, J. F., Simmons, S. F., Harrington, C., Cadogan, M., Garcia, E., & Bates-Jensen, B. M. (2004). Relationship of nursing home staffing to quality of care. *Health Services Research, 39*(2), 225–250.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton, Mifflin and Company.

Sharma, H., Konetzka, R. T., & Smieliauskas, F. (2019). The relationship between reported staffing and expenditures in nursing homes. *Medical Care Research & Review, 76*(6), 758–783. https://doi.org/10.1177/1077558717739214

Shin, J. H., & Bae, S.-H. (2012). Nurse staffing, quality of care, and quality of life in US nursing homes, 1996-2011: An integrative review. *Journal of Gerontological Nursing, 38*(12), 46–53.

Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin*, *86*(2), 420–428.

Smith, K. M., Thomas, K. S., Johnson, S., Meng, H., & Hyer, K. (2019). Dietary service staffing impact nutritional quality in nursing homes. *Journal of Applied Gerontology: The Official Journal of the Southern Gerontological Society, 38*(5), 639–655. https://doi.org/10.1177/0733464816688309

Snyder, R. L., Anderson, L. E., White, K. A., Tavitian, S., Fike, L. V., Jones, H. N., Jacobs-Slifka, K. M., Stone, N. D., & Sinkowitz-Cochran, R. L. (2021). A qualitative assessment of factors affecting nursing home caregiving staff experiences during the COVID-19 pandemic. *PLoS One, 16*(11), e0260055. https://doi.org/10.1371/journal.pone.0260055

Spector, W. D., Limcangco, R., Williams, C. S., Rhodes, W., & Hurd, D. (2013). Potentially avoidable hospitalizations for elderly long-stay residents in nursing homes. *Medical Care, 51*(8), 673–681.

Turner-Stokes, L., Harding, R., Sergeant, J., Lupton, C., & McPherson, K. (2006). Generating the evidence base for the National Service Framework for Long Term Conditions: A new research typology. *Clinical Medicine, 6*(1), 91–97. http://doi.org/10.7861/clinmedicine.6-1-91

Umpierrez, G. E., Hellman, R., Korytkowski, M. T., Kosiborod, M., Maynard, G. A., Montori, V. M., Seley, J. J., & Van den Berghe, G. (2012). Management of hyperglycemia in hospitalized patients in non-critical care setting: an endocrine society clinical practice guideline. *The Journal of Clinical Endicronology & Metabolism, 97*(1), 16-38. https://doi.org/10.1210/jc.2011-2098

U.S. Government Accountability Office. (2021). *Additional reporting on key staffing information and stronger payment incentives needed for skilled nursing facilities.* GAO Publication No. 21-408. U.S. Government Printing Office. https://www.gao.gov/products/gao-21-408

U.S. Government Accountability Office. (2022). *COVID-19 in nursing homes: CMS needs to continue to strengthen oversight of infection prevention and control. Report to Congressional addressees.* GAO-22-105133. https://www.gao.gov/assets/gao-22-105133.pdf

Valmadrid, L. C., Schwei, R. J., Maginot, E., & Pulia, M. S. (2021). The impact of health care provider relationships and communication dynamics on urinary tract infection management and antibiotic utilization for long-term care facility residents treated in the emergency department: A qualitative study. *American Journal of Infection Control, 49*(2), 198–205. https://doi.org/10.1016/j.ajic.2020.07.009

Van Houtven, C. H., DePasquale, N., & Coe, N. B. (2020). Essential long-term care workers commonly hold second jobs and double- or triple-duty caregiving roles. *Journal of the American Geriatrics Society, 68*(8), 1657–1660. https://doi.org/10.1111/jgs.16509

Wage and Hour Division. (2022). *Minimum length of meal period required under state law for adult employees in private sector 1*. U.S. Department of Labor. https://www.dol.gov/agencies/whd/state/meal-breaks

Wagner, L. M., Katz, P., Karuza, J., Kwong, C., Sharp, L., & Spetz, J. (2021). Medical staffing organization and quality of care outcomes in post-acute care settings. *Gerontologist, 61*(4), 605–614. https://doi.org/10.1093/geront/gnaa173

Weech-Maldonado, R., Lord, J., Pradhan, R., Davlyatov, G., Dayama, N., Gupta, S., & Hearld, L. (2019). High Medicaid nursing homes: Organizational and market factors associated with financial performance. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing,* 56. https://doi.org/10.1177/0046958018825061

Weech-Maldonado, R., Pradhan, R., Dayama, N., Lord, J., & Gupta, S. (2019). Nursing home quality and financial performance: Is there a business case for quality? *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 56. https://doi.org/10.1177/0046958018825191

Weerawat, W., Pichitlamken, J., & Subsombat, P. (2013). A generic discrete-event simulation model for outpatient clinics in a large public hospital. *Journal of Healthcare Engineering*, *4*(2), 285–305.

The White House. (2022). *Fact sheet: Protecting seniors by improving safety and quality of care in the nation's nursing homes*. https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/28/fact-sheet-protecting-seniors-and-people-with-disabilities-by-improving-safety-and-quality-of-care-in-the-nations-nursing-homes/

Williams, C. S., Zheng, Q., White, A. J., Bengtsson, A. I., Shulman, E. T., Herzer, K. R., & Fleisher, L. A. (2021). The association of nursing home quality ratings and spread of COVID-19. *Journal of the American Geriatrics Society, 69*(8), 2070–2078.

Yang, B. K., Carter, M. W., Trinkoff, A. M., & Nelson, H. W. (2021). Nurse staffing and skill mix patterns in relation to resident care outcomes in US nursing homes. *Journal of the American Medical Directors Association, 22*(5), 1081–1087.e1081. https://doi.org/10.1016/j.jamda.2020.09.009

Yuan, Y., Lapane, K. L., Baek, J., Jesdale, B. M., & Ulbricht, C. M. (2019). Nursing home star ratings and new onset of depression in long-stay nursing home residents. *Journal of the American Medical Directors Association, 20*(10), 1335–1335. https://doi.org/10.1016/j.jamda.2019.05.004

Appendix A. Literature Review Supplemental Materials

List of Exhibits

Chapter 2.1 provided an overview of the systematic literature review methods and findings. This appendix volume provides additional detail on methods (Appendix A.1) and results (Appendix A.2), followed by four supporting appendixes organized by research question (Appendixes A.3-A.6).

A.1 Literature Review Methods

After an initial scoping review to determine the range of available literature, the Staffing Study team conducted a systematic literature review using a stepwise process to identify recent information relevant to the research intent. Details of this process are outlined here.

Conduct a Brief Scoping Review

The study team conducted a scoping review to better understand the depth and breadth of literature associated with nursing home staffing and its relationship with quality (see Arksey & O'Malley, 2005). This review used the terms "nursing home" and "staffing" with multiple search engines including EBSCO Discovery Service, the National Library of Medicine's PubMed database, EBSCO's Cumulative Index to Nursing and Allied Health Literature (CINAHL), Google Scholar, and JSTOR. The team filtered results for those sources: published from 2015 to 2022, U.S.-based, and relevant to nursing home staffing and quality. This broad search returned 1,883 results.

Of the 1,883 results returned from this scoping review, 44 were deemed sufficiently applicable to the research topics—though the majority were earlier than the threshold the team established for the systematic review (i.e., 2019 or later). Older articles identified in the scoping review that had particular relevance to our research topics have been incorporated into **Section 2.2.1 Overview** of **Chapter 2.1 Literature Review**.

Based on the results of this preliminary scoping review, the team refined its search parameters to develop unique search terms specific to each of the four research questions that the Staffing Study team, in consultation with CMS, had identified for the systematic literature review. After considering the scoping review results and previous direction provided by CMS regarding inclusion of non-nurse staffing, the team limited the scope of the systematic review to nursing staff.[1]

Determine Search Terms

The team determined a specific set of search terms both to identify the nursing home setting and to identify work relevant to each of the four research questions using the following steps:

- Identify key search terms and informed standard Medical Subject Headings (MeSH) terms.
- Discuss search terms as a group, including consultation with a long-term care nurse and other staff with significant staffing expertise.
- Test search terms for appropriateness (i.e., terms returned more than 20 results but fewer than 500 results).
- Finalize search terms.

The team's initial search terms were deemed appropriate and subsequently used in three major health science databases: EBSCO Discovery Service, PubMed, and CINAHL. For each database, the team restricted results to those dated between January 1, 2019, and August 31, 2022, and U.S.-based.

---

[1] Although the scoping review revealed some relationships between non-nursing staffing (e.g., physical therapists, occupational therapists, activities directors, and social workers) and quality, these studies did not address the primary research questions and were deemed outside of the scope of this study.

Exhibit A.1.1 presents the final search terms for each research question and the number of articles identified in each database. A single article could appear in multiple databases.

Exhibit A.1.1: Final Search Terms and Initial Search Results

Research Question	Search Terms	Initial Search Results
1. What is the relationship of nurse staffing levels with safety and quality of care?	"nursing home" AND "staffing" AND ("quality" or "safety")	EBSCO: 58 PubMed: 118 CINAHL: 46
2. What are the current state and federal standards for staffing levels and types in nursing homes for weekdays, weekends, and evenings? What are the outcomes associated with these standards?	"nursing home" AND ("state" OR "federal" OR "regulation") AND "staff" AND ("safety" OR "quality")	EBSCO: 86 PubMed: 73 CINAHL: 53
3 What is the role of different nurse types (i.e., RN, LPN, nurse aide) in ensuring safety and quality of nursing home care?	"nursing home" AND ("staff" OR "nurse") AND "role"	EBSCO: 30 PubMed: 132 CINAHL: 89
4. What are the costs associated with nurse staffing in nursing homes?	"nursing home" AND ("staff" OR "nurse") AND "cost"	EBSCO: 24 PubMed: 49 CINAHL: 34

The study team exported all results into an EndNote library. All articles identified in this stage were considered peer-reviewed. Peer-reviewed articles were categorized as either "Expert evidence" or "Research-based evidence."

Review Identified Database Articles

To facilitate review, the study team designated an EndNote library for each of the four research questions. Within each question-specific library, the team designated folders for three levels of article relevance to the research topic: (1) Relevant, (2) Somewhat relevant, and (3) Insufficiently relevant. The study team excluded insufficiently relevant articles from the results based on a review of either the abstract or the full text. Group consensus determined whether somewhat relevant articles should be included as relevant or excluded as insufficiently relevant. Potential reasons for exclusion included incorrect setting (e.g., non-nursing home, not U.S.-based), incorrect population (e.g., not Medicare or Medicaid), and lack of specificity to the research topics.

Identify and Review Gray Literature

The study team identified relevant informally published material ("gray" literature) that might provide data not found in journal articles. Examples of gray literature include technical reports from government agencies or research groups, working papers, and white papers. **Exhibit A.1.2** presents the specific sites searched. Study team members reviewed the identified gray literature items, applying the same criteria used for peer-reviewed literature. Of the 22 sites searched, 15 provided relevant content.

Exhibit A.1.2: Gray Literature Sites

Site Type	Site Name
Federal government or affiliated entity	• Government Accountability Office (GAO)* • Office of the Inspector General (OIG)* • Assistant Secretary for Planning and Evaluation (ASPE)* • Medicaid and CHIP Policy and Access Commission (MACPAC)* • Medicare Policy and Access Commission (MedPAC)

Site Type	Site Name
Nursing home provider association	• American Health Care Association / National Center for Assisted Living (AHCA/NCAL) • LeadingAge* • Society for Post-Acute and Long-Term Care Medicine (AMDA)* • American Association of Post-Acute Care Nursing (AAPACN)* • National Association of Health Care Assistants (NAHCA)*
Consumer advocacy organization	• Long-Term Care Community Coalition (LTCCC)* • California Association of Long Term Care Medicine (CALTCM)* • The National Consumer Voice for Quality Long-Term Care (Consumer Voice)* • Center for Medicare Advocacy* • AARP*
Foundation	• Alliance for Health Reform (AHR) • The Commonwealth Fund • Robert Wood Johnson Foundation • Kaiser Family Foundation (KFF)*
Other health policy–focused organization	• Academy Health • Gerontological Society of America • National Academies of Sciences, Engineering, and Medicine*

* Provided relevant content

Review Additional Supplemental Information

The study team also compiled materials provided by other stakeholders over the course of the study. Literature review staff evaluated these materials and incorporated relevant findings into the review. **Exhibit A.1.3** presents a summary of the sources identified and reviewed.

Exhibit A.1.3: Review Results, by Research Question

1. What is the relationship of nurse staffing levels with safety and quality of care?	
Peer-Reviewed Articles	176
Title/Abstract Rejection	147
Full Text Rejections	8
Final Articles	21
Gray Literature	4
Supplemental Literature	2
Total Number of Relevant Sources	**27**
2. What are the current state and federal standards for staffing levels and types in nursing homes for weekdays, weekends, and evenings? What are the outcomes associated with these standards?	
Peer-Reviewed Articles	160
Title/Abstract Rejection	153
Full Text Rejections	6
Final Articles	1
Gray Literature	6
Supplemental Literature	1
Total Number of Relevant Sources	**8**

3. What is the role of different nurse types (i.e., RN, LPN, nurse aide) in ensuring safety and quality of nursing home care?	
Peer-Reviewed Articles	205
Title/Abstract Rejection	133
Full Text Rejections	62
Final Articles	10
Gray Literature	6
Supplemental Literature	4
Total Number of Relevant Sources	**20**
4. What are the costs associated with nurse staffing in nursing homes?	
Peer-Reviewed Articles	76
Title/Abstract Rejection	70
Full Text Rejections	1
Final Articles	5
Gray Literature	9
Supplemental Literature	1
Total Number of Relevant Sources	**15**

Summarize Final Search Results

The Staffing Study team reviewed final relevant sources to determine the strength of their evidence and alignment with definitions of staff type and quality measures used by the study team's quantitative analysis staff.

To rate the evidence, the Staffing Study team adapted and applied the National Service Framework for Long Term Conditions (NSF) evidence typology (see Turner-Stokes et al., 2006). This framework was chosen because it accounts for the viewpoints of professionals, service users, and families and caregivers; is easy to understand, use, and apply; is well-suited to research topics for which there might be few randomized controlled trials; and accounts for a varied research base, including expert opinion (Baker et al., 2010). Consistent with the NSF, only peer-reviewed research-based evidence was rated ("High," "Medium," or "Low").

To rate whether a source's definition of staff aligned with the definition used in the Staffing Study's quantitative analyses, the team assessed both the staff description and the data set the source used; both had to align with the Staffing Study to be considered in "Good" alignment (versus "Some" or "No" alignment). The team assessed alignment on peer-review literature only.

For the four research questions, **Appendixes A.3-A.6** provide literature review support tables detailing the content of each included source, including, for peer-reviewed sources, how the team assessed the strength of evidence and alignment with the staffing and quality definitions used in this report's quantitative analyses.

A.2 Literature Review Detailed Results

This appendix section summarizes in detail the results from the systematic literature review, organized by the four research questions. Note that throughout this Appendix A.2, the study team is representing the work of others. The team has used standardized terminology that could deviate from the authors' original terms (e.g., the report will use *resident* instead of *patient*). Additionally, sources could have defined these terms, particularly staff types, differently than does this report's **Glossary** (e.g., whether "nurse aide" includes aides in training will vary across cited sources).

A.2.1 Relationship of Nurse Staffing Levels with Safety and Quality of Care

Key Findings

- Higher levels of nurse staffing are associated with improved resident care outcomes such as reduced numbers of pressure ulcers, emergency department visits, and rehospitalizations.
- Higher levels of nurse staffing are associated with better safety and quality outcomes related to COVID-19 (e.g., fewer positive cases, fewer outbreaks, and fewer deaths among staff and residents), though some studies found that the prevalence of COVID-19 within a community was a potentially stronger predictor of COVID-19 outcomes than staffing was.
- Increased staffing levels could be particularly beneficial to vulnerable subpopulations in nursing homes (e.g., residents with Alzheimer's disease or other types of dementia) and for particular quality outcomes (e.g., antipsychotic use, obesity rates, severity of depressive symptoms).
- Stakeholders favor adoption of minimum nurse staffing requirements in nursing homes, with most focused on the RNs, though not all authors recommended a specific minimum requirement.

Empirical Evidence Demonstrating a Relationship between Staffing and Quality

Overall, existing research indicates that higher levels of nurse staffing are associated with higher quality of care and better resident safety outcomes. The study team identified seven studies reflecting empirical evidence that nurse staffing levels in nursing homes affect residents' quality of care, as well as several additional studies that reflected how nurse staffing affects residents' safety as it relates to COVID-19.

Five out of seven studies reported that higher nurse staffing levels improved resident care outcomes, including reducing pressure ulcers, emergency department visits, and rehospitalizations. One systematic review showed that an increase in total nurse staffing reduced hospitalizations, psychoactive drug use deficiencies, and government audit deficiencies (Clemens et al., 2021). A 2021 study used both interview data and multivariate analyses of resident outcomes to conclude that higher total nurse staffing was significantly associated with better outcomes for three out of six long-stay measures—decreased numbers of pressure ulcers, an increase in influenza vaccination, and an increase in pneumonia vaccination—and three out of five short-stay measures—decreased numbers of outpatient emergency department visits, increased influenza vaccination, and increased pneumonia vaccination (Wagner et al., 2021). Though that study's goal was to determine how the organization of medical staff in nursing homes affects nursing home quality of care, the authors concluded that nurse type (e.g., licensed nurses and nurse aides) and the level of nurse staffing might be more important in determining quality outcomes than was the organization of medical staffing. However, other research found that although higher RN nursing levels were associated with lower rehospitalization rates and fewer emergency department visits, total nursing levels were associated with increased rates of rehospitalization and had no significant effect on emergency department visits (Min & Hong, 2019). This finding suggests that staff type plays a role in improving care quality.

The daily variation in total nurse staffing also influences quality of care. Researchers concluded that greater daily staffing variation for both RNs and nurse aides was significantly associated with lower Five-Star Survey scores and Five-Star Quality Measure ratings. Their study showed that among all nursing disciplines, RN staffing variation was most strongly associated with quality outcomes (Mukamel et al., 2022).

Employing combinations of nurse staff and non-nurse staff can improve quality outcomes. An observational study of more than 12,000 nursing homes found that a combination of physical and occupational therapy staff with nurse staff improves performance of activities of daily living (ADLs) and reduces falls (Livingstone et al., 2019). Another study concluded that increasing levels of both dietary staff and CNAs could improve the quality of nutritional care in nursing homes, as measured by their having fewer dietary service–related deficiency citations (Smith et al., 2019).

Several studies suggest that higher levels of nurse staffing are associated with better safety and quality outcomes related to COVID-19 (e.g., fewer positive cases, fewer outbreaks, and fewer deaths among staff and residents). One study analyzing COVID-19 data from nursing homes across eight states found that nursing homes with higher Nursing Home Care Compare[2] star ratings for nurse staffing had fewer COVID-19 cases than did their lower-scoring counterparts (Figueroa et al., 2020). Another study, of 13,000 nursing homes, concluded that higher nurse aide and total nursing staff hours were related to a lower probability of COVID-19 outbreaks and fewer COVID-19 deaths (Gorges & Konetzka, 2020). A qualitative study that included interviews with CNAs found that participants frequently suggested that nursing homes could decrease the impact of COVID-19 by improving staffing (Snyder et al., 2021).

Two additional studies focused on nursing homes within a single state, providing case studies for Connecticut and New Jersey. The Connecticut study found that among facilities with at least one COVID-19 case, every 20 minutes per resident day increase in RN staffing was associated with 22 percent fewer confirmed COVID-19 cases among residents (Li et al., 2020). The New Jersey study recommended increasing the hours of daily care to 4.1 HPRD and increasing the staff mix ratio to include more RN staff with solely clinical duties (as opposed to also having administrative duties) to improve safety (Gray-Miceli et al., 2021). Another COVID-19 study found that a 198-facility nursing home chain had higher-than-average COVID-19 infection rates, partly because the chain's staffing levels were more than 80 percent below the national average (Kingsley & Harrington, 2022). However, other research found that having larger numbers of staff on site was strongly associated with higher COVID-19 rates among residents. That study suggested that maintaining direct care hours while reducing the number of staff on site at once—for example, relying on a relatively small number of full-time workers rather than a relatively large number of part-time workers—could help prevent outbreaks (McGarry et al., 2021).

A few studies found that that the prevalence of COVID-19 within a community was a potentially stronger predictor of COVID-19 outbreaks and deaths than staffing was. In one study, the prevalence of the virus within the community was the strongest predictor of COVID-19 outbreaks and deaths, ranking above staff hours for both nursing assistants and total nursing staff (Gorges & Konetzka, 2020). Another study that looked at nursing homes in communities with high percentages of Black or Hispanic residents, found that higher levels of RN staffing resulted in a lower probability of a case of COVID-19, but higher levels of CNA staffing resulted in a higher probability. Its authors suggest that this discrepancy might be due to factors such as CNAs being more likely to live in poverty and use public transportation (creating more

[2] CMS's Nursing Home Care Compare, which was active during the time the cited study was conducted, has since been replaced by Care Compare.

opportunities for viral exposure) and that CNAs typically come from the communities they serve, with many Black and Hispanic communities having higher rates of COVID-19 cases (Cai et al., 2021).

Summary of Findings Related to Other Quality Outcomes

Some studies found ways in which increased staffing levels are specifically beneficial to vulnerable subpopulations in nursing homes, such as residents with dementia or Alzheimer's disease. One cross-sectional study of long-stay residents with Alzheimer's disease and related dementias who had died found that residents in nursing homes that had higher licensed nurse staffing levels had better end-of-life care and were less likely to experience potentially avoidable hospitalizations (Orth et al., 2021). Another study of nursing homes in seven states reported that without sufficient staffing and adequate funding, nursing home staff and prescribing physicians found it more difficult to implement nonpharmacological alternatives to antipsychotic medication use for dementia residents (Rosenthal et al., 2022).

Research found that nursing homes with higher RN and licensed practical/vocational nurse (LPN) staffing had lower obesity prevalence rates (Harris et al., 2020). Another study looked at the risk of new-onset depression and the severity of depressive symptoms among nursing home residents, finding that residents of nursing homes with a one-star staffing rating were more likely to develop moderate, moderately severe, or severe depressive symptoms than were residents of nursing homes with a three-star staffing rating (Yuan et al., 2019). An additional study explored ways in which inadequate staffing creates barriers to caring for residents with dementia, obesity, mental or behavioral health conditions, and medically complex conditions. Nursing home administrators viewed staffing concerns as creating key structural challenges in providing high-quality care across all resident groups; participants noted that staffing challenges included recruiting, retaining, and training staff in rural communities (Henning-Smith et al., 2021).

Minimum Staffing Levels Recommended to Ensure Safety and Quality of Care

Literature the study team identified in the review favored adoption of minimum nurse staffing requirements in nursing homes, though not all authors recommended a specific minimum requirement. The California Association of Long Term Care Medicine (CALTCM), California Advocates for Nursing Home Reform (CANHR), and the National Academies of Sciences, Engineering, and Medicine all explicitly recommended minimum staffing levels derived from CMS's 2001 staffing study—0.75 RN hours, 0.55 LPN hours, and 2.8 CNA hours, for a total of at least 4.1 nursing HPRD (CALTCM, n.d.; CANHR et al., 2021; National Academies, 2022). They make those recommendations even though that CMS study does not indicate a staffing minimum, but rather a staffing level at which quality is maximized (Abt Associates, 2001). One study outlined a five-step process for how nursing homes should staff their facilities, using existing research to conclude that total nurse staffing levels should range from 4.30 to 6.81 HPRD, depending on the intensity of resident care needs (Harrington et al., 2020).

In advocating for better nursing home staffing, many stakeholders focused on the role of the RN in nursing homes. All but one source explicitly noted that nursing home reform should include 24/7 RN coverage in every facility (Bakerjian et al., 2021; Kolanowski et al., 2021; Mollot, 2022; CANHR et al., 2021; National Academies, 2022). Kolanowski and colleagues stated that 24-hour RN staffing levels should be 1.0 HPRD at a minimum and adjust upward for greater resident acuity. Bakerjian and colleagues also recommended increasing RN recruitment efforts and supporting care delivery models centered around RNs. Finally, authors of the outlier article, in their efforts to develop a conceptual model for minimum staffing levels and adequate skills mix that support safe, high-quality care in residential settings, posited that both staffing levels and skills mixes are necessary but not sufficient for safe, high-quality care. In addition to minimum staffing levels and adequate skills mix, any staffing requirements developed should consider education, training, staff attitude, and continuity of care as important factors (Peters et al., 2021).

A.2.2 Current State and Federal Standards for Staffing Levels and Types

Key Findings

- Federal nursing home staffing regulations are relatively minimal, and requirements for staff types that nursing homes must have available are often non-specific. Federal regulations do not specify the types of staff that must be employed or the staffing levels required per resident.
- Currently, 38 states plus the District of Columbia have minimum nursing home staffing standards, which vary widely.
- Many states changed nursing home staffing requirements in response to the COVID-19 public health emergency (PHE), though the nature of these changes varied. Some states increased staffing requirements, others loosened staffing regulations to make it easier for nursing homes to meet requirements under staffing shortages, and others broadened how they define direct care staff.
- Empirical evidence on the effect of staffing regulations on nursing home staffing levels and quality of care is limited; however, literature suggests that federal nursing home staffing regulations do not ensure adequate nursing home staffing.

Federal Staffing Regulations

Federal nursing home requirements related to staffing are often non-specific, and they do not specify the types of staff that must be employed or staffing levels required per resident (Nursing Services, 1989). As of August 2022, federal regulations stated that an RN must be on site eight hours a day, for seven days a week (42 C.F.R. § 483.35(b)(1)), and that nursing homes must have licensed nurses and other nursing personnel (e.g., nurse aides) available 24 hours a day (42 C.F.R. § 483.35(a)(1)(i)). As the National Consumer Voice for Quality Long-Term Care (Consumer Voice) notes in its State Nursing Home Staffing Standards *Summary Report,* "the regulations do not specify that these hours must be dedicated to direct care only, meaning that facilities are able to meet this requirement by including hours from registered nurses performing administrative duties" (2021, p. 3). A nursing home must also have a full-time RN director of nursing (DON) (42 C.F.R. § 483.35(b)(2)) and a licensed nurse (either RN or LPN) serving as a charge nurse on each tour of duty (42 C.F.R. § 483.35(a)(2)). If a facility has a daily occupancy of 60 residents or fewer, the DON may serve as the charge nurse (42 C.F.R. § 483.35(a)(3)).

Federal regulations require that facilities provide staff sufficient to "ensure resident safety and attain or maintain the highest practicable physical, mental, and psychosocial well-being of each resident," which facilities should determine through "resident assessments and individual plans of care and considering the number, acuity, and diagnoses of the facility's resident population" (42 C.F.R. § 483.35). As Consumer Voice notes, absent a clear definition of how much nursing staff is considered sufficient, "each nursing home can decide for itself how many certified nursing assistants and nurses to assign, leaving open the possibility that a facility can cut staffing levels dangerously low" (2021, p. 3).

State Staffing Regulations

According to a Medicaid and CHIP Policy and Access Commission (MACPAC) report, 38 states plus the District of Columbia currently have minimum nursing home staffing standards that exceed what would be

required for a 100-bed facility to comply with the federal nursing home staffing regulations, which vary widely. That report reviewed each state's nursing home staffing policies from 2016 through 2021, finding that each state's policies were intended to encourage adequate staffing despite the variations in required staffing levels (MACPAC, 2022a). Nine states have total nurse staffing standards of less than 2.0 HPRD, 18 states have total nurse staffing standards between 2.1 and 3.0 HPRD, 11 states and the District have total nurse staffing standards greater than 3.0 HPRD for facilities with 100 or more beds. The District has the only minimum standard of at least 4.1 HPRD (MACPAC, 2022b). Only six states require an RN on site 24 hours a day regardless of facility size (Consumer Voice, 2021).

Many states changed nursing home staffing requirements in response to the COVID-19 PHE, though the nature of these changes varied.

Multiple states made changes intended to increase overall nursing home staffing. At least five states permanently increased minimum staffing standards in response to the COVID-19 PHE (Musumeci et al., 2022). In response to actual or anticipated staffing shortages, some states loosened staffing regulations to make it easier for nursing homes to meet requirements. At least three states decreased minimum nursing home staffing requirements, with two intending the decreases to be temporary and one making the decrease permanent (Musumeci et al., 2022). MACPAC (2022b) also reported that 15 states reduced direct care staff training requirements, with four having since rescinded this flexibility.

At least two states made changes to the definitions of direct care staff, either by including more staff types to count toward minimum staffing requirements or by excluding staff types previously counted toward the minimums. Arkansas broadened the definition of direct care staff from nurse aides and licensed nurses to include any licensed or certified health care professionals providing direct care through interpersonal resident contact or care management—for example, medication assistants, physicians, physician assistants, physical or occupational therapists or therapy assistants, respiratory therapists, speech-language pathologists, and infection preventionists—to all count towards the state's staffing requirement. Rhode Island narrowed its direct care staff definition to exclude DON hours (Musumeci et al., 2022).

Some states restructured how daily minimum staffing hours are allocated across staffing types or shifts, without affecting their total daily minimum staffing hours. Florida increased the number of LPN hours and added personal care attendant hours, while decreasing the number of CNA hours. New Jersey divided the daily minimum staffing hours to set specific HPRD requirements during each of the three shifts in a day—day shift, evening shift, and night shift (Musumeci et al., 2022).

Impact of Staffing Regulations on Staffing Levels and Quality of Care

Though there is little recent evidence on the effect of staffing regulations on nursing home staffing levels and quality of care, literature suggests that the limited existing federal nursing home staffing regulations are not always met. According to a 2020 Office of the Inspector General (OIG) report, in 2018 approximately 7 percent of nursing homes were below the federally required RN staffing levels on at least 30 total days during the year. A 2019 cross-sectional analysis of facility-level data found that although nursing homes almost always met the federal RN staffing requirement, many facilities were frequently below the staffing levels expected to meet resident care needs based on resident acuity (Geng et al., 2019). A recent MACPAC report that discussed the impact of state staffing requirements found that states with higher minimum staffing standards had higher staffing levels, but it did not evaluate the magnitude of the effect (Gerber & Nelb, 2022).

Currently, CMS's Nursing Home Care Compare includes staffing ratios in its Five-Star ratings. Though Care Compare does not specify staffing minimums, the staffing component of the Five-Star rating is a federal policy related to nursing home staffing levels. A 2019 study of nursing home spending and reported staffing quality following the implementation of the Five-Star system suggests nursing homes might have started to report higher staffing levels than they employed throughout the year, to improve

their ratings (Sharma et al., 2019). Because licensed nurses are expensive to employ, there could be an incentive for nursing homes to alter their licensed nurse staffing to maximize quality ratings while also cutting costs.

A.2.3 Role of Different Nurse Types in Ensuring Safety and Quality of Care

Key Findings

- Registered nurses are more likely to be assigned administrative roles in nursing homes and play key roles in resident assessment and care planning, which typically results in less hands-on time with residents and their needing non-clinical skills (e.g., managerial and time management skills).
- CNAs spend the most time with residents and are, therefore, most familiar with resident preferences. With additional training, CNA roles could be expanded to benefit residents in areas such as dementia care, infection control, behavioral health, and chronic diseases. More-comprehensive training across varied care domains (e.g., dementia care, personal care, meal preparation, and laundry) might help CNAs assume greater responsibility for, and could improve, both quality of care and quality of life for residents.
- Though nurse practitioners and advanced practice registered nurses (APRNs) are typically not the focus of nursing home staffing research, they may meaningfully contribute to improved resident outcomes.
- All nurse types face their own challenges in a nursing home setting, including relatively low pay and increasing responsibility. CNAs are more likely to have second jobs and had the longest work hours. Both CNAs and LPNs may also experience increasing responsibilities in their roles and may be asked to perform roles outside their scope.

Nurse Types Employed in Nursing Homes

Nursing homes employ several nurse types, with each type responsible for different aspects of resident care. **Exhibit A.2.1** provides an overview of different nurse types and their typical level of training and responsibilities.

Each nurse type reflects differing administrative responsibility and resident interaction and, therefore, can have a different influence on a resident's clinical care and quality of life. Because of the unique role each nurse has within a nursing home, advocacy groups recommend that RNs, LPNs, and CNAs be given separate minimum staffing requirements (Mollot, 2022).

Exhibit A.2.1: Nursing Home Nurse Types and Associated Training and Responsibilities

Nurse Type	Educational Training	Typical Responsibilities
Certified nursing assistant (CNA), nurse aide1	75 hours of training	Assist residents with activities of daily living (e.g., feeding, bathing, dressing)
Licensed practical/vocational nurse (LPN)	At least a 1-year degree	Provide routine bedside care (e.g., taking vital signs)
Registered nurse (RN)	At least a 2-year degree	Oversee resident care
Nurse practitioner, advanced practice registered nurse (APRN)	At least a master's degree and board certification2	Provide medical care (e.g., assessing residents, ordering tests and prescriptions)

[1]CNAs have passed a certification exam, but typical responsibilities are the same. Nurse aides typically take the certification exam after receiving their initial on-the-job training.
[2]There can be exceptions to board certification for certain types of APRNs.
Source: U.S. Government Accountability Office (2021); NurseJournal (2022)

When RNs have administrative roles, they typically spend less hands-on time with residents and need to possess non-clinical skills (e.g., managerial skills). For example, RNs primarily serve as a nursing home's DON or the director of quality and safety (Bonner et al., 2022). They are more likely to set priorities and have effective time management skills than are less-skilled nurse types (Burt, 2019). RNs are increasingly asked to supervise complex tasks and to delegate these tasks to licensed nurses and CNAs, so they need to be skilled at motivating staff, decision-making, problem solving, and use of best practices (Bakerjian et al., 2021). Though RNs might not interact with residents and families as much as other nurse types, RNs believe their interactions with residents, families, and medical providers affect resident care decisions (Firnhaber et al., 2020). Though administrative roles such as those held by RNs are important, advocacy groups suggest applying minimum staffing requirements to direct care nurses rather than those in administrative roles (Mollot, 2022).

In addition to supervising LPNs, RNs directly influence quality of care. They play key roles in infection control, resident assessments, and care planning (CALTCM, n.d.). Indeed, when RNs or licensed nurses are not available to supervise staff, resident care needs (e.g., bathing, grooming, and toileting) might not be met—leading to adverse outcomes (OIG, 2020). One systematic review of 26 U.S. studies showed that a higher RN presence decreased pressure ulcers among residents (Clemens et al., 2021). Another study found that nursing homes with higher RN HPRD than the national average had lower rehospitalization rates and fewer emergency department visits than did nursing homes with higher LPN or CNA HPRD (Yang et al., 2021). A separate cross-sectional study similarly concluded lower total RN staffing hours were correlated with higher rates of rehospitalizations and emergency department visits (Min & Hong, 2019).

Literature specific to the role of LPNs is limited; however, evidence suggests that they might have more-limited resident relationships than other nurse types do. A study of nursing home staff roles in the southeastern United States found that LPNs discussed resident relationships less than did both CNAs and RNs; when faced with resident care decisions, they often turned to the RN on duty or the DON (Firnhaber et al., 2020). LPNs are responsible for documentation, including verifying and expanding on CNA-reported resident information before providing it to higher-level clinicians (Firnhaber et al., 2020).

CNAs spend the most time with residents and are, therefore, most familiar with resident preferences, such as the resident's favorite sweater or how they like their coffee. However, processes for communicating these preferences to others are often lacking (Bonner et al., 2022). In a recent qualitative study, all participating CNAs reported experiencing a close relationship with at least one resident or their family member and believed those relationships affected decisions about resident care. Unlike RNs, CNAs did not believe that their interactions with medical providers affected resident care decisions (Firnhaber et al., 2020).

Some literature posits that with additional training, CNA roles can be expanded to benefit residents. A 2022 Consensus Study Report from the National Academies recommends competency-based CNA training in areas such as dementia care, infection control, behavioral health, chronic diseases, and cultural sensitivity and humility. Reflecting on the Green House model of nursing home care, a recent AARP article suggested that more-comprehensive training of CNAs across multiple, varied care domains (e.g., dementia care, personal care, meal preparation, and laundry), rather than specializing in just one or two more-finite domains, would allow CNAs to be more responsive to resident needs "in the moment" (Reinhard & Hado, 2021). As a result, CNAs could be given greater responsibility for, and might improve, both quality of care and quality of life for residents.

The literature review indicated that nurse practitioners and APRNs are typically not the focus of nursing home staffing research but can meaningfully contribute to improved resident outcomes. Two recent perspective pieces discuss the role of advanced nursing in long-term care. The first noted the knowledge and skill APRNs bring to nursing home care; that they can engage staff (e.g., providing "on the spot" education, advocating for evidence-based practices) to improve quality of care and can offer clinical care beyond that of RNs, such as primary care management (Bakerjian, 2022). Indeed, the author opined that nursing homes should be required to hire APRNs. The second study similarly summarized evidence supporting the idea that nurse practitioners can reduce emergency department visits, reduce pain, improve functional status, and improve outcomes for frail residents. However, its authors also note that although nurse practitioners have an expansive scope of practice in some states, other states restrict their role and require significant physician oversight. Lessening these restrictions could improve access to quality nursing home care at lower cost (Katz et al., 2021).

Some studies discuss the role of nurses in specific clinical processes and outcomes, including antibiotic use for urinary tract infections (UTIs), and COVID-19 cases. Though physicians are ultimately responsible for final diagnostic and prescribing decisions for residents with a suspected UTI, physicians rely on the information nurses collect, interpret, and deliver to them. Additionally, long-term care nurses often have specific knowledge about the risks and side effects of unnecessary antibiotic use in older adults; as a result, they might take on informal antibiotic stewardship roles (Valmadrid et al., 2021). With respect to COVID-19, different nurse types had different relationships with the probability of having COVID cases. Higher RN hours were associated with a higher probability of having any COVID cases, but higher nurse aide hours and higher total nursing hours were associated with a lower probability of an outbreak and fewer deaths (Gorges & Konetzka, 2020).

All nurse types face their own challenges in a nursing home setting, including relatively low pay and increasing responsibility. RNs who work in nursing homes are often paid significantly less than RNs who work in hospitals; they receive much of their training, such as how to effectively supervise care, on the job (Harris et al., 2022). An analysis of Work, Family, and Health Study data found that CNAs, who have lower incomes than both RNs and LPNs, were more likely to have second jobs and had the longest work hours (Van Houtven et al., 2020). Both CNAs and LPNs also can experience increasing responsibilities in their roles. A recent opinion piece expressed concern over evidence suggesting that RNs and LPNs are starting to be "used interchangeably," leading LPNs to perform tasks outside their scope of practice (Bakerjian et al., 2021). CNAs have experienced this as an impact of the COVID-19 PHE, as reported in a recent qualitative study. That study found that 68 percent of CNAs reported having added responsibilities (e.g., more cleaning responsibilities) and performing tasks beyond their scope of work—such as enforcing protocols, non-clinical care such as hairstyling, and moving residents within the facility (Snyder et al., 2021).

A.2.4 Costs Associated with Nurse Staffing

Key Findings

- Several factors contribute to the cost of nurse staffing, including direct labor costs associated with the types of nurses a facility employs, costs associated with nurse turnover and retention, and recent costs caused by the COVID-19 PHE.
- The type of staff whose numbers are increased will affect the associated costs, with more highly trained nurses (RNs and LPNs) being more expensive to hire than non-licensed nursing staff such as CNAs.
- Maintaining existing nursing home staffing levels has become more difficult and more expensive due to the COVID-19 PHE's impacts on the labor market. Increased wages might help ensure high-quality care and low staff turnover, but they can also be costly for nursing homes to implement.
- A recent analysis reported that a minimum staffing requirement of 4.1 HPRD would cost the long-term care industry more than $10 billion, requiring approximately 187,000 additional nurses (CNAs, LPNs, RNs), and. It highlighted the risk that nursing homes might be unable to afford additional staff and would instead decrease resident census to meet HPRD requirements, putting more than 200,000 residents at risk of displacement.
- For the 22 percent of facilities nationwide that do not currently have 24-hour RN staff, increasing their staffing to that level would cost $75 million annually.
- Leveraging existing funding sources could help to offset the cost of improving resident care through minimum staffing requirements.

Factors Contributing to the Cost of Nurse Staffing

Several different factors contribute to the cost of nurse staffing, including direct labor costs associated with the types of nurses a facility employs, and costs associated with nurse turnover and retention—the latter of which has been exacerbated by the COVID-19 PHE. Though increased staffing levels incur additional costs, maintaining trained, compensated, and sufficient staff is vital for residents to receive quality care to justify the expense (Edelman, 2022).

The type of staff employed or increased will affect the associated costs. Commensurate with their relative training levels, RNs had the highest median hourly wage rate in 2022 ($34.58), followed by LPNs ($26.46) and CNAs ($16.87) (LeadingAge, 2022). Though RNs have the highest wages, one study found that for nursing homes with care deficiencies, deficiencies were most improved by increasing administrative nursing and social services staff (Bowblis & Roberts, 2020). However, a higher RN skill mix was associated with lower nursing home operating margins and financial performance (Weech-Maldonado, Lord et al., 2019; Weech-Maldonado, Pradhan et al., 2019). Higher LPN HPRD was also associated with poorer financial performance in one study (Weech-Maldonado, Pradhan et al., 2019).

In addition to direct labor costs, nursing staff turnover or poor staff retention can be costly for nursing homes. High turnover is associated with poorer quality of care and quality of life for residents, more complaints, and more instances of abuse (Kennedy et al., 2020; Consumer Voice, 2022). CNA turnover is particularly related to resident mortality, worse resident safety culture, and more quality-of-care

deficiencies. Based on national 2015 data, one study found that CNAs tend to have high turnover rates (average annual rate of 54.7 percent) and low retention rates (average annual rate of 63.8 percent) (Kennedy et al., 2020). Higher CNA turnover was generally found in facilities that are part of a chain, have higher levels of DON turnover, have low CNA empowerment, or have higher percentages of residents with psychiatric illness (Kennedy et al., 2020).

Maintaining existing nursing home staffing levels has become more difficult and more expensive because of the COVID-19 PHE's impacts on the labor market. A 2020 Assistant Secretary for Planning and Evaluation report found that the PHE contributed to staffing shortages and health care worker attrition, thereby pushing nursing homes to create and implement new recruitment infrastructures, increase wages, and augment benefits to retain staff (Denny-Brown et al., 2020). A LeadingAge (2022) report also presented data showing that hourly wages for RNs, LPNs, and CNAs in 2022 increased amidst COVID-19 and staffing issues.

Costs of Implementing Minimum Nurse Staffing Standards

Projected costs of implementing a minimum staffing requirement range are mostly estimated in the billions. In 2022, a consulting firm analyzed Payroll Based Journal (PBJ) data and Medicare cost reports on behalf of the American Health Care Association to determine the costs to the long-term care industry if various minimum staffing standards were to be implemented. Its analysis found that a minimum staffing requirement of 4.1 HPRD would cost the long-term care industry more than $10 billion, requiring approximately 187,000 additional nurses (CNAs, LPNs, RNs). A requirement of 3.6 HPRD would cost the industry more than $6.4 billion, requiring approximately 115,000 additional nurses. A requirement of 3.1 HPRD would cost the industry more than $3.5 billion, requiring approximately 60,000 additional nurses (CLA, 2022). Hawk and colleagues (2022) estimated that a 4.1 HPRD threshold would represent an additional $7.5 billion in salary costs.

The CLA report also highlighted the risk that nursing homes might be unable to afford additional staff and would instead decrease resident census to meet HPRD requirements. More than 900,000 residents are in facilities below 4.1 HPRD. The report noted that if facilities reduce their census to meet a 4.1 HPRD staffing requirement, more than 200,000 residents could be displaced. More than 600,000 residents are in facilities below 3.6 HPRD. If facilities reduce their census to meet this staffing requirement, more than 100,000 residents could be displaced. More than 300,000 residents are in facilities below 3.1 HPRD. If facilities reduce their census to meet this staffing requirements, almost 70,000 residents could be displaced (CLA, 2022).

A 2021 Long Term Care Community Coalition (LTCCC) data report estimated the annual cost of reaching 24-hour RN staffing in all nursing homes to be $75 million. LTCCC believes this figure is more reasonable than the billions cited by others, because facilities can replace some LPNs with RNs rather than adding new nurse staff. Based on the report's 2021 data, roughly 22 percent of nursing homes nationwide do not currently employ 24-hour RN staff; to do so would cost a facility $61.82 per day on average. That is equivalent to more than $200,000 per day to achieve 24-hour RN staffing nationwide. Across the 22 percent of facilities that do not currently have 24-hour RN staff, increasing their staffing to that level would cost $75 million annually (LTCCC, 2021).

Methods for Achieving Higher Staffing Levels

Increased wages might help ensure high-quality care and low staff turnover but can also be costly for nursing homes to implement. A 2022 presentation to MACPAC reported that facilities that paid higher wages had higher staffing rates (Gerber & Nelb, 2022). One study found that if the minimum wage were increased to $15 per hour, 76 percent of nursing assistants would receive increased wages, thereby increasing total direct labor costs in nursing homes by more than $2.5 billion (Lepore et al., 2020). Considering these potential costs, not all nursing homes are equally equipped to implement high

minimum staffing levels and higher wages to offset staff turnover (Hawk et al., 2022; Weech-Maldonado, Lord et al., 2019). Nursing facilities with high Medicaid census, larger bed size, for-profit ownership, higher county-level skilled nursing facility (SNF) competition, and higher community poverty are less able to meet proposed minimum staffing levels (Hawk et al., 2022). High Medicaid census nursing homes are at risk for financial strain, and therefore closure, even before considering increased wages (Weech-Maldonado, Lord et al., 2019).

Leveraging existing funding sources might help to offset the cost of improving resident care through minimum staffing requirements. A 2021 special report from the Center for Medicare Advocacy proposed several ways to better divert funds toward resident care, including eliminating or restricting related-party transactions or provider self-dealing; requiring facilities to assign funds to a specifically designated cost category that facilities would be prohibited from shifting funds into or out of; and enacting direct care ratios that require facilities to spend specific portions of their reimbursement on resident care and services, thereby limiting spending on profit and administration (Edelman, 2021). Similarly, a 2022 National Academies Consensus Study Report recommended designating a specific percentage of Medicaid and Medicare payments to direct care services (e.g., to staff and wages).

A.3 Literature Review Support Tables: Relationship of Nurse Staffing Levels with Safety and Quality of Care

- For summary descriptions of the literature reviewed, refer to Exhibit A.3.1: Literature Summary Table: Relationship of Nurse Staffing Levels with Safety and Quality of Care
- For details on the Evidence Grade, refer to Exhibit A.3.2: Evidence Grading Table: Relationship of Nurse Staffing Levels with Safety and Quality of Care
- For details on the Alignment Rating, refer to Exhibit A.3.3: Definitions Alignment Table: Relationship of Nurse Staffing Levels with Safety and Quality of Care

Exhibit A.3.1: Literature Summary Table: Relationship of Nurse Staffing Levels with Safety and Quality of Care

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
1. Bakerjian, D., Boltz, M., Bowers, B., Gray-Miceli, D., Harrington, C., Kolanowski, A., & Mueller, C. A. (2021). Expert nurse response to workforce recommendations made by the Coronavirus Commission for Safety and Quality in Nursing Homes. *Nursing Outlook, 69*(5), 735–743. https://doi.org/10.1016/j.outlook.2021.03.017	Peer-reviewed	U.S. nursing homes	n/a	**Position paper** providing recommendations to federal policymakers for meaningful nursing home reform in response to the Final Report of the Coronavirus Commission on Safety and Quality in Nursing Homes	n/a	Meaningful nursing home reform should: 1. Ensure 24/7 RN coverage and adequate compensation. 2. Ensure RNs have geriatric nursing and leadership competencies. 3. Increase efforts to recruit and retain the nursing home workforce, particularly RNs. 4. Support care delivery models that strengthen the role of the RN for quality resident-centered care.	Not evidence, but rather policy recommendations	n/a	Some	None
2. Cai, S., Yan, D., & Intrator, O. (2021). COVID-19 cases and death in nursing homes: The role of racial and ethnic composition of facilities and their communities. *Journal of the American Medical Directors Association, 22*(7), 1345–1351. https://doi.org/10.1016/j.jamda.2021.05.002	Peer-reviewed	U.S. nursing homes	In total, included 12 weeks of data (between the week of June 7, 2020, and the week of August 23, 2020) for 13,123 nursing homes in the United States	Estimated a set of linear probability models with nursing home random effects and robust standard errors (clustered at county level) to examine the probabilities of any COVID-19 infection and COVID-19 deaths	• CMS Nursing Home COVID-19 Data • Certification and Survey Provider Enhanced Reports (CASPER) data • CMS Nursing Home Compare 2020 May data • 2018 Minimum Data Set • Several types of publicly available community-level data were obtained and linked,	• The relationship between higher RN staffing and lower likelihood of any nursing home COVID-19 cases was stronger in high-minority communities than in low-minority communities. Nursing homes with higher RN staffing may have been better prepared to implement and manage the procedures of infection control in nursing homes. • Found that higher CNA staffing was associated with a higher probability of COVID-19 infection and death in nursing homes	• Although this study examined the probabilities of COVID-19 cases and deaths across nursing homes and communities with different racial and ethnic composition, it was unable to determine the underlying reasons for such variations. • This was a facility-level analysis, and the study was unable to account for individual	High	Some	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
					including county-level COVID-19 infection data, the Area Health Resource File, LTCFocus data, and the American Community Survey data.	located in high-minority communities but was not associated with COVID-19 cases or death in low-minority communities. Several reasons could contribute to this observed relationship: • First, it is possible that CNAs are likely to be from the communities where nursing homes are located. Communities with a higher percentage of racial and ethnic minorities are more likely to be economically deprived and have higher COVID-19 rates, and thus might amplify the risks of cross-infections between CNAs and staff members. • Or as many CNAs live in poverty, they are likely to use public transportation to work, which increases their exposure to COVID-19 outbreaks in high-minority communities. • Lastly, as nursing homes in high-minority communities are more likely to be resource deprived, they could have less capacity to implement necessary infection control protocols and have a higher risk of cross-infection between residents and their direct care workers.	resident characteristics, which could also be related to the likelihood of COVID-19 infection or death. • Nursing home staffing is likely to change with the COVID-19 outbreak in nursing homes. The study was only able to account for the staffing level prior to the pandemic and was not able to capture the effects of time-varying staffing levels during the pandemic.			

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
3. Clemens, S., Wodchis, W., McGilton, K., McGrail, K., & McMahon, M. (2021). The relationship between quality and staffing in long-term care: A systematic review of the literature 2008–2020. *International Journal of Nursing Studies, 122*(October), 104036. https://doi.org/10.1016/j.ijnurstu.2021.104036	Peer-reviewed	Long-term care residents in nursing homes in Canada, the U.S., United Kingdom, Europe, New Zealand, and Australia	• 11,096 studies were identified, of which 34 were included in this review, published between January 2008 and June 2020. • Most studies were conducted in the U.S. (n = 26, 76%), with Canada and Switzerland contributing two studies each, and Norway, Italy, Belgium, and the Netherlands contributing one study each.	Systematic review	Published articles focused on quality and nursing and personal care staffing in long-term care in peer-reviewed databases (MEDLINE, CINAHL, and AGELINE) and several Cochrane databases to retrieve studies published between January 2008 and June 2020	• Evidence on the relationships between quality and long-term care staffing level and skill mix remains mixed. • Higher staffing levels and skill mix generally supported better rather than worse outcomes. • Significant and consistent findings were more evident when staffing levels were further analyzed by indicator and staffing category. • This study found that RNs were consistently associated with a reduction in pressure ulcers, and all three staffing categories of RN, LPN and nurse aide were consistently associated with reduced restraints. • Also, total nursing staff was consistently associated with reduced hospitalizations and deficiencies. • Total nursing staff was consistently associated with reduced hospitalizations and deficiencies. Skill mix findings were also mixed, • Higher proportions of RN care were associated with better outcomes (e.g., fewer deficiencies).	This study excluded gray literature, reducing the amount of potentially relevant evidence.	High	Some	Some

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
4. Figueroa, J. F., Wadhera, R. K., Papanicolas, I., Riley, K., Zheng, J., Orav, E. J., & Jha, A. K. (2020). Association of nursing home ratings on health inspections, quality of care, and nurse staffing with covid-19 cases. *JAMA: Journal of the American Medical Association, 324*(11), 1103–1105. https://doi.org/10.1001/jama.2020.14709	Peer-reviewed	U.S. nursing homes across eight states (California, Connecticut, Florida, Illinois, Maryland, Massachusetts, New Jersey, and Pennsylvania)	4,254 nursing homes	**Three separate ordinal logistic regression models** using existing data from nursing homes and Nursing Home Compare	• COVID data from eight state health departments • CMS Nursing Home Compare star ratings	• Across eight states, high-performing nursing homes in terms of nurse staffing had fewer COVID-19 cases than low-performing nursing homes. • These findings suggest that poorly resourced nursing homes with nurse staffing shortages may be more susceptible to the spread of COVID-19.	Does not break down all the same staffing categories as our Staffing Study	Medium	Some	None
5. Gorges, R. J., & Konetzka, R. T. (2020). Staffing levels and COVID-19 cases and outbreaks in US nursing homes. *Journal of the American Geriatrics Society, 68*(11), 2462–2466. https://doi.org/10.1111/jgs.16787	Peer-reviewed	All nursing homes in the CMS COVID-19 Nursing Home Dataset with reports that passed the CMS Quality Assurance Check as of June 25, 2020	The study sample consists of 13,167 nursing homes, the 85% of facilities in Nursing Home Compare (NHC) that reported COVID-19 data for at least one of the first four weeks of CMS reporting and have staffing hours in NHC	• Used multivariable regressions to determine the adjusted association between staffing levels and COVID-19 cases/outbreaks • Conducted two sets of regressions for each outcome, one examining the individual effects of nurse aide, LPN, and RN hours and one examining the effect of total nursing hours and RN hours/total nursing hours • Controlled for facility size, ownership type, chain status, percentage of Medicaid residents, percentage of white residents, metropolitan status, and county cases per capita. Standard errors are clustered by state.	• COVID-19 Nursing Home Dataset7 released by CMS on June 25, 2020 • NHC archives • LTCFocus	• Among facilities with at least one COVID case, high nurse aide hours and high total nursing hours are associated with a lower probability of outbreak and fewer deaths. • The prevalence of COVID-19 in the community remains the strongest predictor of COVID-19 cases and deaths in nursing homes, but higher nurse aide hours and total nursing hours may help contain the number of cases and deaths.	CMS required reporting beginning May 8, and facilities have the option to report cases/deaths going back to January 1. As a result, the CMS data on total cases/deaths represent an undercount, especially in states that experienced early outbreaks.	Medium	Good	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
6. Gray-Miceli, D., Rogowski, J., de Cordova, P. B., & Boltz, M. (2021). A framework for delivering nursing care to older adults with COVID-19 in nursing homes. *Public Health Nursing, 38*(4), 610–626. https://doi.org/10.1111/phn.12885	Peer-reviewed	All nursing homes in New Jersey	All nursing homes in New Jersey	• This paper is organized using the modified Mitchell's Quality Health Outcomes Model (QHOM), a dynamic, multidimensional model of contextual factors operative within health care systems that impact the delivery of nursing and health care to nursing home residents. • The broad aim of this narrative review was to analyze evidence on COVID-19 incidence in NJ nursing homes from the geriatric literature, policy papers, and databases, and then to use this information to illustrate the impact of the virus on the delivery of nursing care to OAs within these nursing homes and to offer tangible recommendations.	Geriatric literature, policy papers, and databases such as the CMS COVID-19 nursing home data, CDC WONDER Online Database, U.S. Bureau of Labor Statistics, U.S. Census Bureau; and others	Recommendations: • All nursing home residents require an increase in the number of hours devoted to the provision of their daily care needs to meet the minimum recommendations outlined by the CGNO (4.1 hr. per resident day) and to allow nursing home staff to perform care activities reasonably and safely. • Increase in the skill mix ratio to include a greater proportion of professional nursing staff (RNs) within each nursing home who are solely engaged in clinical roles and not solely engaged in joint clinical/administrative roles (in joint positions, nursing administrators are also engaged in clinical assessments)	• A case study of New Jersey nursing homes, which may not be representative of all U.S. nursing homes • A summary of secondary data sources with no statistical analyses	n/a	Some	None
7. Harrington, C., Dellefield, M. E., Halifax, E., Fleming, M. L., & Bakerjian, D. (2020). Appropriate nurse staffing levels for US nursing homes. *Health Services Insights*, 13, 1–14. https://doi.org/10.1177/1178632920934785	Peer-reviewed	U.S. nursing homes	n/a	This paper presents a guide for determining whether a nursing home has adequate and appropriate nurse staffing.	Previous nursing home staffing research and Staff Time Measurement data, PBJ data	The total recommended staffing HPRD ranges from 4.49 to 6.77 depending on facility characteristics and level of resident acuity. **Recommended minimum staffing levels for levels of acuity:** • Extensive services: 1.85 RN HPRD, 1.36 LVN/LPN HPRD, 3.6 nurse aide HPRD (Total 6.81) • Special care high: 1.36 RN HPRD, 0.84 LVN/LPN HPRD, 3.4 nurse aide HPRD (Total 5.61)	A summary of secondary data sources with no statistical analyses	n/a	Good	Some

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
						• Special care low: 1.36 RN HPRD, 0.84 LVN/LPN HPRD, 3.4 nurse aide HPRD (Total 5.61) • Clinically complex: 1.03 RN HPRD, 0.67 LVN/LPN HPRD, 3.20 nurse aide HPRD (Total 4.90) • Behavioral symptoms: 0.75 RN HPRD, 0.55 LVN/LPN HPRD, 3.0 nurse aide HPRD (Total 4.30) • Reduced physical function: 0.75 RN HPRD, 0.56 LVN/LPN HPRD, 3.2 nurse aide HPRD (Total 4.51)				
8. Harris, J. A., Engberg, J., & Castle, N. G. (2020). Organizational and geographic nursing home characteristics associated with increasing prevalence of resident obesity in the United States. *Journal of Applied Gerontology, 39*(9), 991–999. https://doi.org/10.1177/0733464819843045	Peer-reviewed	U.S. nursing homes	14,812 nursing homes in the U.S.	• **Bivariate linear regression** • Derived the conceptual framework for understanding the effect of obesity on facility characteristics from profit maximization theory. Profit maximization theory holds that rational organizations will determine the price and output quantity that leads to the greatest profit.	Minimum Data Set (MDS) from 2013 was used to define obesity prevalence rate for each nursing home in the U.S.	• Higher LPN and RN staffing hours were associated with a lower nursing home obesity prevalence rate. • Nursing homes with a higher prevalence of residents with obesity and severe obesity often have lower staffing levels of nurse aides and licensed nurses.	The main outcome, nursing home obesity prevalence rate, may not specify the population of interest most effectively: the residents with obesity who have care needs that require the most resources and facilities.	High	Some	None
9. Henning-Smith, C., Cross, D., & Rahman, A. (2021). Challenges to admitting residents: Perspectives from rural nursing home administrators and staff. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 58*. https://doi.org/10.1177/00469580211005191	Peer-reviewed	Rural U.S. nursing homes	• 209 rural nursing homes in the U.S. who are Medicare-certified as an SNF • Nursing homes were classified as being located in a rural area if they were located in a nonmetropolitan county, either micropolitan (generally, a county with a population	• Exploratory, observational study • Descriptive statistics • Qualitative coding of open-ended questions	Surveys asking administrators (or other designated staff) about the challenges of admitting results for both short- or long-stay, from both hospital and community settings, were conducted by the HealthPartners Survey Research Center between April and December 2017.	• Administrators focused primarily on staffing concerns, as well as space and equipment needs, that created key structural challenges to high-quality care across all complex resident groups. • Staffing issues included recruiting, retaining, and training staff in their rural communities, especially staff with particular expertise in each condition or especially	• Administrators' responses were not coupled with responses from nursing home staff/residents, and this may introduce response bias. • Nonrespondents were more likely to be in micropolitan rural counties and have larger facilities. This may	High	Some	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
			center of 10,000-49,999 people) or noncore (generally, a county with no population center of 10,000 or more).			in cases when conditions require additional training (e.g., wound care).	bias the results toward smaller, more rural facilities.			
10. Kingsley, D. E., & Harrington, C. (2022). Financial and quality metrics of a large, publicly traded U.S. nursing home chain in the age of Covid-19. *International Journal of Health Services, 52*(2), 212–224. https://doi.org/10.1177/0020731422107764 9	Peer-reviewed	U.S. nursing homes under the ownership of The Ensign Group Inc. between March 2020 and May 2021	198 nursing homes with a total of 21,770 beds in March 2020 and May 2021	Descriptive case study design to develop an in-depth and focused analysis of a high-growth, publicly traded nursing home chain	• Used Ensign's own public reports to the U.S. Securities and Exchange Commission (SEC) from Ensign's SEC annual 10 K reports • For quality measures, researchers used data from CMS for March 2020 prior to the pandemic and for October 2020 and May 2021, during the pandemic. • Researchers also collected data on Ensign's board members' and executives' stock shares and percentage of ownership from SEC Schedule 14A proxy statements for 2008 to 2020.	• Ensign's RN staffing was 88% lower than the national average prior to the pandemic and dropped to 84% in May 2021. • Ensign's CNA staffing levels were 2.15 to 2.19 HPRD during 2020 to 2021 compared to a minimum recommended level by experts of 2.8 CNA HPRD (78% of recommended). • Its RN staffing levels were 0.61 to 0.65 HPRD • Overall, Ensign staffing ratings were below the national average (2.8 stars out of 5 for total and RN staffing in 2021). • Ensign had a slightly higher number of deficiencies and weighted deficiency scores than the U.S. average, both before and after the pandemic. • Even though Ensign has remarkable financial resources to operate its nursing homes, its strategy has been to keep its staffing levels low to maximize profits, based on evidence of its low staffing prior to and during the 2020 to 2021 pandemic. Because Ensign had many Medicare short-term residents with high resident acuity needs, its staffing levels probably	This study did not cite any limitations.	Medium	Good	Good

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
						should have been much higher. • With its low staffing and below-average survey ratings prior to the pandemic, Ensign reported higher COVD-19 resident infection rates than the U.S. average facility, although its reported death rates were about the national average.				
11. Kolanowski, A., Cortes, T. A., Mueller, C., Bowers, B., Boltz, M., Bakerjian, D., Harrington, C., Popejoy, L., Vogelsmeier, A., Wallhagen, M., Fick, D., Batchelor, M., Harris, M., Palan-Lopez, R., Dellefield, M., Mayo, A., Woods, D. L., Horgas, A., Cacchione, P. Z., & Carter, D. (2021). A call to the CMS: Mandate adequate professional nurse staffing in nursing homes. *AJN American Journal of Nursing, 121*(3), 24–27. https://doi.org/10.1097/01.naj.0000737292.96068.18	Peer-reviewed	U.S. nursing homes	n/a	Policy White Paper	Expert knowledge/opinion as well as literature from the years 2001–2021	Call to Action: 1. Establish and enforce a regulation that mandates a 24-hour, 7-day-a-week on-site RN presence. This RN should be someone other than the DON. 2. Establish and enforce a regulation that mandates 24-hour RN staffing levels at a minimum of one HPRD and adjusts upward for greater resident acuity and complexity. 3. Partner with professional nursing organizations to ensure that all directors of nursing in nursing homes become certified and maintain certification in core geriatric nursing and leadership competencies.	A summary of secondary data sources with no statistical analyses	n/a	None	None
12. Li, Y., Temkin-Greener, H., Shan, G., & Cai, X. (2020). COVID-19 infections and deaths among Connecticut nursing home residents: Facility correlates. *Journal of American Geriatrics Society, 68*(9), 1899–1906. https://doi.org/10.1111/jgs.16689	Peer-reviewed	Nursing homes in Connecticut	215 nursing homes in Connecticut	• Cross-sectional analysis on Connecticut nursing home COVID-19 report, linked to other nursing home files and county counts of confirmed cases and deaths • Multivariable two-part models determined the associations of key nursing home characteristics with the likelihood of at least one	• COVID-19 laboratory-confirmed cases and associated deaths in each of Connecticut's nursing homes as of April 16, 2020. These data were collected and regularly updated by the Connecticut	• Among facilities with at least one case confirmed, every 20 mins per resident day increase in RN staffing was associated with 22% fewer confirmed cases. • Compared to 1–3-star facilities, 4–5 star facilities had 13% fewer confirmed cases. • Among facilities with one confirmed case, every 20 minute increase in RN	Limited sample and short analytic period	High	Good	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
				confirmed case (or death) in the facility, and with the count of cases (deaths) among facilities with at least one confirmed case (death). • Examined distributions and used multivariable analyses.	Department of Health and Human Services, • NHC quality measures • Used LTCFocus.org to obtain data on the percentage of racial and ethnic minority residents and facility-level case mix.	staffing significantly predicted 26% fewer COVID-19 deaths.				
13. Livingstone, I., Hefele, J., Nadash, P., Barch, D., & Leland, N. (2019). The relationship between quality of care, physical therapy, and occupational therapy staffing levels in nursing homes in 4 years' follow-up. *Journal of the American Medical Directors Association, 20*(4), 462–469. https://doi.org/10.1016/j.jamda.2019.02.002	Peer-reviewed	For-profit and nonprofit U.S. nursing homes participating in Medicare and/or Medicaid	The final analytic sample includes 42,374 observations from 12,352 nursing homes, 2013–2016.	Observational study that used secondary data sources to perform panel data analyses 2013–2016	Four data sources were used: 1. Nursing Home Compare (NHC), 2. CASPER 3. The Area Health Resources File 4. Long-term Care: Facts on Care in the U.S. (LTCFocus).	• The findings demonstrate that PT/OT staffing may be important components in improving long-stay resident outcomes and overall quality. • Evidence was found in support of using a combination of both PT/OT staff and nursing staff to improve resident outcomes.	Primarily focuses on non-nursing staff, with nursing staff as a secondary consideration.	High	Some	Good
14. McGarry, B. E., Gandhi, A. D., Grabowski, D. C., & Barnett, M. L. (2021). Larger nursing home staff size linked to higher number of COVID-19 cases in 2020. *Health Affairs, 40*(8), 1261–1269. https://doi.org/10.1377/hlthaff.2021.00323	Peer-reviewed	The study sampled U.S. nursing facilities and the staff and residents within them between June 202 and September 2020.	15,071 nursing facilities in the U.S.	Retrospective cohort study examining nursing homes from June 1, 2020, to September 27, 2020, to understand the association between facilities' staff size and COVID-19 outcomes	Obtained information on COVID-19 outcomes from the CMS Nursing Home COVID-19 Public File across quartiles	• By the end of September 2020, sample SNFs in the lowest quartile of staff size had 6.2 resident cases and 0.9 deaths per 100 beds, compared with 11.9 resident cases and 2.1 deaths per 100 beds among facilities in the highest quartile. • Staff size, including staff members not involved in resident care, was strongly associated with SNFs' COVID-19 outcomes, even after facility size was accounted for. • Conventional staffing quality measures, including direct care staff-to-resident ratios	• Because of data limitations, researchers were unable to account for other factors that could be related to both staff size and COVID-19 outcomes, including the extent to which employees work in more than one nursing home. • This study estimated the association between staff size and COVID-19 outcomes in SNFs	High	Good	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
						and skill mix, were not significant predictors of COVID-19 cases or deaths. • Reducing the number of individual staff members without decreasing direct care hours, such as by relying on full-time rather than part-time staff, could help prevent outbreaks.	but was not able to account for all sources of potential confounding bias from unobserved differences across SNFs by staff size. Therefore, these results should not be interpreted as causal estimates.			
15. Min, A., & Hong, H. C. (2019). Effect of nurse staffing on rehospitalizations and emergency department visits among short-stay nursing home residents: A cross-sectional study using the US Nursing Home Compare database. *Geriatric Nursing, 40*(2), 160–165. https://doi.org/10.1016/j.gerinurse.2018.09.010	Peer-reviewed	U.S. nursing homes	11,132 U.S. nursing homes	• Cross-sectional study • Descriptive statistics: multivariate regression	Data were drawn from the 2016 NHC.	• Rates of rehospitalizations and emergency department visits were positively correlated, and nurse staffing levels simultaneously predicted rehospitalization and emergency department visit rates. • Small but significant relationships were identified between the percentage of rehospitalizations and RN HPRD and LPN HPRD. Similarly, small but significant relationships were identified between the percentage of emergency department visits and RN HPRD, LPN HPRD, and CNA HPRD. • Nursing homes with lower RN staffing ratings calculated based on only RNs HPRD were more likely to have higher rehospitalization rates. Nursing homes with lower RN staffing ratings were more likely to have higher emergency department visits.	• Although the study controlled for significant facility characteristics in the analysis, it did not account for resident-level variables that may contribute to differences in the rates of rehospitalizations and emergency department visits. • Approximately 29% of nursing homes that had not reported both rehospitalizations and emergency department visits were excluded from the study, so the results cannot be generalized to all U.S. nursing homes.	High	Some	Good

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
16. Mukamel, D. B., Saliba, D., Ladd, H., & Konetzka, R. T. (2022). Daily variation in nursing home staffing and its association with quality measures. *JAMA Network Open, 5*(3), e222051–e222051. https://doi.org/10.1001/jamanetworkopen.2022.2051	Peer-reviewed	U.S. nursing homes	2017–2018 payroll data of RNs and CNAs at 13,339 certified nursing homes	• Quality improvement study • Retrospective analyses	PBJ, Medicare Cost Reports, and Nursing Home Care Compare	• There is a significant association between three measures of daily variation and two widely accepted measures of quality, the 5-Star Survey and the 5-Star Quality Measures ranking. • Associations between the 5-Star Survey and the 5-Start Quality Measure rankings were significantly and negatively associated with staffing variation for both RNs and CNAs. • Daily RN staffing variation was more strongly associated with quality measure outcomes than daily CNA staffing variation. • Findings suggest that two facilities with the same average staffing achieve different quality of resident care and survey ratings in association with day-to-day variation in staffing. • Measures of daily staffing may enhance the value of Nursing Home Care Compare for nursing homes and others engaged in quality improvement and consumers searching for high-quality nursing homes.	The sample excluded 8% of nursing homes. The excluded facilities tended to be hospital-based, smaller, and caring mostly for Medicare beneficiaries, so the findings may not generalize to them.	High	Good	Good
17. Orth, J., Li, Y., Simning, A., Zimmerman, S., & Temkin-Greener, H. (2021). End-of-life care among nursing home residents with dementia varies by nursing home and market characteristics. *Journal of the American Medical Directors Association, 22*(2), 320–328.e324.	Peer-reviewed	Long-stay nursing home residents with Alzheimer's disease/related dementias (ADRD), age 65+ years of age, who died in 2017 in nursing homes or hospitals shortly	• N = 191,435 • 14,618 nursing homes	• Cross-sectional design • Descriptive analyses and multivariable logistic regressions	National Medicare claims, MDS, public datasets	• Decedents with ADRD in nursing homes that were nonprofit, had Alzheimer's units, had higher licensed nurse staffing, and were in more competitive markets, had better EOL care/outcomes. • Medicaid pay rate was associated with lower likelihood of Potentially Avoidable Hospitalizations	ADRD may be underdiagnosed, potentially resulting in underestimations, or conservative estimates, of associations between EOL care and outcomes and nursing home and market characteristics among residents with ADRD.	High	Some	Good

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
https://doi.org/10.1016/j.jamda.2020.06.021		after nursing home discharge				(PAHs) and hospice use, and state minimum nurse staffing requirements were associated with higher likelihood of PAHs and hospice use. • Regardless of severity level, researchers found that residents with ADRD in nursing homes with higher licensed nurse staffing were less likely to experience PAHs and use hospice care. Having more licensed nurse staff may increase capacity for on-site care and attending to unique needs of patients at EOL rather than referring them to hospice care.				
18. Peters, M. D. J., Marnie, C., & Butler, A. (2021). Delivering, funding, and rating safe staffing levels and skills mix in aged care. International *Journal of Nursing Studies. 119*(July), 103943. https://doi.org/10.1016/j.ijnurstu.2021.103943	Peer-reviewed	U.S. nursing homes	n/a	Conceptual model / literature review	n/a	• Introduced three tools related to staffing levels and skill mix determination, reporting, and funding. • Authors argue that minimum staffing levels and skill mix are the necessary foundations for the provision of adequate care in nursing homes. • The researchers' conceptual model of how determining, funding, and rating staffing levels and skills mix relate to one another and fulfill different but related purposes can be used to demonstrate how minimum staffing levels and skills mix can be understood as foundational to ensuring respectful, safe, quality care. • The researchers suggest that mandated minimum staffing levels and skills mix should operate as a baseline	A review of three different staffing models/tools with no statistical analyses or evidence from implementation	n/a	None	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
						to help to ensure provision of safe quality care, with important additional factors such as education (E), attitude (A), continuity of care (C), and other factors, such as interfaces with health and social services (O), enhancing care in an additive manner. • Ultimately, researchers suggest that any reforms in aged care designed to support the delivery of safe, quality, respectful care must be underpinned by having at least the right number of the right staff to do the work. Without this, older people in nursing homes with insufficient staffing levels and skills mixes will continue to suffer the same neglect they have for far too long.				
19. Rosenthal, M., Poling, J., Wec, A., Connolly, E., Angell, B., & Crystal, S. (2022). Medication is just one piece of the whole puzzle: How nursing homes change their use of antipsychotic medications. *Journal of Applied Gerontology, 41*(1), 62–72. https://doi.org/10.1177/0733464820958919	Peer-reviewed	14 nursing homes in 7 states (2 per state): Arkansas, California, Georgia, Maine, North Carolina, Texas, and Wisconsin	40 semi-structured interviews: 30 telephone interviews with nursing home staff (primarily nursing, activities, and social services staff) and 10 prescribing physicians	• Transcribed interviews were entered into the qualitative data analysis program ATLAS.ti. Research staff (MR, JP, AW, and EC) created code families (e.g., "nonpharmacological alternative;" "challenges to antipsychotic medication reduction") for broad topics, subcodes with specific details (e.g., "nonpharmacological alternatives: pet therapy"), and coded the interviews. • For the analyses, research staff developed memos on important topics and themes that emerged	• Interviews conducted in 2017 • Questions focused on decision-making related to use of antipsychotics, effects of CMS regulation, barriers to change, and sources of improvement.	• Respondents explained the difficulty of implementing nonpharmacological alternatives without sufficient staffing and without adequate funding. As staff must be trained in implementing nonpharmacological programs that reach individual residents, staff turnover diminishes the pool of staff members who know the residents. • Respondents indicated that patient-centered care cannot be done by formula, but they expressed confidence that the medication reduction can be done on a case-by-case basis. These responses point to the need for additional resources for	The number of respondents was limited, although the research team concurred that the staff interviews reached saturation, and the physician interviews cohered with the same themes.	High	Some	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
				from participants' responses, and identified specific codes and associated quotes.		training and staffing, if nursing homes are to provide the optimal level of services to address dementia without antipsychotics.				
20. Smith, K. M., Thomas, K. S., Johnson, S., Meng, H., & Hyer, K. (2019). Dietary service staffing impact nutritional quality in nursing homes. *Journal of Applied Gerontology: The Official Journal of the Southern Gerontological Society, 38*(5), 639–655. https://doi.org/10.1177/0733464816688309	Peer-reviewed	U.S. nursing homes	14,881 nursing homes	• An unconditional logit model with random effects was deployed using XTLOGIT in Stata®. • Included two measures of dietary service staffing levels: (a) the number of full-time equivalent (FTE) dietitians on staff per 100 residents and (b) the number of FTE dietary service personnel on staff per 100 residents • Included six covariates in the analysis that have been shown to be related to receipt of deficiency citations, including a facility's profit status, the proportion of Medicaid residents, and the proportion of Medicare residents	2007–2011 Online Survey and Certification and Reporting (OSCAR) data	• The findings demonstrate that staffing higher levels of dietary service personnel and CNAs has the potential to support quality nutritional care for nursing home residents. • The cross functionality of dietary service personnel and CNAs should also be carefully considered given the high rates of turnover and burnout seen within each of these employee groups. • The findings establish a significant relationship among dietitians, dietary service personnel, CNAs, and dietary service-related deficiency citations, and suggest that higher staffing levels have the potential to improve the quality of nutritional care in nursing homes.	The analysis employed secondary data; although widely used, such data creates the potential for unreliability given that it is collected for administrative rather than research purposes.	High	Some	None
21. Snyder, R. L., Anderson, L. E., White, K. A., Tavitian, S., Fike, L. V., Jones, H. N., Jacobs-Slifka, K. M., Stone, N. D., & Sinkowitz-Cochran, R. L. (2021). A qualitative assessment of factors affecting nursing home caregiving staff experiences during the COVID-19 pandemic. *PLoS One, 16*(11), e0260055.	Peer-reviewed	LTC facilities actively reporting to the National Healthcare Safety Network (NHSN)	• Throughout April 2021, 23 focus groups were held including 110 participants from 84 nursing home facilities across 34 states. • Twelve of the focus groups were held for CNAs (51 participants total) and 11 for EVS	• Focus groups were conducted homogenous by participant role and were offered during weekdays and weekends, with morning, afternoon, and night sessions to accommodate differing shifts. • Chi-square tests were used to compare the distribution of selected	Facility characteristics were obtained via NHSN, the National Center for Health Statistics Urban-Rural Classification Scheme and the Centers for Disease Control and Prevention (CDC) SVI based on facility county	• When asked what their nursing home could improve on, one of the most convergent themes reported by participants in the discussion was to improve staffing (33% of respondents). • Participants across focus groups consistently reported the need to mitigate staffing shortages. Concerns included, but were not	• Participating nursing home facilities and staff represented a voluntary convenience sample. • All data collected were self-reported and subject to recall bias, as well as social desirability bias.	High	Some	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
https://doi.org/10.1371/journal.pone.0260055			staff (59 participants total). • Of the 84 participating nursing homes, 73% were located in urban areas and 51% were for-profit facilities.	variables (urban/rural facility location, Social Vulnerability Index (SVI) quartile, facility bed size quartile, and facility ownership) between participant facilities and the general population of nursing homes actively reporting into NHSN, with p values < 0.05 considered statistically significant.		limited to, low wages and inconsistent employment benefits and incentives, such as supplemental hazard pay for essential workers.	• Generalizability of participant perceptions may be limited, as participants may not be representative of the overall nursing home staff population in the United States, with more participating facilities located in counties in the low/moderate range of social vulnerability and more facilities having nonprofit ownership than the general population of non-participating U.S. nursing homes.			
22. Wagner, L. M., Katz, P., Karuza, J., Kwong, C., Sharp, L., & Spetz, J. (2021). Medical staffing organization and quality of care outcomes in post-acute care settings. *Gerontologist, 61*(4), 605–614. https://doi.org/10.1093/geront/gnaa173	Peer-reviewed	Respondents of the survey were medical directors and attending physicians providing post-acute and long-term care	425 medical provider responses contained sufficient data for analysis	Nursing Home Medical Staff Organization Survey study with medical directors and attending physicians providing PALTC. A cross-sectional, descriptive design	• Nursing Home Medical Staff Organization Survey • NHC's "Provider Information" data set	• The results of the impact of nursing home medical staffing organization dimensions were mixed, with many domains not having any significance or having negative relationships between provider characteristics and quality measures. • Respondents who reported having a formal process for granting privileges and nursing homes with direct employment of physicians reported significantly fewer emergency visits.	Focused on staffing organization rather than staffing levels	High	Some	Good

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
23. Yuan, Y., Lapane, K. L., Baek, J., Jesdale, B. M., & Ulbricht, C. M. (2019). Nursing home star ratings and new onset of depression in long-stay nursing home residents. *Journal of the American Medical Directors Association, 20*(10), 1335–1335. https://doi.org/10.1016/j.jamda.2019.05.004	Peer-reviewed	U.S. nursing homes	129,837 long-stay residents without indicators of depression admitted to 13,921 nursing homes	Cohort study	NHC and 2013 MDS 3.0	• In nursing homes with 1-star staffing compared to 3-star, residents had 37% higher odds of moderate symptoms and 57% higher odds of moderately severe to severe depressive symptoms • Lower nursing home quality ratings were associated with more severe depressive symptoms • Findings reiterate the crucial need for more resources allocated to poorly rated nursing homes to retain an optimal staffing level and improve quality of care.	Limitations included unmeasured confounders that could affect depression, including changes in resident and facility characteristics over time and unmeasured variables in the MDS 3.0 (e.g., loss of a home or family member).	High	Some	Good
24. Mollot, R. (2022, June 8). Re: CMS-1765-P; *Request for Information on Revising the Requirements for Long-Term Care Facilities To Establish Mandatory Minimum Staffing Levels.* (Comments to CMS on minimum staffing standard). Long Term Care Community Coalition. https://nursinghome411.org/cms-min-staffing/	Gray Literature	n/a	n/a	Interim Report	n/a	Concrete, clear, and appropriate minimum staffing standards are needed now to finally realize the promise of the Nursing Home Reform Law in the lives of residents and the vast majority of American families who will depend on nursing home services at some time or another. They are needed to ensure that vulnerable residents receive care and services that are (at a minimum) humane and safe, and that American taxpayers get value for the billions of dollars that we pay every year for nursing home care	n/a	n/a	n/a	n/a
25. California Association of Long Term Care Medicine. (n.d.). CALTCM *white paper on nursing home staffing.* https://www.caltcm.org/assets/CALTCM%20White%20Paper%20on%20Nursing%20Home%20Staffing%20-%20FINAL.pdf	Gray literature	California	n/a	Policy review	California policies	• Ensure that minimum recommended staffing levels are met. • Reduce nursing turnover and minimize the use of waivers by ensuring adequate wages. • Ensure that nursing homes adjust staffing levels to meet the acuity needs of residents.	n/a	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
26. California Advocates for Nursing Home Reform, Center for Medicare Advocacy (CANHR), Justice in Aging, Long Term Care Community Coalition, Michigan Elder Justice Initiative, and The National Consumer Voice for Quality Long-Term Care. (2021). *Framework for nursing home reform post COVID-19*. https://theconsumervoice.org/uploads/files/actions-and-news-updates/Framework_and_overview_FINAL.pdf	Gray literature	National	n/a	Policy Framework	n/a	• Ensure adequate staffing levels with requirements for minimum staffing standards, including RNs staffing 24-hours per day. • Provide living wages and benefits to recruit and retain nursing staff. • Require a full-time qualified Infection Preventionist in all facilities. • Increase required nurse aide training to a minimum of 150 hours and require enhanced training on infection control.	n/a	n/a	n/a	n/a
27. National Academies of Sciences, Engineering, and Medicine. (2022). *The national imperative to improve nursing home quality: Honoring our commitment to residents, families, and staff.* The National Academies Press. https://doi.org/10.17226/26526	Gray literature	n/a	n/a	Consensus Study Report	n/a	• Recommend direct care RN coverage for a least 24 hours a day, 7 days a week, with additional coverage as needed, a full-time social worker with at least an accredited bachelor's level social work degree and one year of supervised health care setting experience, and an infection control specialist who is an RN, APRN, or physician. • They support research-based minimum staffing requirements for all direct care staff, including for weekends and holidays, that is based on resident case mix and population-specific staffing needs. • They believe that investing in CNAs is necessary to improve quality of care and advocate for competency-based training that includes topics such as dementia, infection control, behavioral	n/a	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating**	
									Staff	Quality
						health, chronic diseases, use of assistive medical devices, and cultural sensitivity and humility. • They recommend designating a specific percentage of Medicaid and Medicare payments to direct care services (e.g., staff and wages). • They support addition Care Compare measures related to weekend staffing and staff turnover by role and increasing the weight of the staffing measures within the Five-Star composite rating.				

Exhibit A.3.2: Evidence Grading Table: Relationship of Nurse Staffing Levels with Safety and Quality of Care

Based on the National Service Framework for Long Term Conditions (see Turner-Stokes et al., 2006). Consistent with the Framework, only peer-reviewed researched-based evidence is rated.

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
Full citation	E: Reflects "expert" (user/caregiver/professional) evidence R: Research-based evidence	**Primary Research-Based Evidence** P1 Primary research using quantitative approaches P2 Primary research using qualitative approaches P3 Primary research using mixed methods **Secondary research-based evidence** S1 Meta-analysis of existing data analysis S2 Secondary analysis of existing data **Review Based Evidence** R1 Systematic reviews of existing research R2 Descriptive or summary reviews of existing research	Are the research question/aims and design clearly stated? 0 = No 1 = Somewhat 2 = Yes	Is the research design appropriate for the aims and objectives of the research? 0 = No 1 = Somewhat 2 = Yes	Are the methods clearly described? 0 = No 1 = Somewhat 2 = Yes	Is the data adequate to support the authors' interpretations/ conclusions? 0 = No 1 = Somewhat 2 = Yes	Are the results generalizable? 0 = No 1 = Somewhat 2 = Yes	Sum of quality question scores	Based on total quality score 7 to 10 = high-quality 4 to 6 = Medium quality 3 or less = poor quality
1. Bakerjian, D., Boltz, M., Bowers, B., Gray-Miceli, D., Harrington, C., Kolanowski, A., & Mueller, C. A. (2021). Expert nurse response to workforce recommendations made by the Coronavirus Commission for Safety and Quality in Nursing Homes. *Nursing Outlook, 69*(5), 735–743. https://doi.org/10.1016/j.outlook.2021.03.017	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2. Cai, S., Yan, D., & Intrator, O. (2021). COVID-19 cases and death in nursing homes: The role of racial and ethnic composition of facilities and their communities. *Journal of the American Medical Directors Association, 22*(7), 1345–1351. https://doi.org/10.1016/j.jamda.2021.05.002	R	S2	2	2	2	2	1	9	High

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
3. Clemens, S., Wodchis, W., McGilton, K., McGrail, K., & McMahon, M. (2021). The relationship between quality and staffing in long-term care: A systematic review of the literature 2008–2020. *International Journal of Nursing Studies, 122*(October), 104036. https://doi.org/10.1016/j.ijnurstu.2021.104036	R	R1	2	2	2	2	2	10	High
4. Figueroa, J. F., Wadhera, R. K., Papanicolas, I., Riley, K., Zheng, J., Orav, E. J., & Jha, A. K. (2020). Association of nursing home ratings on health inspections, quality of care, and nurse staffing with covid-19 cases. *JAMA: Journal of the American Medical Association, 324*(11), 1103–1105. https://doi.org/10.1001/jama.2020.14709	R	S2	0	2	1	2	0	5	Medium
5. Gorges, R. J., & Konetzka, R. T. (2020). Staffing levels and COVID-19 cases and outbreaks in US nursing homes. *Journal of the American Geriatrics Society, 68*(11), 2462–2466. https://doi.org/10.1111/jgs.16787	R	S2	1	2	1	2	1	7	Medium
6. Gray-Miceli, D., Rogowski, J., de Cordova, P. B., & Boltz, M. (2021). A framework for delivering nursing care to older adults with COVID-19 in nursing homes. *Public Health Nursing, 38*(4), 610–626. https://doi.org/10.1111/phn.12885	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7. Harrington, C., Dellefield, M. E., Halifax, E., Fleming, M. L., & Bakerjian, D. (2020). Appropriate nurse staffing levels for US nursing homes. Health Services Insights, 13, 1–14. https://doi.org/10.1177/1178632920934785	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
8. Harris, J. A., Engberg, J., & Castle, N. G. (2020). Organizational and geographic nursing home characteristics associated with increasing prevalence of resident obesity in the United States. *Journal of Applied Gerontology, 39*(9), 991–999. https://doi.org/10.1177/0733464819843045	R	S2	2	1	2	2	2	9	High
9. Henning-Smith, C., Cross, D., & Rahman, A. (2021). Challenges to admitting residents: Perspectives from rural nursing home administrators and staff. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 58.* https://doi.org/10.1177/00469580211005191	R	P3	1	2	2	2	0	9	High

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
10. Kingsley, D. E., & Harrington, C. (2022). Financial and quality metrics of a large, publicly traded U.S. nursing home chain in the age of Covid-19. *International Journal of Health Services, 52*(2), 212–224. https://doi.org/10.1177/00207314221077649	R	S2	1	2	1	2	0	6	Medium
11. Kolanowski, A., Cortes, T. A., Mueller, C., Bowers, B., Boltz, M., Bakerjian, D., Harrington, C., Popejoy, L., Vogelsmeier, A., Wallhagen, M., Fick, D., Batchelor, M., Harris, M., Palan-Lopez, R., Dellefield, M., Mayo, A., Woods, D. L., Horgas, A., Cacchione, P. Z., & Carter, D. (2021). A call to the CMS: Mandate adequate professional nurse staffing in nursing homes. *AJN American Journal of Nursing, 121*(3), 24–27. https://doi.org/10.1097/01.naj.0000737292.96068.18	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12. Li, Y., Temkin-Greener, H., Shan, G., & Cai, X. (2020). COVID-19 infections and deaths among Connecticut nursing home residents: Facility correlates. *Journal of American Geriatrics Society, 68*(9), 1899–1906. https://doi.org/10.1111/jgs.16689	R	S2	1	2	2	2	0	7	High
13. Livingstone, I., Hefele, J., Nadash, P., Barch, D., & Leland, N. (2019). The relationship between quality of care, physical therapy, and occupational therapy staffing levels in nursing homes in 4 years' follow-up. *Journal of the American Medical Directors Association, 20*(4), 462–469. https://doi.org/10.1016/j.jamda.2019.02.002	R	S2	2	2	2	2	1	9	High
14. McGarry, B. E., Gandhi, A. D., Grabowski, D. C., & Barnett, M. L. (2021). Larger nursing home staff size linked to higher number of COVID-19 cases in 2020. *Health Affairs, 40*(8), 1261–1269. https://doi.org/10.1377/hlthaff.2021.00323	R	S2	2	1	2	1	1	7	High
15. Min, A., & Hong, H. C. (2019). Effect of nurse staffing on rehospitalizations and emergency department visits among short-stay nursing home residents: A cross-sectional study using the US Nursing Home Compare database. *Geriatric Nursing, 40*(2), 160–165. https://doi.org/10.1016/j.gerinurse.2018.09.010	R	S2	2	2	2	2	0	8	High

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
16. Mukamel, D. B., Saliba, D., Ladd, H., & Konetzka, R. T. (2022). Daily variation in nursing home staffing and its association with quality measures. *JAMA Network Open, 5*(3), e222051–e222051. https://doi.org/10.1001/jamanetworkopen.2022.20051	R	S2	2	1	2	1	1	8	High
17. Orth, J., Li, Y., Simning, A., Zimmerman, S., & Temkin-Greener, H. (2021). End-of-life care among nursing home residents with dementia varies by nursing home and market characteristics. *Journal of the American Medical Directors Association, 22*(2), 320–328.e324. https://doi.org/10.1016/j.jamda.2020.06.021	R	S2	2	2	2	2	1	9	High
18. Peters, M. D. J., Marnie, C., & Butler, A. (2021). Delivering, funding, and rating safe staffing levels and skills mix in aged care. *International Journal of Nursing Studies. 119*(July), 103943. https://doi.org/10.1016/j.ijnurstu.2021.103943	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
19. Rosenthal, M., Poling, J., Wec, A., Connolly, E., Angell, B., & Crystal, S. (2022). Medication is just one piece of the whole puzzle: How nursing homes change their use of antipsychotic medications. *Journal of Applied Gerontology, 41*(1), 62–72. https://doi.org/10.1177/0733464820958919	R	P2	1	2	2	2	0	7	High
20. Smith, K. M., Thomas, K. S., Johnson, S., Meng, H., & Hyer, K. (2019). Dietary service staffing impact nutritional quality in nursing homes. *Journal of Applied Gerontology: The Official Journal of the Southern Gerontological Society, 38*(5), 639–655. https://doi.org/10.1177/0733464816688309	R	S2	2	2	2	1	2	9	High
21. Snyder, R. L., Anderson, L. E., White, K. A., Tavitian, S., Fike, L. V., Jones, H. N., Jacobs-Slifka, K. M., Stone, N. D., & Sinkowitz-Cochran, R. L. (2021). A qualitative assessment of factors affecting nursing home caregiving staff experiences during the COVID-19 pandemic. *PLoS One, 16*(11), e0260055. https://doi.org/10.1371/journal.pone.0260055	R	P2	2	2	2	2	n/a	8	High
22. Wagner, L. M., Katz, P., Karuza, J., Kwong, C., Sharp, L., & Spetz, J. (2021). Medical staffing organization and quality of care outcomes in post-acute care settings. *Gerontologist, 61*(4), 605–614. https://doi.org/10.1093/geront/gnaa173	R	P1	1	2	2	2	1	8	High

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
23. Yuan, Y., Lapane, K. L., Baek, J., Jesdale, B. M., & Ulbricht, C. M. (2019). Nursing home star ratings and new onset of depression in long-stay nursing home residents. *Journal of the American Medical Directors Association, 20*(10), 1335–1335. https://doi.org/10.1016/j.jamda.2019.05.004	R	P1	1	2	1	2	2	8	High

Exhibit A.3.3: Definitions Alignment Table: Relationship of Nurse Staffing Levels with Safety and Quality of Care

Provides an assessment of how peer-reviewed literature definitions of staff types and quality of care align with the Staffing Study team's analyses.

The study team used Payroll Based Journal (PBJ) job codes to identify RNs, LPNs, and nurse aides. Literature that had No Alignment used both different staff types and a different data set. Literature with Some Alignment used the same staff types but identified them with different data. Literature with Good Alignment used the same staff types and the same data set.

Quality of care alignment ratings are qualitative assessments. The study team's measures include MDS Long Stay Measures (% of residents whose ability to move independently worsened; % of residents whose need for help with daily activities has increased; % of high-risk residents with pressure ulcers); Claims Based Long Stay Measures (# of hospitalizations per 1,000 resident days; # of outpatient emergency department visits per 1,000 resident days); Minimum Data Set (MDS) Short-Stay Measures (% of residents who improved in their ability to move around on their own); Claims Based Short-Stay Measures (% of short-stay residents who were rehospitalized after a nursing home admission; % of short-stay residents who had an outpatient emergency department visit; rate of successful return to home or community from an skilled nursing facility).

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
Full citation	*Data set used and staff types included in the study*	*Indicator of how well staff types align with the study team's quantitative analyses*	*Quality of care measures included in the study*	*Indicator of how well quality metrics aligned with the study team's quantitative analyses*
1. Bakerjian, D., Boltz, M., Bowers, B., Gray-Miceli, D., Harrington, C., Kolanowski, A., & Mueller, C. A. (2021). Expert nurse response to workforce recommendations made by the Coronavirus Commission for Safety and Quality in Nursing Homes. *Nursing Outlook, 69*(5), 735–743. https://doi.org/10.1016/j.outlook.2021.03.017	RN/LPN/CNA No dataset was used	Some Alignment	n/a	n/a
2. Cai, S., Yan, D., & Intrator, O. (2021). COVID-19 cases and death in nursing homes: The role of racial and ethnic composition of facilities and their communities. *Journal of the American Medical Directors Association, 22*(7), 1345–1351. https://doi.org/10.1016/j.jamda.2021.05.002	CNA/RN 2019 CASPER data, the CMS NHC 2020 May data, and 2018 MDS. Several publicly available community-level data, including county-level COVID-19 infection data, the Area Health Resource File, LTCFocus data, and the American Community Survey data	Some Alignment	Two outcome variables were determined based on the CMS COVID-19 data: whether a nursing home had any new COVID-19 cases in a week, and whether a nursing home had any COVID-19 related deaths in a week	No Alignment
3. Clemens, S., Wodchis, W., McGilton, K., McGrail, K., & McMahon, M. (2021). The relationship between quality and staffing in long-term care: A systematic review of the literature 2008–2020. *International Journal of Nursing Studies, 122*(October), 104036. https://doi.org/10.1016/j.ijnurstu.2021.104036	Nursing and personal care staffing level (e.g., the "dose" of a nurse / personal care staff) measured by HPRD, and skill mix (e.g., the proportion of RNs to total nursing staff) RNs, LPNs and/or nurse aides (or their equivalents).	Some Alignment	Fourteen different quality indicators were used; 10 were outcome indicators, three were process indicators and one was government citations / audit deficiencies. The most frequently used indicator was regulatory deficiencies (n = 14), followed by pressure ulcers (n = 10), restraints (n = 6), catheterization (n = 6) and hospitalizations (n = 4).	Some Alignment

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
4. Figueroa, J. F., Wadhera, R. K., Papanicolas, I., Riley, K., Zheng, J., Orav, E. J., & Jha, A. K. (2020). Association of nursing home ratings on health inspections, quality of care, and nurse staffing with covid-19 cases. *JAMA: Journal of the American Medical Association, 324*(11), 1103–1105. https://doi.org/10.1001/jama.2020.14709	Used the CMS nurse staffing rating to examine nurse staffing types as a group CMS NHC, which includes star ratings. The nurse staffing domain is based on the mean staffing hours per resident by qualified nursing staff	Some Alignment	State-reported data on number of COVID cases in the nursing homes	No Alignment
5. Gorges, R. J., & Konetzka, R. T. (2020). Staffing levels and COVID-19 cases and outbreaks in US nursing homes. *Journal of the American Geriatrics Society, 68*(11), 2462–2466. https://doi.org/10.1111/jgs.16787	RNs, LPNs, nurse aides PBJ data	Good Alignment	Whether facilities had any COVID-19 cases, and among facilities with at least one case, the size of the outbreak	No Alignment
6. Gray-Miceli, D., Rogowski, J., de Cordova, P. B., & Boltz, M. (2021). A framework for delivering nursing care to older adults with COVID-19 in nursing homes. *Public Health Nursing, 38*(4), 610–626. https://doi.org/10.1111/phn.12885	RNs, LPNs, CNAs American Nurses Association (ANA)	Some Alignment	Mortality & Morbidity due to COVID-19, Hospitalization due to COVID, 30-day Rehospitalization Rates, Quality of Life	No Alignment
7. Harrington, C., Dellefield, M. E., Halifax, E., Fleming, M. L., & Bakerjian, D. (2020). Appropriate nurse staffing levels for US nursing homes. *Health Services Insights*, 13, 1–14. https://doi.org/10.1177/1178632920934785	RNs, LPNs/LVNs, CNAs PBJ, MDS	Good Alignment	General health and safety of nursing home residents	Good Alignment
8. Harris, J. A., Engberg, J., & Castle, N. G. (2020). Organizational and geographic nursing home characteristics associated with increasing prevalence of resident obesity in the United States. *Journal of Applied Gerontology, 39*(9), 991–999. https://doi.org/10.1177/0733464819843045	Nurse aide, LPN, RN, and physical therapist staffing hours MDS	Some Alignment	Nursing home obesity prevalence rate defined as the proportion of residents who were obese in each nursing home calculated using resident-level data from the MDS	No Alignment
9. Henning-Smith, C., Cross, D., & Rahman, A. (2021). Challenges to admitting residents: Perspectives from rural nursing home administrators and staff. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 58*. https://doi.org/10.1177/00469580211005191	"Staffing" generally, which includes nursing staff Interviews from administrators	Some Alignment	Challenges to admitting residents in rural nursing homes	No Alignment
10. Kingsley, D. E., & Harrington, C. (2022). Financial and quality metrics of a large, publicly traded U.S. nursing home chain in the age of Covid-19. *International Journal of Health Services, 52*(2), 212–224. https://doi.org/10.1177/00207314221077649	RN, LPN/LVN, CNA PBJ data for: RNs, licensed vocational or practical nurses (LVN/LPNs), certified nursing assistants (CNAs), and total nursing HPRD	Good Alignment	Average facility deficiencies, weighted deficiency scores, total staffing rating, RN staffing rating, facility survey rating, resident quality measure ratings, and overall facility quality rating	Good Alignment
11. Kolanowski, A., Cortes, T. A., Mueller, C., Bowers, B., Boltz, M., Bakerjian, D., Harrington, C., Popejoy, L., Vogelsmeier, A., Wallhagen, M., Fick, D., Batchelor, M., Harris, M., Palan-Lopez, R., Dellefield, M., Mayo, A., Woods, D. L., Horgas, A., Cacchione, P. Z., & Carter, D. (2021). A call to the CMS: Mandate adequate professional nurse staffing in nursing homes. *AJN American Journal of Nursing, 121*(3), 24–27. https://doi.org/10.1097/01.naj.0000737292.96068.18	RN/LPN/CNA No dataset was used	Some Alignment	General health and safety of nursing home residents	Some Alignment
12. Li, Y., Temkin-Greener, H., Shan, G., & Cai, X. (2020). COVID-19 infections and deaths among Connecticut nursing home residents: Facility correlates. *Journal of American Geriatrics Society, 68*(9), 1899–1906. https://doi.org/10.1111/jgs.16689	RNs NHC data files and PBJ	Good Alignment	Total numbers of confirmed COVID cases and deaths	No Alignment

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
13. Livingstone, I., Hefele, J., Nadash, P., Barch, D., & Leland, N. (2019). The relationship between quality of care, physical therapy, and occupational therapy staffing levels in nursing homes in 4 years' follow-up. *Journal of the American Medical Directors Association, 20*(4), 462–469. https://doi.org/10.1016/j.jamda.2019.02.002	RNs, LPNs, CNAs, speech-language pathologists, physical and occupational therapists NHC, CASPER, the Area Health Resources File, and Long-term Care: Facts on Care in the U.S. (LTCFocus)	Some Alignment	The percentage of long-term care residents whose need for help with activities of daily living has increased [National Quality Forum (NQF) 0688] (ADL measure); the percentage of long-term care residents experiencing one or more falls with major injury (NQF 0674) (falls measure); and the facility's 5-star quality measure rating	Good Alignment
14. McGarry, B. E., Gandhi, A. D., Grabowski, D. C., & Barnett, M. L. (2021). Larger nursing home staff size linked to higher number of COVID-19 cases in 2020. *Health Affairs, 40*(8), 1261–1269. https://doi.org/10.1377/hlthaff.2021.00323	RN, LPN, and CNA hours combined into a "direct care staff" category PBJ data	Good Alignment	COVID-19 cases among staff and residents, and COVID-related resident deaths	No Alignment
15. Min, A., & Hong, H. C. (2019). Effect of nurse staffing on rehospitalizations and emergency department visits among short-stay nursing home residents: A cross-sectional study using the US Nursing Home Compare database. *Geriatric Nursing, 40*(2), 160–165. https://doi.org/10.1016/j.gerinurse.2018.09.010	RNs, LPNs, CNAs Two nurse staffing measures in the Five-Star Quality Rating System: the total nurse staffing rating and the RN staffing rating	Some Alignment	The percentage of residents rehospitalized after nursing home admission and the percentage of residents who had an outpatient Emergency Department visit. Data for these quality measures were drawn from Medicare claims and were updated every 6 months	Good Alignment
16. Mukamel, D. B., Saliba, D., Ladd, H., & Konetzka, R. T. (2022). Daily variation in nursing home staffing and its association with quality measures. *JAMA Network Open, 5*(3), e222051–e222051. https://doi.org/10.1001/jamanetworkopen.2022.2051	RNs, CNAs PBJ data	Good Alignment	The 5-Star Survey and the 5-Star Quality Measures rankings of the Nursing Home Care Compare	Good Alignment
17. Orth, J., Li, Y., Simning, A., Zimmerman, S., & Temkin-Greener, H. (2021). End-of-life care among nursing home residents with dementia varies by nursing home and market characteristics. *Journal of the American Medical Directors Association, 22(*2), 320–328.e324. https://doi.org/10.1016/j.jamda.2020.06.021	Sum of RN, LPN, and CNA hours Minimum Data Set	Some Alignment	Place-of-death (hospital/nursing home), presence of pressure ulcers, PAHs, and hospice use at EOL	Good Alignment
18. Peters, M. D. J., Marnie, C., & Butler, A. (2021). Delivering, funding, and rating safe staffing levels and skills mix in aged care. *International Journal of Nursing Studies. 119*(July), 103943. https://doi.org/10.1016/j.ijnurstu.2021.103943	Unspecified	No Alignment	n/a	No Alignment
19. Rosenthal, M., Poling, J., Wec, A., Connolly, E., Angell, B., & Crystal, S. (2022). Medication is just one piece of the whole puzzle: How nursing homes change their use of antipsychotic medications. *Journal of Applied Gerontology, 41*(1), 62–72. https://doi.org/10.1177/0733464820958919	Nursing staff, activities staff, social services staff, and prescribing physicians No dataset was used.	Some Alignment	Five recurring themes elicited by the interviews provide insight into decisions during changes in antipsychotic medication use since 2012: (a) staff and physicians are aware of the need to reduce antipsychotic medication use; (b) the value of person-centered approaches to accomplish these reductions; (c) the contribution of collaboration and communication to achieving reductions; (d) **the need for more training and education about dementia and for more staffing**; (e) the challenges posed by CMS regulations and surveys.	No Alignment

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
20. Smith, K. M., Thomas, K. S., Johnson, S., Meng, H., & Hyer, K. (2019). Dietary service staffing impact nutritional quality in nursing homes. *Journal of Applied Gerontology: The Official Journal of the Southern Gerontological Society, 38*(5), 639–655. https://doi.org/10.1177/0733464816688309	The number of full-time equivalent dietitians on staff per 100 residents and the number of FTE dietary service personnel on staff per 100 residents. Controlled for CNA hours Online Survey and Certification and Reporting (OSCAR) data	Some Alignment	Dietary service deficiency citations relate to all facets of food planning, preparation, storage, and sanitation	No Alignment
21. Snyder, R. L., Anderson, L. E., White, K. A., Tavitian, S., Fike, L. V., Jones, H. N., Jacobs-Slifka, K. M., Stone, N. D., & Sinkowitz-Cochran, R. L. (2021). A qualitative assessment of factors affecting nursing home caregiving staff experiences during the COVID-19 pandemic. *PLoS One, 16*(11), e0260055. https://doi.org/10.1371/journal.pone.0260055	CNAs and Environmental Services Staff (EVS) Self-reported	Some Alignment	To understand what individual and facility level factors may have contributed to the impact of COVID-19 on CNAs and Environmental Services (EVS) staff working in nursing homes	No Alignment
22. Wagner, L. M., Katz, P., Karuza, J., Kwong, C., Sharp, L., & Spetz, J. (2021). Medical staffing organization and quality of care outcomes in post-acute care settings. *Gerontologist, 61*(4), 605–614. https://doi.org/10.1093/geront/gnaa173	RN, LPN, CNA NHC's "Provider Information" data set	Some Alignment	Long-stay and short-stay measures from the Nursing Home Care Compare website	Good Alignment
23. Yuan, Y., Lapane, K. L., Baek, J., Jesdale, B. M., & Ulbricht, C. M. (2019). Nursing home star ratings and new onset of depression in long-stay nursing home residents. *Journal of the American Medical Directors Association, 20*(10), 1335–1335. https://doi.org/10.1016/j.jamda.2019.05.004	RNs, LPN/LVNs, CNAs MDS and CMS quality measures	Some Alignment	Two study outcomes were derived from the 90-day assessment: (1) depression diagnosis and (2) severity of depressive symptoms	No Alignment

A.4 Literature Review Support Tables: Current State and Federal Standards for Staffing Levels and Types

- For summary descriptions of the literature reviewed, refer to Exhibit A.4.1: Literature Summary Table: Current State and Federal Standards for Staffing Levels and Types
- For details on the Evidence Grade, refer to Exhibit A.4.2: Evidence Grading Table: Current State and Federal Standards for Staffing Levels and Types
- For details on the Alignment Rating, refer to Exhibit A.4.3: Definitions Alignment Table: Current State and Federal Standards for Staffing Levels and Types

Exhibit A.4.1: Literature Summary Table: Current State and Federal Standards for Staffing Levels and Types

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
1. Geng, F., Stevenson, D. G., & Grabowski, D. C. (2019). Daily nursing home staffing levels highly variable, often below CMS expectations. *Health Affairs, 38*(7), 1095–1100. https://doi.org/10.1377/hlthaff.2018.05322	Peer-reviewed	U.S. nursing homes	All nursing homes included in PBJ and CASPER data (n=15,399), with different samples for each analysis based on exclusions from missing data.	Cross-sectional study • The study analyzes staffing at the time of the annual inspection relative to the rest of the year, staffing across different days of the week, facility factors associated with low weekend staffing, observed versus expected staffing based on resident acuity, and compliance with federal nurse staffing standards. • Researchers conducted several analyses comparing various time and facility characteristics against staffing levels and reported summary statistics.	• Facility-level PBJ data for one year (2017-2018) • Facility-level staffing and resident census data and annual inspection data from CASPER for calendar years 2017-2018 • NHC data for additional facility data (ownership type, size overall 5-star rating, expected staffing levels adjusted for resident acuity)	• There is a discrepancy between how often nursing homes meet expected staffing levels based on resident acuity and how often nursing homes meet the federal eight-hour RN staffing requirement. • These conflicting results suggest that the eight-hour requirement does little to ensure adequate RN staffing levels needed to care for people who live in nursing homes. • Actual vs. Expected staffing (based on resident acuity): • 54% of facilities met CMS total staffing level expectations less than 20% of the time. • 90% of facilities met expected RN staffing levels less than 60% of the time. • 28% of facilities met expected LPN staffing levels less than 60% of the time. • 70% of facilities met expected nurse aide staffing levels less than 60% of the time. • Almost all nursing homes (96%) met the federal eight-hour RN staffing requirement for the majority of days.	• PBJ and CASPER staffing data are measured with potential error. • PBJ collects data only on paid hours and may not accurately reflect salaried staff hours. • Each measure collects staffing hours and resident census information through different processes.	High	Good	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
2. Sharma, H., Konetzka, R. T., & Smieliauskas, F. (2019). The relationship between reported staffing and expenditures in nursing homes. *Medical Care Research & Review, 76*(6), 758–783. https://doi.org/10.1177/1077558717739214	Peer-reviewed	Medicare-certified, freestanding nursing homes	• 37,095 observations for 11,091 facilities; mostly for-profit (74.0%); with total occupancy averaging 84.4% (±13.7) while Medicaid occupancy averaging 52.4% (±17.9). • The average case mix in terms of the ADL index is 10.3, and the SCI index is 0.22.	Series of facility and year fixed-effects regressions to estimate the relationship between changes in spending and changes in staffing scores within facilities over time	Nursing Home Compare rating scores (2007-2010)	• In terms of magnitudes, an additional hour of RN and LPN staffing cost a facility $6.6 and $1.6, respectively, in the pre-5-star period. However, in the post-5-star period, an additional hour of RN and LPN cost a facility only $5.33 (a decrease of $1.23), and $0.61 (a decrease of $0.99), respectively. • For-profit facilities with a high-Medicaid census exhibit a weakening relationship between staffing and expenditures for both LPN and RN hours, consistent with incentives. The returns to achieving a higher quality rating may be attractive enough for these facilities to attempt different ways to improve their scores in the post-5-star period.	The study is based on pre-post differences in expenditures and staffing scores rather than a more robust difference-in-difference study design	High	None	Good
3. Medicaid and CHIP Payment and Access Commission (MACPAC). (2022a). *Compendium: State policies related to nursing facility staffing*. https://www.macpac.gov/publication/state-policies-related-to-nursing-facility-staffing/	Gray Literature	National	50 states and District of Columbia	Policy review	Nursing home staffing and Medicaid policies dating from 2016 to October 22, 2021, including staffing regulations that already existed at that time. RTI shared a copy of identified policies with an official contact in that state; state officials were given a month to verify the collected policies.	Each state's policies related to nursing home staffing, including minimum staffing requirements and Medicaid payment policies intended to encourage adequate staffing.	Relies on publicly available data	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
4. Consumer Voice (The National Consumer Voice for Quality Long-Term Care). (2021). *State nursing home staffing standards: Summary report.* https://theconsumervoice.org/issues/other-issues-and-resources/staffing	Gray Literature	National	All 50 states	Summary Report	State Policies	Twenty years after the CMS study found that at least 4.1 HPRD of direct care nursing staff time are needed just to prevent poor outcomes, state staffing requirements, with a few exceptions, are nowhere near that recommended level. Only the District of Columbia requires this overall level of staffing, and only six states mandate the presence of a RNs 24 hours a day regardless of facility size. Despite what is known about the relationship between staffing levels and quality care, staffing standards in almost every state remain severely low.	n/a	n/a	n/a	n/a
5. Musumeci, M., Childress, E., & Harris, B. (2022). *State actions to address nursing home staffing during COVID-19.* KFF [Kaiser Family Foundation]. https://www.kff.org/medicaid/issue-brief/state-actions-to-address-nursing-home-staffing-during-covid-19/	Gray literature	n/a	n/a	Issue Brief	n/a	• Staffing Requirements: At least five states (AR, CT, MA, NY, RI) adopted permanent increases to nursing home minimum staffing requirements after the onset of the COVID-19 pandemic, while at least one state (GA) adopted a permanent decrease. At least two states (OR, SC) adopted temporary decreases to account for potential staffing issues during the pandemic. • Wages: At least four states (CO, IL, MA, NC) adopted laws or regulations that require increases to nursing home staff wages since the onset of the COVID-19 pandemic. At least three states (MI, NC, OH) adopted temporary increases or one-time bonuses to nursing home staff wages post-COVID. Other states may have adopted or proposed Medicaid provider reimbursement rate changes that do not explicitly require corresponding increases in direct care staff wages. • Training: At least three states (KY, MO, WI) adopted permanent changes to staff training requirements post-COVID to expand the pool of staff available to work in nursing homes, while at least eight states (AK, CT, DE, IA, IN, KS, MO, WI) adopted temporary changes in this area.	n/a	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
6. Medicaid and CHIP Payment and Access Commission (MACPAC). (2022b). *State policy levers to address nursing facility staffing issues.* https://www.macpac.gov/wp-content/uploads/2022/03/State-Policy-Levers-to-Address-Nursing-Facility-Staffing-Issues.pdf	Gray literature	U.S. nursing homes	All states and DC	Issue brief	State staffing requirements	• According to the CMS's NHC website, roughly 72% of nursing homes had total staffing rates below 4.1 HPRD in 2019. • 38 states plus DC have a staffing standard that exceeds the Federal level (when converting federal requirements to an HPRD); 9 states have standards that are less than 2.0 HPRD; 11 states + DC have standards that are greater than 3.0 HPRD (for 100+ bed facility); DC has a minimum standard of 4.1 HPRD. • In response to COVID, 10 states increased minimum staffing standards and 15 states reduced staffing training requirements for direct care staff (but four have rescinded this flexibility).	n/a; not an empirical study. Presents analysis of policymaking methods states could use to address staffing issues.	n/a	n/a	n/a
7. Office of the Inspector General, U.S. Department of Health and Human Services. (2020). *Some nursing homes' reported staffing levels in 2018 raise concerns; consumer transparency could be increased.* HHS OIG Data Brief OEI-04-18-00450. https://oig.hhs.gov/oei/reports/OEI-04-18-00450.pdf	Gray literature	U.S. nursing homes	12,862 U.S. nursing homes	OIG Data Brief	2018 PBJ data 20 local LTC ombudsmen surveys, MDS data, CASPER data, and facility staffing star ratings and daily staffing	• 7% of nursing homes fell below Federally required staffing levels on at least 30 total days in 2018. • After CMS announced Staffing Star Rating based incentives for nursing homes, 27% fewer nursing homes reported at least 7 days without any RN time. However, 7% more nursing homes reported days with less RN time than the required 8 hours per day. • When RNs and licensed nurse staff are not present to adequately supervise Aides, residents' day-to-day care needs—such as bathing, grooming, and toileting—may not be met, which can contribute to a variety of health problems, such as pressure sores, UTIs, and falls. • CMS's Star Ratings are based on quarterly averages, which do not convey the extent to which staffing varies day to day.	Descriptive analysis that relies on self-reported data	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
8. Gerber, D., & Nelb, R. (2022). *Principles for assessing Medicaid nursing facility payments relative to costs.* Medicaid and CHIP Payment and Access Commission (MACPAC). https://www.macpac.gov/wp-content/uploads/2022/09/05_Principles-for-Assessing-Medicaid-Nursing-Facility-Payment-Relative-to-Costs-Drew-Rob.pdf	Gray literature	U.S. freestanding dually certified nursing homes	12.785 facilities in 27 states and DC (91% of freestanding dually certified facilities)	Empirical analysis, but details not provided	Technical expert panel, Medicare cost reports, TMSIS, UPL demonstration data	• Facilities with high staffing rates paid higher wages. • At a state level, different payment rates were not clearly correlated with different staffing rates. • States with higher minimum staffing standards has higher staffing regardless of their payment rates.	Summarized MACPAC presentation	n/a	n/a	n/a

Exhibit A.4.2: Evidence Grading Table: Current State and Federal Standards for Staffing Levels and Types

Based on the National Service Framework for Long Term Conditions (see Turner-Stokes et al., 2006). Consistent with the Framework, only peer-reviewed researched-based evidence is rated.

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
Full citation	E: Reflects "expert' (user/caregiver/professional) evidence R: Research-based evidence	**Primary Research-Based Evidence** P1 Primary research using quantitative approaches P2 Primary research using qualitative approaches P3 Primary research using mixed methods **Secondary research-based evidence** S1 Meta-analysis of existing data analysis S2 Secondary analysis of existing data **Review Based Evidence** R1 Systematic reviews of existing research R2 Descriptive or summary reviews of existing research	Are the research question/aims and design clearly stated? 0 = No 1 = Somewhat 2 = Yes	Is the research design appropriate for the aims and objectives of the research? 0 = No 1 = Somewhat 2 = Yes	Are the methods clearly described? 0 = No 1 = Somewhat 2 = Yes	Is the data adequate to support the authors interpretations/ conclusions? 0 = No 1 = Somewhat 2 = Yes	Are the results generalizable? 0 = No 1 = Somewhat 2 = Yes	Sum of quality question scores	Based on total quality score 7 to 10 = high-quality 4 to 6 = medium quality 3 or less = poor quality
1. Geng, F., Stevenson, D. G., & Grabowski, D. C. (2019). Daily nursing home staffing levels highly variable, often below CMS expectations. *Health Affairs, 38(*7), 1095–1100. https://doi.org/10.1377/hlthaff.2018.05322	R	S2	2	2	2	2	2	10	High
2. Sharma, H., Konetzka, R. T., & Smieliauskas, F. (2019). The relationship between reported staffing and expenditures in nursing homes. *Medical Care Research & Review, 76*(6), 758–783. https://doi.org/10.1177/1077558717739214	R	S2	1	2	2	2	1	8	High

Exhibit A.4.3: Definitions Alignment Table: Current State and Federal Standards for Staffing Levels and Types

Provides an assessment of how peer-reviewed literature definitions of staff types and quality of care align with the Staffing Study team's analyses.

The study team used Payroll Based Journal (PBJ) job codes to identify RNs, LPNs, and nurse aides. Literature that had No Alignment used both different staff types and a different data set. Literature with Some Alignment used the same staff types but identified them with different data. Literature with Good Alignment used the same staff types and the same data set.

Quality of care alignment ratings are qualitative assessments. The study team's measures include MDS Long Stay Measures (% of residents whose ability to move independently worsened; % of residents whose need for help with daily activities has increased; % of high-risk residents with pressure ulcers); Claims Based Long Stay Measures (# of hospitalizations per 1,000 resident days; # of outpatient emergency department visits per 1,000 resident days); Minimum Data Set (MDS) Short-Stay Measures (% of residents who improved in their ability to move around on their own); Claims Based Short-Stay Measures (% of short-stay residents who were rehospitalized after a nursing home admission; % of short-stay residents who had an outpatient emergency department visit; rate of successful return to home or community from an skilled nursing facility).

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
Full citation	*Data set used and staff types included in the study*	*Indicator of how well staff aligns with the study team's quantitative analyses*	*Quality of care measures included in the study*	*Indicator of how well quality with the study team's quantitative analyses*
1. Geng, F., Stevenson, D. G., & Grabowski, D. C. (2019). Daily nursing home staffing levels highly variable, often below CMS expectations. *Health Affairs, 38*(7), 1095–1100. https://doi.org/10.1377/hlthaff.2018.05322	RN: Registered nurse with or without administrative duties, RN DON. LPN: Licensed practical nurse with or without administrative duties. Nurse aides: CNAs, nurse aide in training, and Medication Aides/technicians. Used PBJ and CASPER data.	Good Alignment	The % of days that facilities met or exceeded the expected staffing levels used in NHC, based on the facilities' resident acuity. The % of days that facilities met or exceeded the minimum federal standard for RN staffing (8 RN hours per day).	No Alignment
2. Sharma, H., Konetzka, R. T., & Smieliauskas, F. (2019). The relationship between reported staffing and expenditures in nursing homes. *Medical Care Research & Review, 76*(6), 758–783. https://doi.org/10.1177/1077558717739214	RN, LPN, nurse aide Medicare Cost Reports (2007-2010), OSCAR (2007-2010), and raw NHC rating scores (2007-2010)	Some Alignment	Uses the raw rating scores used by CMS to assign star ratings to nursing homes (the underlying continuous scores, not simply the star categories)	Good Alignment

A.5 Literature Review Support Tables: Role of Different Nurse Types in Ensuring Safety and Quality of Care

- For summary descriptions of the literature reviewed, refer to Exhibit A.5.1: Literature Summary Table: Role of Different Nurse Types in Ensuring Safety and Quality of Care
- For details on the Evidence Grade, refer to Exhibit A.5.2: Evidence Grading Table: Role of Different Nurse Types in Ensuring Safety and Quality of Care
- For details on the Alignment Rating, refer to Exhibit A.5.3: Literature Summary Table: Role of Different Nurse Types in Ensuring Safety and Quality of Cares

Exhibit A.5.1: Literature Summary Table: Role of Different Nurse Types in Ensuring Safety and Quality of Care

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
1. Bakerjian, D. (2022). The advanced practice registered nurse leadership role in nursing homes: Leading efforts toward high quality and safe care. *Nursing Clinics of North America, 57*(2), 245–258.	Peer-reviewed	Nursing homes; skilled nursing homes; long-term care	Not applicable	Not research-based. Goal is to advocate for increased use of APRNs is nursing homes	Not Applicable	• At the individual care level as clinicians, APRNs lead the clinical care of residents and engage with nursing home staff to improve individual resident quality of care that results in improved resident outcomes. They also play an important role in leading resident, family, and staff education and facilitate communication among the team. At the organization of system level, APRNs act as consultants and lead QAPI efforts. • In this role, they lead teams of staff to work together to set goals, implement improvement processes, measure the improvements, and put systems in place to reinforce and sustain improvements.	Not Applicable	n/a	None	Some
2. Bakerjian, D., Boltz, M., Bowers, B., Gray-Miceli, D., Harrington, C., Kolanowski, A., & Mueller, C. A. (2021). Expert nurse response to workforce recommendations made by the Coronavirus Commission for Safety and Quality in Nursing Homes. *Nursing Outlook, 69*(5), 735–743. https://doi.org/10.1016/j.outlook.2021.03.017.	Peer-reviewed	U.S. nursing homes	Not applicable	Opinion article This article is responding to the 2020 Coronavirus Commission for Safety and Quality in nursing homes report.	Not applicable	• The authors believe the Commission's recommendation falls short by not requiring CNA staffing based on resident needs and by not recommending increased wages and benefits for CNAs. • Harrington et al. (2020) have developed a detailed system for determining adequate staffing levels based on resident acuity and care needs. This method can be used by nursing homes to guide staffing decisions. • RNs are increasingly responsible for the supervision and delegation of complex care tasks to LPN/LVNs and CNAs. • RN managers should have competencies including motivating staff, budgeting, problem solving and decision-making, and/or use of best practices.	Not Applicable	n/a	Good	Some

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
						• There is evidence that RNs and LPN/LVNs are used interchangeably in nursing homes, and it results in the LPN/LVN performing tasks outside their scope of practice. The pervasiveness of interchangeability minimizes the residents' access to professional nursing care.				
3. Bonner, A., Fulmer, T., Pelton, L., & Renton, M. (2022). Age-friendly nursing homes: Opportunity for nurses to lead. *Nursing Clinics of North America, 57*(2), 191–206. https://doi.org/10.1016/j.cnur.2022.02.002	Peer-reviewed	Nursing homes	n/a	Descriptive article that summarizes the roles of RNs, LPNs, and CNAs in the context of the *Age-Friendly Health Systems* movement.	Existing literature	• The roles of RNs and LPNs or LVNs may differ in nursing homes from other settings. In nursing homes, RNs are primarily in administrative roles such as the DON or Director of Quality and Safety and do not spend as much time with residents as the LPNs. Federal staffing regulations simply require "sufficient quality and quantity of staff" to care for residents who have been admitted to the nursing home; the Centers for Medicare and Medicaid Services (CMS) does not require minimum staffing ratios. • CNAs spend more hours per day with residents than any other nursing home team member. They often know things about a resident that no one else on staff does, such as how they like their coffee, or which sweater is their favorite. They may know what time the person prefers to get up in the morning or go to sleep at night. While these preferences should be documented and shared with the interprofessional team, processes are often not in place to facilitate that communication.	Not Applicable	n/a	Good	Good
4. Burt, S. C. (2019). Measuring preceptor selection in long-term care. *Journal of Continuing Education in Nursing, 50*(10), 455–462. https://doi.org/10.3928/00220124-20190917-07	Peer-reviewed	U.S., Northeast City, long-term care/ subacute care facility	Single 180 bed facility with ~150 nursing personnel	Quantitative descriptive observational that explored characteristics of nursing staff in long-term and subacute facilities.	Cotter Preceptor Selection Instrument data	• RNs and LPNs were more likely than CNAs to have complete and appropriate documentation. • RNs were more likely than CNAs to set priorities and demonstrate time management skills, and delegate appropriately and effectively.	Single site and was focused on fitness to be a preceptor rather than provision of patient care.	High	Some	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
5. Clemens, S., Wodchis, W., McGilton, K., McGrail, K., & McMahon, M. (2021). The relationship between quality and staffing in long-term care: A systematic review of the literature 2008–2020. *International Journal of Nursing Studies, 122*(October), 104036. https://doi.org/10.1016/j.ijnurstu.2021.104036	Peer-reviewed	Long-term care residents in nursing homes in Canada, the U.S., United Kingdom, Europe, New Zealand, and Australia.	34 studies were published between January 2008 and June 2020. Studies were from: U.S. (26); Canada (2); Switzerland (2); Norway (1); Italy (1); Belgium (1): Netherlands (1)	Systematic review	Published articles focused on quality and nursing and personal care staffing in long-term care in peer-reviewed databases (MEDLINE, CINAHL, and AGELINE) and several Cochrane databases to retrieve studies published between January 2008 and June 2020	• Evidence on the relationships between quality and long-term care staffing level and skill mix, remain mixed • Higher staffing levels and skill mix generally supported better rather than worse outcomes • Significant and consistent findings were more evident when staffing levels were further analyzed by indicator and staffing category • This study found that RNs were consistently associated with a reduction in pressure ulcers and all three staffing categories of RN, LPN and nurse aide were consistently associated with reduced restraints • Also, total nursing staff was consistently associated with reduced hospitalizations and deficiencies • Total nursing staff was consistently associated with reduced hospitalizations and deficiencies. Skill mix findings were also mixed, other than a higher ratio of RN to LPN findings, which associated higher proportions of RN care with better outcomes (e.g., fewer deficiencies)	This study excluded gray literature, reducing potentially relevant evidence	High	Some	Some

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
6. Firnhaber, G. C., Roberson, D. W., & Kolasa, K. M. (2020). Nursing staff participation in end-of-life nutrition and hydration decision-making in a nursing home: A qualitative study. *Journal of Advanced Nursing, 76*(11), 3059–3068. https://doi.org/10.1111/jan.14491	Peer-reviewed	Southeastern U.S. freestanding nursing home	19 direct care nursing staff members (RNs, LPNs, CNAs)	• A qualitative exploration with an ethnographic focus. • To better understand how nursing staff participate end-of-life nutrition and hydration decision-making processes and what factors impact that participation.	Semi-structured interviews with staff, participant observation and organizational and regulatory policy review.	• In the USA, regulations vary somewhat from state to state with RNs generally having greater administrative responsibility, LPNs performing more technical tasks and CNAs providing care delegated to them as appropriate to their training and certification. • RNs perceived their interactions with residents, family members and medical providers as influencing formal decision-making, while CNAs perceived their interactions with familiar residents and family members—not medical providers—as influencing formal decision-making. • Most direct resident care begins with CNAs. • LPNs often verify, add to, and pass information "up the chain of command." • RNs initiate and coordinate discussions between physicians and residents/family member. • All RNs but only have of LPNs expressed comfort influencing decisions regarding end-of-life nutrition and hydration. LPNs often engaged he RN on duty or the DON. • All CNAs experiences close relationships with at least some residents and family members. LPNs discussed resident relationships less than RNs or CNAs. RNs often reported building relationships with families to improve care through better communication.	Using a simple convenience sample of volunteers from a single, self-selected facility may limit generalizability of findings.	High	Good	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
7. Gorges, R. J., & Konetzka, R. T. (2020). Staffing levels and COVID-19 cases and outbreaks in US nursing homes. *Journal of the American Geriatrics Society, 68*(11), 2462–2466. https://doi.org/10.1111/jgs.16787	Peer-reviewed	Nursing homes	Residents of nursing homes that met COVID-19 reporting requirements.	Cross-sectional study using Logistic regression to analyze the associations of staffing levels from Nursing Home Compare with the outcomes of any COVID-19 cases and, conditional on at least one case, an outbreak.	• Centers for Medicare & Medicaid Services (CMS) facility-level data on COVID-19 cases and deaths merged with nursing home and county characteristics. • CMS COVID-19 Nursing Home Data Set, NHS archives, LTCFocus, PBJ	• Higher registered nurse-hours are associated with a higher probability of experiencing any COVID cases. • However, among facilities with at least one case, higher nurse aide hours and total nursing hours are associated with a lower probability of experiencing an outbreak and with fewer deaths. • The strongest predictor of cases and outbreaks in nursing homes is per capita cases in the county.	• The effect sizes of staffing are relatively small. For example, being in the top third of the distribution of nurse aide hours is associated with one fewer death; similarly, being in the top third of total nursing hours is associated with 1.1 fewer deaths. • CMS required reporting beginning May 8, and facilities have the option to report cases/deaths going back to January 1. As a result, the CMS data on total cases/deaths represent an undercount, especially in states that experienced early outbreaks.	High	Good	None
8. Harris, M., Kolanowski, A., & Greenberg, S. (2022). The making of nurse leaders in the nursing home. *Nursing Clinics of North America, 57*(2), 171–178. https://doi.org/10.1016/j.cnur.2022.02.010	Peer-reviewed	Long-term care	Registered nurses	Position paper • This article reflects on what nursing leadership is, the educational and experiential paths that prepare nurse leaders, the characteristics and role of nurse leaders in long-term care, and recommendations for improving nursing leadership in long-term care settings.	Not Applicable	• It is more likely that professional RNs who choose to work in long-term care will receive much of their training on the job. • The pay scale is significantly lower for RNs in the nursing home, which may account for the alarming workforce disparities with only 7% of RNs choosing to work in long-term care compared with an overwhelming 60% of RNs who are employed in the hospital. • One cross-sectional study showed five characteristics of nurse leaders in long-term care including experiments with new ideas, controls work closely, relies on subordinates, coaches and gives feedback, and handles conflicts in a constructive way. • Only RNs have the education and responsibility to assess, supervise care, and monitor the health status of nursing home residents.	Not a study	n/a	Good	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
9. Katz, P. R., Ryskina, K., Saliba, D., Costa, A., Jung, H.-Y., Wagner, L. M., Unruh, M. A., Smith, B. J., Moser, A., Spetz, J., Feldman, S., & Karuza, J. (2021). Medical care delivery in U.S. nursing homes: Current and future practice. *Gerontologist, 61*(4), 595–604. https://doi.org/10.1093/geront/gnaa141	Peer-reviewed	U.S. nursing homes	Not applicable.	Perspective piece that provides an overview of what is currently known about medical provider practice in nursing home and organizational models of practice.	Not applicable	• Existing research suggests that nurse practitioners in nursing homes can improved quality outcomes such as reducing emergency department visits, improving outcomes for frail residents, reducing pain, improving functional status. • In some states nurse practitioners have expansive scopes of practice but in other state nurse practitioner role and highly restrictive, requiring significant physician oversight. Modernizing and lessening these restrictions, such as the VA has done and CMS temporarily done in response to COVID-19 may increase access to quality care at decreased cost.	Not applicable	Medium	Some	None
10. Min, A., & Hong, H. C. (2019). Effect of nurse staffing on rehospitalizations and emergency department visits among short-stay nursing home residents: A cross-sectional study using the US Nursing Home Compare database. *Geriatric Nursing, 40*(2), 160–165. https://doi.org/10.1016/j.gerinurse.2018.09.010	Peer-reviewed	U.S. nursing homes	11,132 U.S. nursing homes	Cross-sectional study. Descriptive statistics: multivariate regression	2016 NHC data	• Rates of rehospitalizations and emergency department visits were positively correlated, and nurse staffing levels simultaneously predicted rehospitalization and emergency department visit rates. • Small but significant relationships were identified between the percentage of rehospitalizations and RN HPRD and LPN HPRD. Similarly, small but significant relationships were identified between the percentage of emergency department visits and RN HPRD, LPN HPRD, and CNA HPRD. • Nursing homes with lower RN staffing ratings calculated based on only RNs HPRD were more likely to have higher rehospitalization rates. Nursing homes with lower RN staffing ratings were more likely to have higher emergency department visits.	• Although the study controlled for significant facility characteristics in the analysis, it did not account for resident-level variables that may contribute to differences in the rates of rehospitalizations and emergency department visits • Approximately 29% of nursing homes had not reported both rehospitalizations and emergency department visits were excluded from the study, so the results cannot be generalized to all U.S. nursing homes	High	Some	Good

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
11. Snyder, R. L., Anderson, L. E., White, K. A., Tavitian, S., Fike, L. V., Jones, H. N., Jacobs-Slifka, K. M., Stone, N. D., & Sinkowitz-Cochran, R. L. (2021). A qualitative assessment of factors affecting nursing home caregiving staff experiences during the COVID-19 pandemic. *PLoS One, 16*(11), e0260055. https://doi.org/10.1371/journal.pone.0260055	Peer-reviewed	Nursing homes	51 CNAs from 84 facilities	Qualitative better understand what individual and facility level factors may have contributed to the impact of COVID19 on CNAs and Environmental Services (EVS) staff working in nursing homes.	National Health Care Safety Network data, participant surveys and participant focus groups.	• Staffing problems were a recurring theme reported. Participants often cited the toll the pandemic took on their emotional well-being, describing increased stress, responsibilities, and time needed to complete their jobs. • With respect to added responsibilities, CNAs were mostly likely to cite rule and protocol enforcement (11%); non-clinical resident care (e.g., hairstyling) (11%), and cleaning and disinfection (13%). As for things that increased the time required to complete tasks CNAs cite staff shortages (24%), additional PPE (21%), and taking more precautions (13%). As for added pressures 24% reported increased stress and job anxiety, 11% reported becoming like family to residents. 7% of CNAs reported no change in responsibilities.	The study had a voluntary convenience sample. Data was self-reported. Generalizability is limited since participants may not be representative of overall nursing home staff population in the U.S.	High	Some	None
12. Valmadrid, L. C., Schwei, R. J., Maginot, E., & Pulia, M. S. (2021). The impact of health care provider relationships and communication dynamics on urinary tract infection management and antibiotic utilization for long-term care facility residents treated in the emergency department: A qualitative study. *American Journal of Infection Control, 49*(2), 198–205. https://doi.org/10.1016/j.ajic.2020.07.009	Peer-reviewed	Long-term care facilities and emergency department across Wisconsin	Long-term care and emergency department nurses and physicians LTCF nurses (12, including floor nurses, nurses in leadership, or nurses holding specialized positions)	Qualitative study that aimed to understand how health care provider communication and relationship dynamics affect LTCF residents treated in the emergency department to identify barriers to antibiotic stewardship for UTIs.	Semi-structured interviews with nurses and physicians from LTCFs and emergency departments, guided by the Systems Engineering Initiative for Patient Safety framework	• Emergency department and LTCF nurses have a critical role in both intrafacility and interfacility communication. Fragmented communication and interprofessional power dynamics were identified barriers to optimal antibiotic prescribing for UTIs. Identified strategies to overcome these issues included using objective diagnostic criteria, development of communication scripts, and nurse-to-nurse education. • Many infection preventionists and nurses took on informal antibiotic steward roles, but given the increased workload, the common issue of turnover, and the time it takes to build trusting relationships, a suggestion for improvement could be to establish a dedicated antibiotic steward nurse position for each facility. • Nurses are often heavily involved in patient assessments and drive care through their communication with providers in both care settings. Both LTCF and emergency department staff recognized that nurse communication has a critical role in both diagnosis and	Voluntary sampling bias through self-selection. Limited to Wisconsin. this study contained three interviews that were conducted by two researchers, one of which is a current emergency medicine physician and promoter of antibiotic stewardship, potentially limiting the depth of conversations and the open expression of the interviewee in those three interviews.	High	Some	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
						antibiotic utilization. Though providers have the final responsibility for diagnosis and prescribing decisions, providers often rely on the information collected (e.g., history and urine testing), interpreted, and delivered by the nurses to make those decisions. • LTCF nurses have specialized knowledge of the particular risks and side effects that unnecessary antibiotics have on their older adult residents.				
13. Van Houtven, C. H., DePasquale, N., & Coe, N. B. (2020). Essential long-term care workers commonly hold second jobs and double- or triple-duty caregiving roles. *Journal of the American Geriatrics Society, 68*(8), 1657–1660. https://doi.org/10.1111/jgs.16509	Peer-reviewed	Northeastern U.S.	958 essential facility-based LTC workers involved in direct patient care (RNs, LPNs, CNAs) across 30 nursing home facilities	Descriptive secondary analysis that. describes the prevalence of the workers (1) second jobs, and (2) unpaid care work for dependent children and/or adult relatives (double- and triple-duty caregiving) overall and by occupational group (registered nurses [RNs], licensed practical nurses [LPNs], or certified nursing assistants [CNAs]).	Work, Family and Health Study data (final wave) which examines the work, family, and health of employees working in New England nursing home facilities	Most LTC workers were CNAs, followed by LPNs and RNs. Overall, more than 70% of these workers agreed or strongly agreed with this statement: "When you are sick, you still feel obligated to come into work." One-sixth had a second job, where they worked an average of 20 hours per week, and more than 60% held double- or triple-duty caregiving roles. Additional paid work and unpaid care work characteristics did not significantly differ by occupational group, although the prevalence of second jobs was highest and accompanying work hours were longest among CNAs.	This analysis is descriptive and provides no causal explanation behind holding second jobs and multiple caregiving roles. In addition to these data dated from 2012, the WFHS represents LTC workers from one region of the United States.	High	Good	None
14. Yang, B. K., Carter, M. W., Trinkoff, A. M., & Nelson, H. W. (2021). Nurse staffing and skill mix patterns in relation to resident care outcomes in US nursing homes. *Journal of the American Medical Directors Association, 22*(5), 1081–1087.e1081. https://doi.org/10.1016/j.jamda.2020.09.009	Peer-reviewed	All nursing homes with Medicare/Medicaid licensure participation during the 2018 CASPER period, with complete data available on select measures,	14,325 facilities	• **Retrospective secondary data analysis** at the facility level using administrative data. • Cluster analysis to identify nursing homes with similar nursing skill mix patterns using measures that capture HPRD	The final analytical data set contained measures merged from the public CMS NHC Claims Based Quality Measures file database (2018), the CASPER (2018), and the public Area Health Resources File (AHRF)	After controlling for regional and organization characteristics, residents in nursing homes in higher RN clusters had significantly lower rehospitalization and emergency department use compared with those in the high-LPN cluster. There was a similar, but not significant, trend for high-CNA v. high-LPN clusters.	Focused specifically on hospitalization and emergency department use	High	Some	Good

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
		were included.		for RNs, LPNs, and CNAs. • Estimated the impact of cluster assignment on unplanned rehospitalization and emergency department using multivariate generalized estimating equations.						
15. Mollot, R. (2022, June 8). Re: CMS-1765-P; *Request for Information on Revising the Requirements for Long-Term Care* Facilities *To Establish Mandatory Minimum Staffing Levels.* (Comments to CMS on minimum staffing standard). Long Term Care Community Coalition. https://nursinghome411.org/cms-min-staffing/	Gray literature	n/a	n/a	Interim Report	n/a	Concrete, clear, and appropriate minimum staffing standards are needed now to finally realize the promise of the Nursing Home Reform Law in the lives of residents and the vast majority of American families who will depend on nursing home services at some time or another. They are needed to ensure that vulnerable residents receive care and services that are (at a minimum) humane and safe, and that American taxpayers get value for the billions of dollars that we pay every year for nursing home care	n/a	n/a	n/a	n/a
16. California Association of Long Term Care Medicine. (n.d.). CALTCM white paper on nursing home staffing. https://www.caltcm.org/assets/CALTCM%20White%20Paper%20on%20Nursing%20Home%20Staffing%20-%20FINAL.pdf	Gray literature	California		Policy review	California policies	• Ensure that minimum recommended staffing levels are met. • Reduce nursing turnover and minimize the use of waivers by ensuring adequate wages. • Ensure that nursing homes adjust staffing levels to meet the acuity needs of residents. • RNs are essential to design, implement and monitor infection control plans for facilities as well as individual resident care plans. • RNs are trained in infection control, resident assessment, and care planning (including for infections), and surveillance of residents (including for infections and	n/a	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
						other conditions). They are responsible for supervising licensed vocational nurses or licensed practical nurses (LVNs/LPNs) who are generally responsible for giving medications and treatments to residents.				
17. Reinhard, S. C., & Hado, E. (2021). *LTSS choices: Small-house nursing homes.* AARP Public Policy Institute. https://doi.org/10.26419/ppi.00126.001	Gray literature	n/a	n/a	Article	n/a	The staffing model is a defining feature of the Green House model, with CNAs holding more responsibility for, and empowered to achieve, quality of care and quality of life for residents. CNAs, who undergo additional hours of specialized training, including dementia care and culinary education, operate as a self-managed work team, and are all trained to provide a diverse range of supports including personal care, meal preparation, laundry, and housekeeping. This allows for any staff member to respond in the moment to resident needs. By contrast, in larger nursing homes, workers typically perform only one or two functions and do so for large numbers of residents, which means delays in meeting residents' needs while awaiting the arrival of specialized staff members.	n/a	n/a	n/a	n/a
18. National Academies of Sciences, Engineering, and Medicine. (2022). *The national imperative to improve nursing home quality: Honoring our commitment to residents, families, and staff.* The National Academies Press. https://doi.org/10.17226/26526	Gray literature	n/a	n/a	Consensus Study Report	n/a	• Recommend direct care RN coverage for a least 24 hours a day, 7 days a week, with additional coverage as needed, a full-time social worker with at least an accredited bachelor's level social work degree and one year of supervised health care setting experience, and an infection control specialist who is an RN, APRN, or physician. • They support research-based minimum staffing requirements for all direct care staff, including for weekends and holidays, that is based on resident case mix and population-specific staffing needs. • They believe that investing in CNAs is necessary to improve quality of care and advocate for competency-based training that includes topics such as dementia, infection control, behavioral health, chronic diseases, use of assistive	n/a	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
						medical devices, and cultural sensitivity and humility. • They recommend designating a specific percentage of Medicaid and Medicare payments to direct care services (e.g., staff and wages). • They support addition Care Compare measures related to weekend staffing and staff turnover by role and increasing the weight of the staffing measures within the Five-Star composite rating.				
19. U.S. Government Accountability Office. (2021). *Additional reporting on key staffing information and stronger payment incentives needed for skilled nursing facilities.* GAO Publication No. 21-408. U.S. Government Printing Office. https://www.gao.gov/products/gao-21-408	Gray literature	U.S. skilled nursing facilities	93% of U.S. SNFs (14,423/ 15,500)	• Government report • Primarily descriptive analyses • Analyzed CMS staffing data compared to critical incident rates; conducted stakeholder interviews	PBJ data for 2018 and 2019	• GAO's analysis of 2019 staffing data found that almost all SNFs frequently met a federal requirement for a registered nurse (RN) on site for 8 hours per day. • Further, about one-quarter of SNFs frequently met staffing thresholds for minimum RN and total nurse staffing that a CMS staffing study identified as needed to avoid quality problems SNFs are not subject to these quality thresholds for ratings or as requirements, but many stakeholders have recommended that they be used as SNF staffing thresholds • RNs have at least a two-year degree and are responsible for overseeing residents' care; LPNs, who have a one-year degree and typically provide routine bedside care (such as taking vital signs); and CNAs, who have at least 75 hours of training and generally assist residents with activities of daily living	Not peer-reviewed but uses recent large data set.	n/a	n/a	n/a
20. Office of the Inspector General (OIG), U.S. Department of Health and Human Services. (2020). *Some nursing homes' reported staffing levels in 2018 raise concerns; consumer transparency could be increased.* HHS OIG Data Brief OEI-04-18-00450. https://oig.hhs.gov/oei/reports/OEI-04-18-00450.pdf	Gray literature	U.S. nursing homes	12,862 U.S. nursing homes	OIG Data Brief	• 2018 PBJ data • 20 local LTC ombudsmen surveys, MDS data, CASPER data, and facility staffing star ratings and daily staffing	• 7% of nursing homes fell below Federally required staffing levels on at least 30 total days in 2018. • After CMS announced Staffing Star Rating based incentives for nursing homes, 27% fewer nursing homes reported at least 7 days without any RN time. However, 7% more nursing homes reported days with less RN time than the required 8 hours per day. • When RNs and licensed nurse staff are not present to adequately supervise Aides, residents' day-to-day care needs—such as bathing, grooming, and	Descriptive analysis that relies on self-reported data	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
						toileting—may not be met, which can contribute to a variety of health problems, such as pressure sores, UTIs, and falls. • CMS's Star Ratings are based on quarterly averages, which do not convey the extent to which staffing varies day to day.				

Exhibit A.5.2: Evidence Grading Table: Role of Different Nurse Types in Ensuring Safety and Quality of Care

Based on the National Service Framework for Long Term Conditions (see Turner-Stokes et al., 2006). Consistent with the Framework, only peer-reviewed researched-based evidence is rated.

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
Full citation	E: Reflects "expert' (user/caregiver/professional) evidence R: Research-based evidence	**Primary Research-Based Evidence** P1 Primary research using quantitative approaches P2 Primary research using qualitative approaches P3 Primary research using mixed methods **Secondary research-based evidence** S1 Meta-analysis of existing data analysis S2 Secondary analysis of existing data **Review Based Evidence** R1 Systematic reviews of existing research R2 Descriptive or summary reviews of existing research	Are the research question/aims and design clearly stated? 0 = No 1 = Somewhat 2 = Yes	Is the research design appropriate for the aims and objectives of the research? 0 = No 1 = Somewhat 2 = Yes	Are the methods clearly described? 0 = No 1 = Somewhat 2 = Yes	Is the data adequate to support the authors interpretations/ conclusions? 0 = No 1 = Somewhat 2 = Yes	Are the results generalizable ? 0 = No 1 = Somewhat 2 = Yes	Sum of quality question scores	Based on total quality score 7 to 10 = high quality 4 to 6 = medium quality 3 or less = poor quality
1. Bakerjian, D. (2022). The advanced practice registered nurse leadership role in nursing homes: Leading efforts toward high quality and safe care. *Nursing Clinics of North America, 57*(2), 245–258.	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2. Bakerjian, D., Boltz, M., Bowers, B., Gray-Miceli, D., Harrington, C., Kolanowski, A., & Mueller, C. A. (2021). Expert nurse response to workforce recommendations made by the Coronavirus Commission for Safety and Quality in Nursing Homes. *Nursing Outlook, 69*(5), 735–743. https://doi.org/10.1016/j.outlook.2021.03.017	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3. Bonner, A., Fulmer, T., Pelton, L., & Renton, M. (2022). Age-friendly nursing homes: Opportunity for nurses to lead. *Nursing Clinics of North America, 57*(2), 191–206. https://doi.org/10.1016/j.cnur.2022.02.002.	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
4. Burt, S. C. (2019). Measuring preceptor selection in long-term care. *Journal of Continuing Education in Nursing, 50*(10), 455–462. https://doi.org/10.3928/00220124-20190917-07	R	P1	1	2	2	2	1	8	High
5. Clemens, S., Wodchis, W., McGilton, K., McGrail, K., & McMahon, M. (2021). The relationship between quality and staffing in long-term care: A systematic review of the literature 2008–2020. *International Journal of Nursing Studies, 122*(October), 104036. https://doi.org/10.1016/j.ijnurstu.2021.104036	R	R1	2	2	2	2	2	10	High
6. Firnhaber, G. C., Roberson, D. W., & Kolasa, K. M. (2020). Nursing staff participation in end-of-life nutrition and hydration decision-making in a nursing home: A qualitative study. *Journal of Advanced Nursing, 76*(11), 3059–3068. https://doi.org/10.1111/jan.14491	R	P2	2	2	2	2	0	8	High
7. Gorges, R. J., & Konetzka, R. T. (2020). Staffing levels and COVID-19 cases and outbreaks in US nursing homes. *Journal of the American Geriatrics Society, 68*(11), 2462–2466. https://doi.org/10.1111/jgs.16787	R	P1	2	2	1	2	1	8	High
8. Harris, M., Kolanowski, A., & Greenberg, S. (2022). The making of nurse leaders in the nursing home. *Nursing Clinics of North America, 57*(2), 171–178. https://doi.org/10.1016/j.cnur.2022.02.010	E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
9. Katz, P. R., Ryskina, K., Saliba, D., Costa, A., Jung, H.-Y., Wagner, L. M., Unruh, M. A., Smith, B. J., Moser, A., Spetz, J., Feldman, S., & Karuza, J. (2021). Medical care delivery in U.S. nursing homes: Current and future practice. *Gerontologist, 61*(4), 595–604. https://doi.org/10.1093/geront/gnaa141	R	R2	1	2	0	2	1	6	Medium
10. Min, A., & Hong, H. C. (2019). Effect of nurse staffing on rehospitalizations and emergency department visits among short-stay nursing home residents: A cross-sectional study using the US Nursing Home Compare database. *Geriatric Nursing, 40*(2), 160–165. https://doi.org/10.1016/j.gerinurse.2018.09.010	R	S2	2	2	2	2	0	8	High

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
11. Snyder, R. L., Anderson, L. E., White, K. A., Tavitian, S., Fike, L. V., Jones, H. N., Jacobs-Slifka, K. M., Stone, N. D., & Sinkowitz-Cochran, R. L. (2021). A qualitative assessment of factors affecting nursing home caregiving staff experiences during the COVID-19 pandemic. *PLoS One, 16*(11), e0260055. https://doi.org/10.1371/journal.pone.0260055	R	P2	1	2	2	2	0	7	High
12. Valmadrid, L. C., Schwei, R. J., Maginot, E., & Pulia, M. S. (2021). The impact of health care provider relationships and communication dynamics on urinary tract infection management and antibiotic utilization for long-term care facility residents treated in the emergency department: A qualitative study. *American Journal of Infection Control, 49*(2), 198–205. https://doi.org/10.1016/j.ajic.2020.07.009	R	P2	2	2	2	2	0	8	High
13. Van Houtven, C. H., DePasquale, N., & Coe, N. B. (2020). Essential long-term care workers commonly hold second jobs and double- or triple-duty caregiving roles. *Journal of the American Geriatrics Society, 68*(8), 1657–1660. https://doi.org/10.1111/jgs.16509	R	S2	2	2	2	2	1	9	High
14. Yang, B. K., Carter, M. W., Trinkoff, A. M., & Nelson, H. W. (2021). Nurse staffing and skill mix patterns in relation to resident care outcomes in US nursing homes. *Journal of the American Medical Directors Association, 22*(5), 1081–1087.e1081. https://doi.org/10.1016/j.jamda.2020.09.009	R	S2	2	2	2	2	2	10	High

Exhibit A.5.3: Definitions Alignment Table: Role of Different Nurse Types in Ensuring Safety and Quality of Care

Provides an assessment of how peer-reviewed literature definitions of staff types and quality of care align with the Staffing Study team's analyses.

The study team used Payroll Based Journal (PBJ) job codes to identify RNs, LPNs, and nurse aides. Literature that had No Alignment used both different staff types and a different data set. Literature with Some Alignment used the same staff types but identified them with different data. Literature with Good Alignment used the same staff types and the same data set.

Quality of care alignment ratings are qualitative assessments. The study team's measures include MDS Long Stay Measures (% of residents whose ability to move independently worsened; % of residents whose need for help with daily activities has increased; % of high-risk residents with pressure ulcers); Claims Based Long Stay Measures (# of hospitalizations per 1,000 resident days; # of outpatient emergency department visits per 1,000 resident days); Minimum Data Set (MDS) Short-Stay Measures (% of residents who improved in their ability to move around on their own); Claims Based Short-Stay Measures (% of short-stay residents who were rehospitalized after a nursing home admission; % of short-stay residents who had an outpatient emergency department visit; rate of successful return to home or community from an skilled nursing facility).

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
Full citation	*Data set used and staff types included in the study*	*Indicator of how well staff aligns with the study team's quantitative analyses*	*Quality of care measures included in the study*	*Indicator of how well quality aligns with the study team's quantitative analyses*
1. Bakerjian, D. (2022). The advanced practice registered nurse leadership role in nursing homes: Leading efforts toward high quality and safe care. *Nursing Clinics of North America, 57*(2), 245–258.	**APRNs** (nurse practitioners and clinical nurse specialists)	No Alignment	Potentially avoidable hospital transfers from nursing homes to acute care hospitals Resident falls, urinary incontinence, depression, pressure injuries, and behaviors	Some Alignment
2. Bakerjian, D., Boltz, M., Bowers, B., Gray-Miceli, D., Harrington, C., Kolanowski, A., & Mueller, C. A. (2021). Expert nurse response to workforce recommendations made by the Coronavirus Commission for Safety and Quality in Nursing Homes. *Nursing Outlook, 69*(5), 735–743. https://doi.org/10.1016/j.outlook.2021.03.017	RN, LPN/LVN), and CNAs	Good Alignment	Falls, pressure injuries, and immobility	Some Alignment
3. Bonner, A., Fulmer, T., Pelton, L., & Renton, M. (2022). Age-friendly nursing homes: Opportunity for nurses to lead. *Nursing Clinics of North America, 57*(2), 191–206. https://doi.org/10.1016/j.cnur.2022.02.002	RNs, LPNs, and CNAs RNs are primarily in administrative roles such as the DON or Director of Quality and Safety and do not spend as much time with residents as the LPNs	Good Alignment	Falls with injuries, functional status, pressure ulcers, and restraint use	Good Alignment

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
4. Burt, S. C. (2019). Measuring preceptor selection in long-term care. *Journal of Continuing Education in Nursing, 50*(10), 455–462. https://doi.org/10.3928/00220124-20190917-07	Potential RN preceptors, certified nursing assistants (CNAs), and LPNs **RN preceptors** are experienced nurses guiding new or inexperienced nurses into their new roles. The preceptor role involves being a role model, socializer, teacher, and evaluator.	Some Alignment	Preceptor characteristics	No Alignment
5. Clemens, S., Wodchis, W., McGilton, K., McGrail, K., & McMahon, M. (2021). The relationship between quality and staffing in long-term care: A systematic review of the literature 2008–2020. *International Journal of Nursing Studies, 122*(October), 104036. https://doi.org/10.1016/j.ijnurstu.2021.104036	Nursing and personal care staffing level (e.g., the dose of a nurse / personal care staff) measured by HPRD, and skill mix (e.g., the proportion of RNs to total nursing staff) So, RNs, LPNs and/or nurse aides (or their equivalents)	Some Alignment	Fourteen different quality indicators were used; 10 were outcome indicators, three were process indicators and one was government citations / audit deficiencies. The most frequently used indicator was regulatory deficiencies (n = 14), followed by pressure ulcers (n = 10), restraints (n = 6), catheterization (n = 6) and hospitalizations (n = 4).	Some Alignment
6. Firnhaber, G. C., Roberson, D. W., & Kolasa, K. M. (2020). Nursing staff participation in end-of-life nutrition and hydration decision-making in a nursing home: A qualitative study. *Journal of Advanced Nursing, 76*(11), 3059–3068. https://doi.org/10.1111/jan.14491	RNs, LPNs, and CNAs deliver the bulk of direct care to residents.	Good Alignment	End-of-life nutrition and hydration of nursing home residents.	No Alignment
7. Gorges, R. J., & Konetzka, R. T. (2020). Staffing levels and COVID-19 cases and outbreaks in US nursing homes. *Journal of the American Geriatrics Society, 68*(11), 2462–2466. https://doi.org/10.1111/jgs.16787	Used the case mix adjusted hours per resident per day for nursing aides (nurse aides), LPNs, and RNs. Also created a measure to characterize the intensity of RN staffing: share of total nursing hours provided by RNs.	Good Alignment	COVID-19 cases in a facility	No Alignment
8. Harris, M., Kolanowski, A., & Greenberg, S. (2022). The making of nurse leaders in the nursing home. *Nursing Clinics of North America, 57*(2), 171–178. https://doi.org/10.1016/j.cnur.2022.02.010	**RNs:** Registered nurses may have 2 to 4 years of education and prepared at the Associate Degree in Nursing level or with a Bachelor of Science in Nursing. All candidates for registered nurse licensure must pass the NCLEX-RN Examination.	Good Alignment	Professional RNs, Hospitalizations	No Alignment
9. Katz, P. R., Ryskina, K., Saliba, D., Costa, A., Jung, H.-Y., Wagner, L. M., Unruh, M. A., Smith, B. J., Moser, A., Spetz, J., Feldman, S., & Karuza, J. (2021). Medical care delivery in U.S. nursing homes: Current and future practice. *Gerontologist, 61*(4), 595–604. https://doi.org/10.1093/geront/gnaa141	Physicians, nurse practitioners, physician assistants, and SNF-ists nurse practitioners are RNs with additional graduate-level preparation to earn a master's degree or a Doctor of Nursing Practice degree.	Some Alignment	**Process or practice-based clinical quality measures** that allow assessment of medical provider adherence to key best practices, allow comparison across providers, provide opportunity for targeted feedback and education, and allow assessment of the value of specific provider models in LTC.	No Alignment
10. Min, A., & Hong, H. C. (2019). Effect of nurse staffing on rehospitalizations and emergency department visits among short-stay nursing home residents: A cross-sectional study using the US Nursing Home Compare database. *Geriatric Nursing, 40*(2), 160–165. https://doi.org/10.1016/j.gerinurse.2018.09.010	RNs, LPNs, CNAs Two nurse staffing measures in the Five-Star Quality Rating System: the total nurse staffing rating and the RN staffing rating	Some Alignment	The percentage of residents rehospitalized after nursing home admission and the percentage of residents who had an outpatient Emergency Department visit. Data for these quality measures were drawn from Medicare claims and were updated every 6 months.	Good Alignment

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
11. Snyder, R. L., Anderson, L. E., White, K. A., Tavitian, S., Fike, L. V., Jones, H. N., Jacobs-Slifka, K. M., Stone, N. D., & Sinkowitz-Cochran, R. L. (2021). A qualitative assessment of factors affecting nursing home caregiving staff experiences during the COVID-19 pandemic. *PLoS One, 16*(11), e0260055. https://doi.org/10.1371/journal.pone.0260055	CNAs and Environmental Services (EVS) staff members (also referred to as housekeeping)	Some Alignment	**Risk of getting COVID**: answering a Zoom poll of their perceived risk of getting COVID-19 at their facility on a scale of one (Not at All) to ten (To a Great Extent) **Changes in duties and responsibilities:** 68% of participants who responded reported performing tasks beyond their scope of work and added responsibilities, 62% reported an increase in time required to complete tasks, and 27% reported added pressures; 7% reported no changes in their responsibilities **Nursing home Facility improvements:** improve staffing (33% of respondents), improve infection prevention practices (29%), and improve organizational culture (19%)	No Alignment
12. Valmadrid, L. C., Schwei, R. J., Maginot, E., & Pulia, M. S. (2021). The impact of health care provider relationships and communication dynamics on urinary tract infection management and antibiotic utilization for long-term care facility residents treated in the emergency department: A qualitative study. *American Journal of Infection Control, 49*(2), 198–205. https://doi.org/10.1016/j.ajic.2020.07.009	Interviewed **16 LTCF** and 16 emergency department providers across Wisconsin. emergency department and **LTCF nurses** have a critical role in both intrafacility and interfacility communication.	Some Alignment	Urinary tract infection management and antibiotic utilization	No Alignment
13. Van Houtven, C. H., DePasquale, N., & Coe, N. B. (2020). Essential long-term care workers commonly hold second jobs and double- or triple-duty caregiving roles. *Journal of the American Geriatrics Society, 68*(8), 1657–1660. https://doi.org/10.1111/jgs.16509	Registered nurses [RNs], licensed practical nurses [LPNs], or certified nursing assistants [CNAs]	Good Alignment	Spread of COVID-19: LTC workers commonly hold second jobs along with double- and triple-duty caregiving roles. To slow the spread of COVID-19, both the paid and unpaid activities of these employees warrant consideration in the identification of appropriate clinical, policy, and informal supports	No Alignment
14. Yang, B. K., Carter, M. W., Trinkoff, A. M., & Nelson, H. W. (2021). Nurse staffing and skill mix patterns in relation to resident care outcomes in US nursing homes. *Journal of the American Medical Directors Association, 22*(5), 1081–1087.e1081. https://doi.org/10.1016/j.jamda.2020.09.009	RN, LPN, CNA CASPER	Some Alignment	Two outcome measures were extracted from the NHC data file: rehospitalization and Emergency Department visits, with measures obtained separately for short-stay and long-stay residents.	Good Alignment

A.6 Literature Review Support Tables: Costs Associated with Nurse Staffing

- For summary descriptions of the literature reviewed, refer to Exhibit A.6.1: Literature Summary Table: Costs Associated with Nurse Staffing
- For details on the Evidence Grade, refer to Exhibit A.6.2: Evidence Grading Table: Costs Associated with Nurse Staffing
- For details on the Alignment Rating, refer to Exhibit A.6.3: Definitions Alignment Table: Costs Associated with Nurse Staffing

Exhibit A.6.1: Literature Summary Table: Costs Associated with Nurse Staffing

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
1. Bowblis, J. R., & Roberts, A. R. (2020). Cost-effective adjustments to nursing home staffing to improve quality. *Medical Care Research and Review, 77*(3), 274–284. https://doi.org/10.1177/1077558718778081	Peer-reviewed	Medicare or Medicaid-certified nursing homes in the U.S.	221,499 inspections in 15,949 unique facilities	Fixed effect panel regression to determine whether which staff types are most cost-effective in improving quality in staff is increased incrementally.	• Period between 1999-2015 • 1999-2008 = OSCAR • 2008-2013 = CASPER • Merged with county-level information from the Area Health Resource File	• Deficiencies related to quality of care were improved most by increasing administrative nursing and social service staff. • While higher staffing consistently yielded better quality, the largest quality improvements resulted from increasing administrative RNs and social service staffing. • For a facility to have the largest effect in improving quality, the authors recommend that providers consider making small increases in social services, activities, and administrative RN staff. After considering wages, the least expensive strategy to improve deficiency outcomes involves increasing social service staff and/or activities staff. • Within the domain of quality of care, modestly increasing the level of social services staffing and administrative RN staffing had the biggest impact on reducing the number of deficiencies and the severity of the deficiency score.	Limited to a statistical identification strategy that used variation in staffing and number of residents to estimate the effect of staffing levels on deficiency measures	High	Some	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
2. Hawk, T., White, E. M., Bishnoi, C., Schwartz, L. B., Baier, R. R., & Gifford, D. R. (2022). Facility characteristics and costs associated with meeting proposed minimum staffing levels in skilled nursing facilities. *Journal of the American Geriatrics Society, 70*(4), 1198–1207. https://doi.org/10.1111/jgs.17678	Peer-reviewed	SNFs in the U.S. that are Medicare and Medicaid-certified.	• SNFs not meeting proposed minimum thresholds: 4.1 total nursing HPRD; 0.75 RN HPRD; 0.54 LPN HPRD; and 2.81 CNAs HPRD. • 14,964 Medicare and Medicaid-certified SNFs.	• Cross-sectional • Logistic regression models estimated the odds of SNFs meeting staffing thresholds. For facilities below the threshold, calculated additional HPRD needed and associated FTE personnel and salary costs.	• 2019Q4 payroll data, the Hospital Wage Index, and other administrative data for 14,964 Medicare and Medicaid-certified SNFs. • Facility characteristics = 2019 LTCFocus (database maintained by Brown University that integrates data from CASPER, NHC, etc.) • County characteristics = Area Health Resource File • Salary estimates = CMS' occupational mix data from the Core Base Statistical Area Hospital Wage Index for FY 2021.	• Factors most strongly associated with SNFs not meeting the proposed minimums were higher Medicaid census, larger bed size, for-profit ownership, higher county SNF competition; and, for RNs specifically, higher community poverty and lower Medicare census • Rural SNFs were less likely to meet all categories, and this was explained primarily by county SNF competition • Achieving proposed minimum nurse staffing levels in SNFs will require substantial financial investment in the workforce and targeted support of low-resource facilities • They estimated that achieving a minimum staffing level of 4.1 HPRD would require an additional 7.25 billion dollars in salary costs.	• Potential unobservable factors influencing the findings due to cross-sectional method. • Actual wage not available, instead estimated. • Cost estimates based on hospital wage rates, which will produce higher estimates that those generated from SNF wage data. • Staffing thresholds examined are based on studies more than 20 years old.	Medium	Good	None
3. Kennedy, K. A., Applebaum, R., & Bowblis, J. R. (2020). Facility-level factors associated with CNA turnover and retention: Lessons for the long-term services industry. *Gerontologist, 60*(8), 1436–1444. https://doi.org/10.1093/geront/gnaa098	Peer-reviewed	Nursing homes in Ohio	536 nursing homes, representing 60% of Ohio facilities operating in 2015	Regression analysis with bivariate tests	• Ohio Biennial Survey of LTC Facilities • Ohio Medicaid Cost Reports (MCR) • CASPER • AHRF	• Not -for-profit facilities had lower CNA turnover (b=-7.92; SE = 3.11; P < 0.05) and higher retention (B=3.30; SE = 1.64, P < 0.05) • Occupancy rate, and the percentage of Medicaid and Medicare payments were not significantly associated with CNA retention or turnover. • DON turnover and CNA empowerment were associated with higher and lower CNA turnover rates, respectively (b=8.28, se=3.64,	• Limited generalizability: Limited to one state, and limited sample size (not representing all nursing homes in OH). • There were key measure differences between the analytic sample and facilities missing retention and turnover rates. The study cannot determine how the missing facilities affected the study's results.	High	None	None

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
						p< 0.05; b= -1.17, se = 0.53, p=0.05) • Nursing homes that are part of a chain have higher CNA turnover rates (b=6.83; se=3.08, p< 0.05) • Nursing homes with higher percentages of patients with psychiatric illness have higher turnover rates and those with higher percentages of patients with intellectual disability have lower turnover rates ([b=0.18, se=0.07, p < 0.01][b= -0.93, se=0.47, p < 0.05]) • A county's unemployment rate was associated with decreased turnover (b=-3.81, se=1.46, p < 0.05)	• Relies on self-reported data without verification. • Data lacked information on other factors that can affect staff stability at the facility level. • CNA empowerment was measured at the organizational level using responses from nursing home administrators or other staff, and may not reflect CNA perceptions.			
4. Weech-Maldonado, R., Lord, J., Pradhan, R., Davlyatov, G., Dayama, N., Gupta, S., & Hearld, L. (2019). High Medicaid nursing homes: Organizational and market factors associated with financial performance. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 56. https://doi.org/10.1177/0046958018825061	Peer-reviewed	Freestanding High-Medicaid Nursing homes (85% and higher number of Medicaid residents) and freestanding, non-high-Medicaid nursing homes	7,754 high-Medicaid nursing home year observations or an average of 1,108 nursing homes per year and 101,013 nursing home year observations, or an average of 14,430 facilities per year from 2009 through 2015	• Bivariate statistical analysis was conducted to compare high-Medicaid to non-high-Medicaid nursing homes on all variables used in the analysis • The dependent variables are nursing homes operating and total margin. The independent variables included size, chain affiliation, occupancy rate, percent Medicare, market competition, and county socioeconomic status. Control variables included staffing variables, resident quality, for-profit status, acuity index, percent	The study uses four secondary data sources for the years 2009 to 2015: 1. Brown University's Long-Term Care Focus (LTCFocus) data set 2. Centers for Medicare and Medicaid Services' (CMS) Medicare Cost Reports 3. CMS NHC 4. the Area Health Resource File (AHRF)	• Compared with non-high-Medicaid nursing homes, high-Medicaid nursing homes had lower operating and total margin, lower Star ratings, more beds and higher occupancy, lower percent of Medicare, and a higher percentage of Black, Hispanic, and Other race/ethnicity. • For High-Medicaid homes, while having a nurse practitioner/PA was associated with higher operating margin, RN skill mix was associated with lower operating margin. • High-Medicaid nursing homes on average had a negative total margin. As such, these nursing homes are at particular risk for financial distress and ultimately closure. • Results suggest smaller facilities and those with lower occupancy and operating in a	• This study is limited to high-Medicaid nursing homes with a Medicare census, because Medicare Cost Reports does not capture data for facilities with no Medicare census. As such, the analysis may have excluded some of the most financially challenged nursing homes, e.g., those with 100% Medicaid census. • The study relied on secondary data, which presents limitations on some of the variables used. For example, the variable on use of NP/PAs only indicates whether or not a facility uses nurse practitioners/PAs; it does not provide information on FTEs, or whether the provider is	High	None	Good

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
				minorities in the facility, percent Medicaid residents, metropolitan area, and Medicare Advantage penetration.		more competitive environment may be at particular financial risk.	hired or on a contract basis. • The study focused on high-Medicaid nursing homes; therefore, our findings may not be generalizable to the industry as a whole.			
5. Weech-Maldonado, R., Pradhan, R., Dayama, N., Lord, J., & Gupta, S. (2019). Nursing home quality and financial performance: Is there a business case for quality? *INQUIRY: The Journal of Health Care Organization, Provision, and Financing,* 56. https://doi.org/10.1177/0046958018825191	Peer-reviewed	Freestanding, nongovernment nursing homes in the U.S.	173,021 nursing home year observations for the years 2000 to 2014 (average of 11,535 facilities per year)	• Panel data linear regression with facility fixed effects. • **Controls variables**: facility size, average acuity index, Herfindahl-Hirschman Index, per capita income, Medicare Advantage penetration.	• OSCAR • CASPER • Medicare Cost Reports • MDS • Area Resource File (ARF) • Brown University's LTCFocus data set (aggregated data from MDS, NHC, ARF, BLS, RHF, OSCAR/CASPER, and state policy surveys)	• Higher LPN HPRD and RN skill mix were associated with significantly poorer financial performance. • Higher RN HPRD and CNA HPRD were **not** significantly associated with financial performance. • Policy incentives, like incremental payments for additional RN staffing, may be necessary to encourage nursing homes to improve their skill mix. • Improved care processes may result in greater productivity and lower costs as the facility is able to prevent negative outcomes (thus incurring more treatment costs). Treatment costs for these negative outcomes may exceed the additional staffing costs employed in improved processes of care.	• Staffing data are based on OSCAR/CASPER data, which is self-reported and not subject to regular audits. • Study is limited to facilities with Medicare residents. • The study used outcomes that were not risk-adjusted.	High	Good	None
6. Denny-Brown, N., Stone, D., Hays, B., & Gallagher, D. (2020). COVID-19 intensifies nursing home workforce challenges. U.S. Department of Health and Human Services, Assistant Secretary for Planning and Evaluation, Behavioral Health, Disability, and Aging Policy.	Gray Literature	National associations	9 stakeholders from leaders of national associations	Qualitative	Stakeholder interviews	• Staffing shortages and attrition have further strained nursing homes during the pandemic. In response to challenging working conditions, and the high risk of COVID-19 infection, some nurses and CNAs staff are leaving the sector during this critical time when there is an increased demand for their skills and expertise.	• Completed late June 2020, not up to date • Small number stakeholders interviewed • Doesn't include direct care workers • Gaps in publicly available data	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
						• To mitigate the impact of COVID-19 on staffing levels, nursing homes are developing new recruitment infrastructure, while states and the Federal Government modified licensing and credentialing requirements and deployed nontraditional staff for surge support. • To retain nursing home staff and other frontline health care workers, federal, state, and local governments--as well as nursing homes--increased wages and augmented non-wage benefits such as childcare, housing, transportation assistance, and food supports. • The lack of a unified testing strategy, test kits, and an approach to covering the cost of testing reportedly delayed assessment of residents and nursing home staff and hindered understanding about the risk of COVID-19 transmission. • To prevent and control COVID-19 infections among nursing home staff and residents, federal and state governments increased access to PPE, expanded use of telehealth, created non-punitive leave policies, and monitored staff for illness.				

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
7. Lepore, M., Livingstone, I., Naden, D., Hatem, M., & Feng, Z. (2020). *Impacts of minimum wage increases on nursing homes: Final report.* Behavioral Health, Disability, and Aging Policy, Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services.	Gray literature	National (49 states and District of Columbia)	State-level analyses: • 49 states • 214,801 LPNs • 560,562 nurse aides	Cross-sectional	U.S. Bureau of Labor Statistics (BLS), U.S. Department of Labor, and CMS PBJ data on hours worked by nursing home employees	• Findings showed positive relationships between state wages and worked hours among RNs and nurse aides but either no relationship or a negative association between wages and worked hours among LPNs. We note again that these relationships may not be causal and many factors other than wages may be contributing to the differences in worked hours observed in this analysis • Wages for most nurse aides (76%) would be increased by a $15 federal minimum wage, and wages for fewer nurse aides would be increased by a $12 minimum wage (38%) or a $10 minimum wage (12%). Wages for a small proportion of LPNs (1%) also would be increased by a $15 federal minimum wage • Increasing the federal minimum wage would increase total direct labor costs (wages and payroll taxes) in nursing homes by approximately $72.6 million if set to $10, approximately $600 million if set to $12, and more than $2.5 billion if set to $15. Almost all increases in direct labor costs would be for nurse aides, with a small proportion for LPNs if the hourly minimum wage is set to $15	The study did not account for any state-level factors, such as state policies or regulations or market dynamics (e.g., competition or availability of workers), that might also impact nursing home wages or hours	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
8. LeadingAge. 2022. *Nursing home caregivers see double digit pay increases in 2022.* https://leadingage.org/nursing-home-caregivers-see-double-digit-pay-increases-in-2022/	Gray literature	National study	• 1,283 nursing homes • 119,100+staff	Cross-sectional	2022 self-reported data from nursing homes revenue size, profit type, region, state, and CBSA. The Report includes 19 fringe benefits, shift differentials, and projected salary increases by department for 2022 to 2023	• Hourly rates for RNs, LPNs, and CNAs spiked upwards in 2022 in a continued response to COVID-19 and ongoing staffing issues. RNs hourly rates rose sharply, increasing from 4.08% in 2021 to 11.08% in 2022. LPNs saw the lowest hourly rate increase of 9.38%, still nearly double the rate increase in 2021, and triple that of 2020. CNAs once again received another large hourly rate raise, with a 2021 increase of 7.13% and 11.15% in 2022. The national hourly rate for RNs was $34.58; the hourly rate for LPNs was $26.46; and the rate for CNAs was $16.87 (National hourly rates represent the 50th percentile of data).	n/a	n/a	n/a	n/a
9. Long Term Care Community Coalition. (2021). *LTCCC Alert: 24-hour registered nurses in nursing homes: Essential & affordable.* http://nursinghome411.org/24-hour-rn/	Gray literature	National	Nursing homes included in the second quarter of CMS data 2021	Cross-sectional	BLS, PBJ, and MDS Census data	• The average cost for a facility to shift to 24-hour RN staffing is $61.82 per day. • The cost range for a facility to achieve 24-hour RN staffing per day ranges from three cents to $141.15 per day. • The actual costs of achieving 24-hour RN staffing nationwide are only $75 million per year. • Over 75% of facilities already have enough RNs for 24-hour coverage.	n/a	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
10. Edelman, T. (2022). *Improving nursing home staffing levels can and must be done.* Center for Medicare Advocacy. https://medicareadvocacy.org/nursing-home-staffing-levels/	Gray literature	n/a	n/a	Position statement	n/a	• Decades of research document that nursing home residents cannot receive high quality of care and enjoy high quality of life, as promised by the 1987 Nursing Home Reform Law, unless nursing homes are appropriately staffed by sufficient numbers of well-trained, well-compensated, and well-treated staff. • The nurse staffing needs of nursing homes are considerable, the challenges of recruiting nursing staff are significant, and undoubtedly, there will be some additional costs to pay for more staff. Addressing these challenges in a meaningful and comprehensive way must be the country's public policy goal. The nursing home industry must be part of the solution, not a hindrance to better care for residents.	n/a	n/a	n/a	n/a
11. Gerber, D., & Nelb, R. (2022). *Principles for assessing Medicaid nursing facility payments relative to costs.* Medicaid and CHIP Payment and Access Commission (MACPAC). https://www.macpac.gov/wp-content/uploads/2022/09/05_Principles-for-Assessing-Medicaid-Nursing-Facility-Payment-Relative-to-Costs-Drew-Rob.pdf	Gray literature	U.S. freestanding, dually certified nursing homes	12.785 facilities in 27 states and DC (91% of freestanding dually certified facilities)	Empirical analysis, but details not provided	Technical expert panel, Medicare cost reports, TMSIS, UPL demonstration data	• Facilities with high staffing rates paid higher wages. • At a state level, different payment rates were not clearly correlated with different staffing rates. • States with higher minimum staffing standards has higher staffing regardless of their payment rates.	Summarized MACPAC presentation	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
12. Edelman, T. (2021). *What can and must be done about the staffing shortage in nursing homes.* Center for Medicare Advocacy. https://medicareadvocacy.org/wp-content/uploads/2021/08/Report-Staffing-Shortages-in-Nursing-Homes-07.2021.pdf	Gray literature	n/a	n/a	Special Report	n/a	• One straightforward way to channel public reimbursement to care for residents is to eliminate or significantly restrict related-party transactions and provider self-dealing. Another method establishes a cost category reimbursement method" to require that facilities spend funds according to each specifically designated cost category and to prohibit facilities from shifting spending to different cost categories. A third method is enacting direct care ratios, which require facilities to spend designated portions of their reimbursement on care and services for residents and which limit the amounts that can be spent on profits and administration. New Jersey, at the recommendation of the Manatt firm, and New York have both enacted direct care ratios in response to the pandemic. • Staffing at nursing homes can and must be improved. Methods to strengthen staffing are well known. Reimbursement can be directed to staffing.	n/a	n/a	n/a	n/a
13. CLA (CliftonLarsonAllen, LLC). (2022). *Staffing mandate analysis. In-depth analysis on minimum nurse staffing levels and local impact.* Report prepared for the American Health Care Association. https://www.ahcancal.org/News-and-	Gray literature	U.S., 14,550 long-term care facilities	Medicare nursing home residents	Compares potential costs to long term care industry for meeting minimum staffing requirements at 4.1., 3.6., and 3.1 HPPD.	PBJ data and Medicare cost reports	• Meeting a staffing minimum of 4.1 HPPD is estimated to cost the LTC industry $10,090,000,000 require an additional 187,112 nurses (CNA, LPN, RN). 916,651 residents are in facilities that are below this staffing level. If facilities reduce their census to meet staffing requirements, 205,000 patients could be displaced.	Summarized independent report not subject to peer-review.	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
Communications/Fact-Sheets/FactSheets/CLA-Staffing-Mandate-Analysis.pdf						• Meeting a staffing minimum of 3.6 HPPD is estimated to cost the long-term care industry $6,418,000,000 require an additional 115,839 nurses (CNA, LPN, RN). 640,432 residents are in facilities that are below this staffing level. If facilities reduce their census to meet staffing requirements, 124.631 patients could be displaced. • Meeting a staffing minimum of 3.1 HPPD is estimated to cost the long-term care industry $3,517,000,000, require an additional 60,037 nurses (CNA, LPN, RN). 301,107 residents are in facilities that are below this staffing level. If facilities reduce their census to meet staffing requirements, 68,953 patients could be displaced.				
14. Consumer Voice (The National Consumer Voice for Quality Long-Term Care). (2022). *High staff turnover: A job quality crisis in nursing homes.* https://theconsumervoice.org/uploads/files/issues/High_Staff_Turnover-A_Job_Quality_Crisis_in_Nursing_Homes.pdf	Gray literature	United States	15,178 nursing homes	Cross-sectional	CMS Care Compare data	• Nursing homes with high staff turnover experience increased instances of abuse, perform poorer on all Five-Star quality measures, and are subject to more substantiated complaints. • The nursing home industry has long neglected nursing home staff which has resulted in high turnover as the result of a job quality crisis. With the average nursing home losing half its nursing home staff each year, the answer is not only how nursing homes can find more staff, but how can they address job quality to retain staff and also attract new workers.	n/a	n/a	n/a	n/a

Citation	Literature Type	Setting	Population	Design	Data Source	Key Findings	Main Limitations	Evidence Grade*	Alignment Rating*	
									Staff	Quality
15. National Academies of Sciences, Engineering, and Medicine. (2022). *The national imperative to improve nursing home quality: Honoring our commitment to residents, families, and staff.* The National Academies Press. https://doi.org/10.17226/26526	Gray literature	n/a	n/a	Consensus Study Report	n/a	• Recommend direct care RN coverage for a least 24 hours a day, 7 days a week, with additional coverage as needed, a full-time social worker with at least an accredited bachelor's level social work degree and one year of supervised health care setting experience, and an infection control specialist who is an RN, APRN, or physician. • They support research-based minimum staffing requirements for all direct care staff, including for weekends and holidays, that is based on resident case mix and population-specific staffing needs. • They believe that investing in CNAs is necessary to improve quality of care and advocate for competency-based training that includes topics such as dementia, infection control, behavioral health, chronic diseases, use of assistive medical devices, and cultural sensitivity and humility. • They recommend designating a specific percentage of Medicaid and Medicare payments to direct care services (e.g., staff and wages). • They support addition Care Compare measures related to weekend staffing and staff turnover by role, and increasing the weight of the staffing measures within the Five-Star composite rating.	n/a	n/a	n/a	n/a

Exhibit A.6.2: Evidence Grading Table: Costs Associated with Nurse Staffing

Based on the National Service Framework for Long Term Conditions (see Turner-Stokes et al., 2006). Consistent with the Framework, only peer-reviewed researched-based evidence is rated.

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
Full citation	E: Reflects "expert' (user/caregiver/professional) evidence R: Research-based evidence	**Primary Research-Based Evidence** P1 Primary research using quantitative approaches P2 Primary research using qualitative approaches P3 Primary research using mixed methods **Secondary research-based evidence** S1 Meta-analysis of existing data analysis S2 Secondary analysis of existing data **Review Based Evidence** R1 Systematic reviews of existing research R2 Descriptive or summary reviews of existing research	Are the research question/aims and design clearly stated? 0 = No 1 = Somewhat 2 = Yes	Is the research design appropriate for the aims and objectives of the research? 0 = No 1 = Somewhat 2 = Yes	Are the methods clearly described? 0 = No 1 = Somewhat 2 = Yes	Is the data adequate to support the authors interpretations/ conclusions? 0 = No 1 = Somewhat 2 = Yes	Are the results generalizable? 0 = No 1 = Somewhat 2 = Yes	Sum of quality question scores	Based on total quality score 7 to 10 = high quality 4 to 6 = medium quality 3 or less = poor quality
1. Bowblis, J. R., & Roberts, A. R. (2020). Cost-effective adjustments to nursing home staffing to improve quality. *Medical Care Research and Review, 77*(3), 274–284. https://doi.org/10.1177/1077558718778081	R	S2	2	2	2	2	2	10	High
2. Hawk, T., White, E. M., Bishnoi, C., Schwartz, L. B., Baier, R. R., & Gifford, D. R. (2022). Facility characteristics and costs associated with meeting proposed minimum staffing levels in skilled nursing facilities. *Journal of the American Geriatrics Society, 70*(4), 1198–1207. https://doi.org/10.1111/jgs.17678	R	S2	1	1	2	1	1	6	Medium
3. Kennedy, K. A., Applebaum, R., & Bowblis, J. R. (2020). Facility-level factors associated with CNA turnover and retention: Lessons for the long-term services industry. *Gerontologist, 60*(8), 1436–1444. https://doi.org/10.1093/geront/gnaa098	R	S2	1	1	2	2	1	7	High

Citation	Evidence Type	Research Design	Quality Q1	Quality Q2	Quality Q3	Quality 4	Quality 5	Total Quality Score	Evidence Grade
4. Weech-Maldonado, R., Lord, J., Pradhan, R., Davlyatov, G., Dayama, N., Gupta, S., & Hearld, L. (2019). High Medicaid nursing homes: Organizational and market factors associated with financial performance. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 56. https://doi.org/10.1177/0046958018825061	R	S2	2	2	2	2	1	9	High
5. Weech-Maldonado, R., Pradhan, R., Dayama, N., Lord, J., & Gupta, S. (2019). Nursing home quality and financial performance: Is there a business case for quality? *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 56. https://doi.org/10.1177/0046958018825191	R	S2	2	2	2	1	2	9	High

Exhibit A.6.3: Definitions Alignment Table: Costs Associated with Nurse Staffing

Provides an assessment of how peer-reviewed literature definitions of staff types and quality of care align with the Staffing Study team's analyses.

The study team used Payroll Based Journal (PBJ) job codes to identify RNs, LPNs, and nurse aides. Literature that had No Alignment used both different staff types and a different data set. Literature with Some Alignment used the same staff types but identified them with different data. Literature with Good Alignment used the same staff types and the same data set.

Quality of care alignment ratings are qualitative assessments. The study team's measures include MDS Long Stay Measures (% of residents whose ability to move independently worsened; % of residents whose need for help with daily activities has increased; % of high-risk residents with pressure ulcers); Claims Based Long Stay Measures (# of hospitalizations per 1,000 resident days; # of outpatient emergency department visits per 1,000 resident days); Minimum Data Set (MDS) Short-Stay Measures (% of residents who improved in their ability to move around on their own); Claims Based Short-Stay Measures (% of short-stay residents who were rehospitalized after a nursing home admission; % of short-stay residents who had an outpatient emergency department visit; rate of successful return to home or community from an skilled nursing facility).

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
Full citation	*Data set used and staff types included in the study*	*Indicator of how well staff aligns with the study team's quantitative analyses*	*Quality of care measures included in the study*	*Indicator of how well quality aligns with the study team's quantitative analyses*
1. Bowblis, J. R., & Roberts, A. R. (2020). Cost-effective adjustments to nursing home staffing to improve quality. *Medical Care Research and Review, 77*(3), 274–284. https://doi.org/10.1177/1077558718778081	RN (administrative and not) /LPN/CNA, social service staff, food service staff and housekeeping staff. Data: Certification and Survey Provider Enhanced Reports (1999-2015) (OSCAR and CASPER)	Some Alignment	Reference of F-Tags, but no specific definition. Table 3 (deficiency measures) uses HPRD of staff, administrative RNs, RNs, LPNs, CNAs, social services, activities, food service, housekeeping.	No Alignment
2. Hawk, T., White, E. M., Bishnoi, C., Schwartz, L. B., Baier, R. R., & Gifford, D. R. (2022). Facility characteristics and costs associated with meeting proposed minimum staffing levels in skilled nursing facilities. *Journal of the American Geriatrics Society, 70*(4), 1198–1207. https://doi.org/10.1111/jgs.17678	RN, LPN, CNA PBJ	Good Alignment	No definition, only acknowledgment that the literature shows that "evidence linking higher RN staffing ratios and higher RN skill mix with better care quality in SNFs, but inconsistent relationships of LPN staffing levels to quality" (p. 1204).	No Alignment
3. Kennedy, K. A., Applebaum, R., & Bowblis, J. R. (2020). Facility-level factors associated with CNA turnover and retention: Lessons for the long-term services industry. *Gerontologist, 60*(8), 1436–1444. https://doi.org/10.1093/geront/gnaa098	CNA 2015 data from the Ohio Biennial Survey of Long-Term Care Facilities, Ohio Medicaid Cost Reports, Certification and Survey Provider Enhanced Report, and the Area Health Resource File	No Alignment	No quality definition. MDS reference, but no explanation of its usage. P. 1436: "High turnover and/or low retention rates of certified nursing assistants (CNAs) have been linked to lower quality of care and quality of life in nursing homes). Specifically, high CNA turnover is related to resident mortality, lower spiritual well-being, worse resident safety culture, and more quality of care deficiencies"	No Alignment

Citation	Staff Type Definition	Staff Type Alignment Rating	Quality of Care Definition	Quality of Care Alignment Rating
4. Weech-Maldonado, R., Lord, J., Pradhan, R., Davlyatov, G., Dayama, N., Gupta, S., & Hearld, L. (2019). High Medicaid nursing homes: Organizational and market factors associated with financial performance. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 56. https://doi.org/10.1177/0046958018825061	Nurse practitioner/ physician assistant; RN skill mix (RN and LPN) Brown University's Long-Term Care Focus (LTCFocus) data set, Centers for Medicare and Medicaid Services' (CMS) Medicare Cost Reports, CMS NHC, and the Area Health Resource File (AHRF)	No Alignment	NHC claims-based quality measures	Some Alignment
5. Weech-Maldonado, R., Pradhan, R., Dayama, N., Lord, J., & Gupta, S. (2019). Nursing home quality and financial performance: Is there a business case for quality? *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 56. https://doi.org/10.1177/0046958018825191	RN, LPN, CNA OSCAR/CASPER staffing data	Some Alignment	Process measures of quality: Facility-acquired restraints, facility-acquired catheters, pressure sore prevention, restorative ambulation Outcome measures of quality: Facility-acquired contractures, facility-acquired pressure ulcers, hospitalizations, third-party SNF rehospitalization, health deficiencies	No Alignment

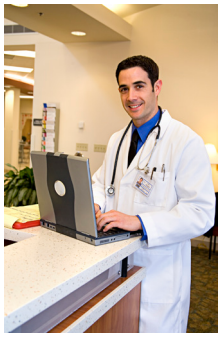
Appendix B. Stakeholder Listening Session on Study Design

Appendix B includes the presentation slides from the June 27, 2022, listening session held with professionals with expertise in nursing home staffing issues and policies, to obtain their feedback on the Nursing Home Staffing Study design.

Study of Nursing Home Minimum Staffing Requirements

Stakeholder Listening Session

June 27, 2022



Welcome from CMS

Study Overview

- As part of a White House initiative to improve the safety and quality of nursing home care, CMS is tasked with establishing minimum staffing requirements for nursing homes
- The purpose of this study is to support CMS in the development of those minimum staffing requirements.
  - Examine relationship between staffing and quality of care/patient safety.
  - Determine the level and type of staffing needed to ensure safe and quality care.

Listening Session Overview

- Discuss several “big picture” questions about minimum staffing requirements.
- Describe our proposed approach for several key project activities and obtain stakeholder input:
  - Quantitative analyses examining the relationship between staffing and safe and quality nursing care
  - Site visits to nursing homes to obtain contextual information about staffing and safe and quality nursing care
  - Simulation analyses of time required to provide safe and quality nursing care
- Each of these represent different data sources and methods to inform the relationship between nurse staffing levels and safe and quality nursing care.

Background

- Largely a consensus that staffing levels have impacts on quality of care and patient safety.
  - Many studies have found a relationship between higher staffing and improved quality
  - Little research has been focused on identifying specific staffing levels below which residents are at substantially increased risk of quality problems.
- Our conceptual model assumes that nursing home administrative practices (such as staffing level and mix) are associated with safe and quality nursing care and improved resident outcomes.

Conceptual Framework

Adapted from Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Hughes RG, editor.Rockville (MD): Agency for Healthcare Research and Quality (US); 2008 Apr.

Background

- Less agreement about the implications of the staffing-quality relationship in terms of minimum staffing requirements:
  - To some, inadequate staffing is the root cause of many of the quality problems in nursing homes, and a minimum staffing requirement would result in better resident care
  - To others, the link between staffing, particularly mandatory staffing requirements, and quality, is far more complex, and the feasibility of minimum staffing requirements is uncertain
- Policy implications depend in part on how staffing levels relate to quality.

Developing Minimum Staffing Requirements: Research Questions

- What minimum staffing levels are required to provide safe, quality care?
  - What nurse staffing levels are associated with positive resident outcomes?
  - What tasks do nursing staff typically perform and how long do those tasks typically take to ensure safe and quality care is provided?
- How should minimum staffing requirements consider acuity differences across nursing homes?
- What are the costs associated with minimum staffing requirements be?
- What barriers exist to implementing minimum staffing requirements?

Initial Questions for Stakeholder Discussion

- How should minimum staffing requirements be determined?
  - What factors should be considered?
  - What factors are most important?
- What concerns do stakeholders have with a minimum staffing requirement for nursing homes?
  - Are there potential unintended consequences?

Quantitative Analyses

- Comprehensive set of quantitative analyses to inform development of minimum staffing requirements
  - Most analyses include all nursing homes with valid data, subgroup analyses will also be conducted.
- Analyses of state staffing requirements, for states that recently adopted new staffing standards
  - Difference-in-differences analysis to compare staffing trends in states with staffing standards changes vs. trends in other states.

Data Sources for Quantitative Analyses

- Staffing measures created from CMS Payroll-Based Journal (PBJ) system
  - Use same specifications and exclusion rules as used for public reporting on Nursing Home Care Compare.
  - Examine nurse aide, LPN, and RN staffing levels.
  - Create measures of nursing hours per resident day/weekend/evening (over a quarter or daily staffing levels).
  - Use case-mix adjusted staffing measures or otherwise account for resident acuity.

Data Sources and Measures: Quality

- Quality measures used in the CMS Five-Star Quality Rating System
  - Measures of resident outcomes selected based on their validity and reliability, the extent to which nursing home practice may affect the measures, statistical performance, and the importance of the measures.
  - Most measures are risk-adjusted using resident-level covariates that adjust for resident factors associated with differences in the performance on the measure.
  - Examine performance on individual measures and measures of performance across multiple measures.

Data Sources and Measures: Health Inspection Survey

- Results from health inspection surveys
  - Health inspection score (normalized for differences in survey results across states) or health inspection ratings.
  - Citations for individual F-tags- for example:
    - Freedom from abuse, neglect, and exploitation (F600- F610)
    - Quality of life (F675-680)
    - Quality of care (F684-F700)
    - Behavioral health (F742-F745)
    - Pharmacy services (F757-F760)

Methods

- Analyses conducted at nursing home level, using all nursing homes with valid data available.
- Examine both continuous quality and staffing measures, as well as measures that are categorized (e.g., into deciles).
- Control for resident acuity and case-mix
  - Use case-mix adjusted staffing measures.
  - Use risk-adjusted QMs (where appropriate)

Methods

- Descriptive univariate analyses (e.g., average staffing levels and trends over time.
  - Overall and by state
  - By nursing home characteristics (e.g., size, ownership type, payor mix, urban/rural status market characteristics)
  - For states that changed their staffing requirements
- Bi-variate comparisons to identify the range of staffing levels over which improved staffing is associated with better outcomes.
- Multivariate regression models (e.g., examining relationship between staffing and quality/safe care; impacts of state staffing requirements on quality/safe care.

Quantitative Analyses: Questions for Stakeholder Discussion

- How should analyses of the relationship between staffing levels and staffing type, and quality and safety of care, inform a minimum staffing requirement?
- What feedback do stakeholders have on the staffing measures proposed for this study (type of staff, acuity adjustment, time period)?
- What additional quality and safety measures should be considered for the study?
- Are there additional analyses to examine the relationship between nurse staffing and quality and safety that should be considered?

Site Visits

- Site visits will provide qualitative information to inform quantitative analyses
  - Better understand the relationship between nurse staffing levels and staffing mix and resident outcomes.
  - Collect contextual information through interviews and site visits.

Site Visits

- Site visits to 65 nursing homes:
  - 40 prior to December 2022
  - 25 from January through March 2023.
- On-site data collection, if feasible.
- Two-person research team spend up to 2 days on site at each nursing home.
  - Conduct interviews with a variety of staff, including nursing home leadership, RNs, LPNs, nurse aides, residents and/or their family members, if feasible.

Site Visits

- Collect data from nursing homes in at least five diverse states.
- Sample stratified based on:
  - Location (e.g., CMS regions), Urban/rural
  - Size (e.g., < 50, 51-150, 150+ beds)
  - Ownership type (for-profit, non-profit)
  - Staffing level (e.g., based on staffing rating from 5-Star)
  - Quality (based on QM rating from 5-Star)
  - Use of agency staff
  - Proportion of Medicaid residents/located in a disadvantaged area

Site Visits

- Semi-structured interview protocols will be developed to explore perceptions about a variety of staffing issues and the relationship between staffing and quality.
  - Interview guides will focus on specific topics relevant for the development of minimum staffing requirements.
  - Data collected will provide contextual information that supports the importance of adequate staffing and the risks to quality of care and resident safety that could result from inadequate staffing.

Site Visits: Sample topics

- Nursing home leadership:
  - Importance of adequate staffing
  - Barriers to increased staffing
  - How nursing home staffing relate to quality
  - Potential unintended consequences of a minimum staffing requirement
  - Management practices
  - Use of ancillary and support staff

Site Visits: Sample topics

- Direct caregivers:
  - Workload
  - Perceptions of staffing adequacy
  - Challenges resulting from inadequate staffing
  - Potential benefits of higher staffing/different types of staffing
  - Response time to call lights/in-room alarms, or general resident care requests
  - Ability to administer clinical assessments and/or treatments in a timely manner
  - Ability to provide medication administration in a timely manner (RNs)
  - Ability to meet resident needs for ADL assistance

Site Visits: Sample topics

- Residents and families:
  - Perceptions of the quality of care at the nursing home and how this relates to nursing home staffing.
  - Adequacy of nursing home staffing levels to meet their care needs
  - Effectiveness of nursing home staff in meeting their care needs, with a focus on ADL assistance and receipt of medications.

Site Visits: Questions for Stakeholder Discussion

- Will the site visits will be useful for informing the development of minimum staffing requirements and why?
- What topics should be included in the site interviews? What types of staff should site visitors interview?
- What topics should be included in discussions with residents and family members?
- Should site visits be announced in advance or unannounced?

Simulation Analyses: Overview

- Directly observe how much time is needed to provide care by licensed nurses (RNs and LPNs) in a sample of high staffed nursing homes (i.e., 4- or 5-star staffing rating).
- Use objective time data to estimate the time spent providing care and rates of care omissions and care delays in low staffed nursing homes (i.e., 1- or 2-star staffing rating).
  - Test hypothesis that the time spent providing care will be less and the rates of care omissions and delays will be higher in lower staffed nursing homes relative to higher staffed nursing homes.

Simulation Analyses: Methodology

- Step 1: Refine the Observational Protocol for Licensed Nurse Tasks:
  - Build on observational protocols that were developed for use in acute care.
- Step 2: Recruit Nursing Homes:
  - 3 to 6 high staffed nursing homes will be targeted for participation in the direct observation of licensed nurses based on their staffing level, Five-Star rating, and case-mix.

Simulation Analyses: Methodology

- Step 3: Conduct Observations of Licensed Nurse Staff in Selected Nursing Homes:
  - Spend approximately two weeks at each nursing home conducting targeted observations of licensed nursing care routines.
  - Observe as many licensed nurses as feasible (estimate that 40 to 60 total staff will be observed).
  - Shadow licensed nurses (RNs and LPNs) with direct care responsibilities, capturing various days of the week and various shifts throughout the day.

Simulation Analyses: Methodology

- Step 4: Construct the Simulation Model and the Initial Validation:
  - Framework for the model will describe the primary care-related tasks completed by licensed nurses, the time required to complete those tasks, and the structure and organization of care delivery.

Simulation Analyses: Methodology

- Step 5: Conduct Sensitivity Analyses within the Model:
  - Simulation models permit both staffing levels and resident acuity to be varied to represent the full range of these metrics found in US nursing homes.
  - Separate estimates of care omissions, care delays and time spent providing care can be estimated within the model based on different staffing and resident acuity levels.

Simulation Analyses: Methodology

- Step 6: Validate the Model in Lower Staffed Nursing Homes:
  - Observations will be conducted in 2 to 3 lower staffed nursing homes to validate the model predictions.
  - Licensed nurse task data and model parameters will be combined with a prior simulation model to estimate care omissions in nursing homes with different staffing levels.

Simulation Analyses: Questions for Stakeholder Discussion

- Does simulation provide a useful approach to model licensed nurse tasks in a typical day?
- What input do stakeholders have about the proposed approach for the simulation analyses?
- Does the validation step of comparing the amount of time licensed nurses spend on various clinical tasks between high and low staffed homes make sense?
- How can the simulation analyses inform development of a minimum staffing requirement?

Wrap-Up and Next Steps

- Next Stakeholder Listening session will be in late August

Appendix C. Site Visits Supplemental Materials

Interview Protocols and MISSCARE Survey

Interview Guide: NH Leadership (Administrator/DON)
Interview Guide: Direct Care Staff (RNs, LPN/LVNs)
Interview Guide: Certified Nursing Assistants
Interview Guide: Families/Caregivers and/or Residents
Missed Nursing Care (The MISSCARE Survey)

List of Exhibits

This appendix contains supplemental information for the qualitative site visit section of the Nursing Home Staffing Study. First, it presents the information sheet used for nursing home recruitment and then copies of the interview protocols and the MISSCARE Survey used to collect primary data (C.1). This is followed by demographic information on nursing homes and individuals participating in the site visits (C.2) and additional quantitative analyses from the closed-ended interview questions and the MISSCARE Surveys (C.3). The appendix also contains additional qualitative findings from site visit respondents, including how staffing affects their ability to meet resident care needs, how care priorities are determined when shifts are short staffed, the personal impact that staffing challenges have had on direct care staff, and feedback about implementation of a minimum staffing requirement (C.2). It includes a copy of the Abt Associates Institutional Review Board approval letter for the site visit task (C.4), and finally an addendum summarizing findings from the final site visits (C.5).

Study to Determine Minimum Staffing Requirements for Nursing Homes

On-site Visits to Nursing Homes

The purpose of the site visits is to understand challenges you face each day related to staffing.

Abt associates will be on site for two days at select nursing homes in different geographic areas

During the site visits, Abt staff will interview leadership, direct care staff, and residents and/or their families/caregivers when feasible, and will administer a brief survey to direct care staff.

The interviews will be 15-30 minutes, accommodating for staff schedules

The Abt site visit teams will not be on-site in any survey capacity and will not be monitoring nursing home staffing or performance while on site.

WHEN will site visits be conducted?

Site visits will be conducted between August and October 2022.

WHY your participation matters...

Being involved in research that will impact nursing home policy ensures that **your voice is heard**.

Abt wants to understand the challenges nursing home providers face with staffing, as well as their perspectives on a federal minimum staffing requirement.

White House Announces Nursing Home Reforms

In February 2022, the White House announced a set of reforms to improve the safety and quality of nursing home care. These reforms include that every nursing home provides:

"a sufficient number of staff who are adequately trained to provide high-quality care."

The Centers for Medicare & Medicaid (CMS) intends to propose minimum standards for staffing adequacy that nursing homes must meet.

As a part of efforts to develop minimum staffing requirements, CMS has contracted with Abt Associates, an independent research organization, to conduct a staffing study to inform CMS rulemaking efforts. This study uses a robust, mixed method design, and includes analyses of staffing and quality data, interview and survey data, as well as cost information.

In addition to the site visits with nursing home staff, other study tasks include:

- A robust and comprehensive review of literature on the provision of safe, quality care to nursing home residents
- A rigorous set of quantitative analyses that examine the relationship between staffing and quality
- Input from stakeholders to inform development of staffing requirements
- An examination of the costs associated with a minimum staffing requirement

Site visit participation is strongly encouraged by CMS.
Please reach out to your State Agency with specific concerns about participation in the site visits.

C.1 Interview Protocols and MISSCARE Survey

Interview Guide: NH Leadership (Administrator/DON)

Introduction (3 minutes)

Hello. My name is [**interviewer name**] and this is [**note taker**] and we are with Abt Associates, a private research company. I want to thank you for taking the time to talk to us today about your role in providing care for the residents at [**name of nursing home**].

Abt is working on behalf of the Centers for Medicare & Medicaid Services, or CMS, to conduct a nursing home staffing study. Information collected will be used to help CMS develop minimum staffing requirements for nursing homes as part of a White House initiative. The purpose of this interview is to better understand your perspectives regarding nursing home staffing, more specifically, the challenges you face each day related to staffing, how staffing impacts quality of care, and how staffing may impact the ability of the direct care staff to do their jobs well.

With that being said, I want to assure you that we are not here in any survey or monitoring capacity, and we are not reporting on an individual's job performance, or this facility's current staffing.

We hope you will feel comfortable sharing your opinions openly and honestly about how staffing levels affects the ability of your staff to complete their assignments; the goal of this interview is to seek your input to help inform policy decisions related to a minimum staffing requirement for nursing homes.

I want to let you know your participation is voluntary and you do not have to answer any questions you do not want to answer. Your responses will be anonymous and kept confidential.

We will summarize your responses, as well as responses from other nursing homes into one report and we will not attribute any comments directly to you or this nursing home. However, we may be asked to share notes from our interviews with CMS. Anything that is shared with CMS will be fully redacted and will not include any individual or facility-level identifiers, and CMS will only use this information for research purposes.

There are no right or wrong answers. We are simply interested in hearing your opinions and about your own experience. This is an opportunity for you to provide feedback on staffing and quality issues.

We would like to record our conversation today so that we can refer to the recording if we need to clarify anything we have in our notes. Only Abt staff working on the project will have access to the raw notes and recordings, and these will be destroyed at the end of this project. Do we have permission to record? (if respondent does not want to be recorded, please confirm that we will not record). We can still proceed with the interview even if you choose not to be recorded.

Out of respect for your time, we will try to keep the interview to 45 minutes. However, if you have more to say, we can continue a bit longer as you're able.

Do you have any questions before we begin?

Do I have your consent to continue this interview?

[[Turn on recorder for those who agree to be recorded]]

Interview Questions (30 minutes)

1. To start, please tell us about you and your position in the nursing home.
    a. What is your job title and responsibilities?
    b. How long have you worked in this nursing home?
    c. How long have you worked in the nursing home industry?

Next, we'd like to hear about your perspectives on how staffing might impact care delivery.

2. What do you think are the most important aspects of care delivery that are related to adequate staffing levels?

    Probes: amount of care provided, type of care provided, timeliness of care, quality of care.

3. Have you received any feedback from your staff about staffing at this facility?
    a. If yes, what is the basis of these concerns?

        Probe for: number of staff available, type of staff available, staff training, supervision/oversight concerns, reliance on agency staff, concerns about the quality of care provided by agency staff
    b. No

4. Have you ever received feedback from residents or families about staffing in this facility?
    a. If yes, what kind of feedback have you received?

        Probe for: number of staff available, type of staff available, staff training, supervision/oversight concerns, concerns about the quality of care provided by staff
    b. No

Now we'd like to focus more specifically on staffing in this facility.

5a. How is the level and type of direct care staffing on each shift determined?

Probes: reasons for more or less staff by shift, reasons for different types of staff by shift

    b. If not mentioned as part of 5a., ask: Who is involved in making staffing decisions?

6. What is the typical level of direct care staffing on the day, evening, and night shifts? On the weekends compared to the weekdays?

Staff type	Days	Evenings	Nights	Weekends
RNs				
LPN/LVNs				
CNAs				
Other (specify: _____)				

7. Thinking over the last month, how often were direct care staff working short, meaning not all staff who were scheduled were present?

a. ☐ Every other week
b. ☐ Every week
c. ☐ Multiple times a week
d. ☐ Other (specify: _____)

8. When shifts are short staffed, which type of direct care staff are typically short staffed?

☐ RNs
☐ LPNs
☐ CNAs

9. During instances when your facility might be short staffed (for direct care staff), what are the biggest barriers to adequate staffing?

   Probes: staffing calling in sick, staff not showing up for scheduled shifts, inadequate availability of employees in the area, competition for staff, staff compensation, staff retention, impact of COVID-19.

10. How do you think inadequate direct care staffing impacts resident's quality of care?

    Probes: increased possibility for delayed/missed care, staff burnout/staff turnover, care provided does not meet quality standards.

As we mentioned earlier, the White House is mandating a minimum staffing requirement for nursing homes.

11. What do you think the minimum staffing requirement for nursing homes should be?

    Probes: minimum requirements by staff type, minimum requirement by shift, minimum requirement on weekdays vs. weekends

    a. Is that minimum different from what you think optimal staffing might be?

12. What factors should be considered when developing a minimum staffing requirement?

    Probe for: staff type/staff mix, consideration of shifts, consideration of weekday vs. weekend staffing, facility acuity, use of agency staff to meet minimum requirements, transition in period

13. Do you have any concerns about a minimum staffing requirement being mandated for all nursing homes in the US?

14. Do you have any concerns about your facilities' ability to meet a minimum staffing requirement? Why or why not?

15. From your perspective, what are the potential benefits to a minimum staffing requirement?

16. From your perspective, what are the potential unintended consequences of a minimum staffing requirement?

Closing (2 minutes)

Thinking back on everything we just discussed, what do you think is the most important takeaway, or top priority regarding staffing?

Those are all the questions I have for you today. Is there anything else you would like to share that we haven't already discussed?

Thank you for taking the time to speak with me today.

If you have questions after we've left this facility or you would like to offer additional feedback, please feel free to reach out to ENTER NAME//PHONE//EMAIL of contact?

Interview Guide: Direct Care Staff (RNs, LPN/LVNs)

Introduction (3 minutes)

Hello. My name is [**interviewer name**] and this is [**note taker**] and we are with Abt Associates, a private research company. I want to thank you for taking the time to talk to us today about your role in providing care for the residents at (name of nursing home).

Abt is working on behalf of the Centers for Medicare & Medicaid Services or, CMS, to conduct a nursing home staffing study. Information collected will be used to develop minimum staffing requirements for nursing homes as part of a White House initiative. The purpose of this interview is to understand your perspectives regarding nursing home staffing, more specifically, the challenges you face each day related to staffing, how staffing impacts the quality of care you are able to provide to residents assigned to you during a shift, and how staffing may impact your ability to complete all of your assigned care tasks on a given day.

With that being said, I want to assure you that we are not here in any survey or quality monitoring capacity, and we are not reporting on an individual's job performance, or this facility's current staffing levels.

We hope you will feel comfortable sharing your opinions openly and honestly about how staffing affects you and your co-workers and the care you provide to residents. The goal of this interview is to seek your input to help inform policy decisions related to a minimum staffing requirement for nursing homes.

I want to let you know your participation is voluntary and you do not have to answer any questions you do not want to answer. Your responses will be kept both confidential and anonymous.

We will summarize what we learn from you and other staff here, as well as from staff at many other nursing homes we are visiting across the nation, into a report to CMS. The information we learn from all nursing homes we visit will be combined into one large report and we will not attribute any comments directly to you or to this nursing home. However, we may be asked to share notes from our interviews with CMS. Anything that is shared with CMS will be fully redacted and will not include any individual or facility-level identifiers, and CMS will only use this information for research purposes.

There are no right or wrong answers. We are simply interested in hearing your opinions and about your own experience. This is an opportunity for you to anonymously provide feedback on your experience and opinions related to staffing and quality issues.

We would like to record the conversation today so that we can refer to the recording if we need to clarify anything we have in our notes. Only Abt staff working on the project will have access to the raw notes and recordings, and these will be destroyed at the end of this project. Do we have permission to record? (if respondent does not want to be recorded, please confirm that we will not record). We can still proceed with the interview even if you choose not to be recorded.

Out of respect for your time, we will try to limit our interview to 30 minutes. However, if you have more to say, we can continue a bit longer, as you're able.

Do you have any questions before we begin?

Do I have your consent to continue this interview?
[[Turn on recorder for those who agree to be recorded]]

Questions for RNs, LPNs/LVNs (25 minutes)

1. To start, please tell us about you and your position in the nursing home.
    a. What is your job title and responsibilities?
    b. How long have you worked in this nursing home?
    c. How long have you worked in similar roles in other nursing homes?

2. We'd like to understand what your typical workday is like.
    a. How many residents are you responsible for <u>today</u>?
    b. How many residents are usually assigned to you? (a range is fine)

3. What shift do you typically work?

    Weekdays: ☐ Day ☐ Evening ☐ Night

    Weekends: ☐ Day ☐ Evening ☐ Night

4. Does the number of residents assigned to you vary across shifts?
    a. Yes
    b. No
5. Does the type of care that residents need vary across shifts?
    a. If yes, please describe the difference in the types of care for residents assigned to you by shift.
    b. No

6. Do you feel that your typical assignment, i.e., staff to resident ratio, is reasonable for you to be able to provide high quality, safe care to all your assigned residents?
    a. Yes
    b. If no, what is the highest number of residents you feel you should be assigned in order to provide high quality, safe care to them? _____

7. When shifts are fully staffed, meaning all staff who were scheduled to work are present, how does that help you with your resident assignment?

    Probes: less pressed for time, less stressed, can spend more time with residents, can spend more time with staff at beginning/end of shifts, improved morale, less turnover, less burnout, can answer call lights timely, etc.

8. Thinking over the last month, how often did you work short staffed, meaning not all staff who were scheduled were present?
    a. ☐ Every other week
    b. ☐ Every week
    c. ☐ Multiple times a week
    d. ☐ Other (specify: _____)

9. When you are working short-staffed, how does your workload change?
    a. What types of changes do you have to make when a shift is short staffed?
    b. How do you prioritize the care you provide to residents when a shift is short staffed?

10. If a shift is short staffed, what kinds of tasks might be delayed? Ask staff member to list the most frequently delayed tasks.
    a. How often do these tasks get delayed (rarely, occasionally, frequently)?

Examples of delayed tasks as noted from interviewee	Rarely	Occasionally	Frequently
Bathing/Showering			
Making the bed			
Teeth brushing			
Other, specify:			
Other, specify:			

11. Are other (support) staff available to help when needed?
    a. If yes, please describe the type of staff who may be available to help
    Probes: nursing staff, dietary aides, activities staff, feeding aides, volunteers, etc.
    b. How often do these other types of staff help you with your job tasks or resident assignment?
    ☐ Rarely ☐ Occasionally ☐ Frequently

12. As you may know, CMS is working towards implementing a minimum staffing requirement for nursing homes. In your opinion, what do you think that minimum requirement should be? Probe for numbers of staff, number of staff by type, mix of staff

13. What would you say is the biggest challenge your facility faces with staffing?

    Probes: inadequate staffing, lack of back-up staffing, recruitment of new staff, competition from other sectors/other nursing homes, retention of existing staff, adequacy of salaries and benefits.

14. What has the facility done to address these challenges?

    Probes: increased recruitment/hiring, increased training, increased staffing on shifts, support from leadership, increased wages, increased paid time off/sick time benefits.

As an RN/LPN, we know that your role and duties are different than other nursing staff, so we'd like to ask you some additional, specific questions about how staffing levels impact your job role and responsibilities.

15. When you think about your roles and duties (for example, completing physical and mental assessments, checking glucose levels and administering insulin, passing medication, etc.) does the number of residents you have on your unit/shift to impact your ability to complete your clinical care in a timely manner? Why or why not?

16. How much time during a typical shift do you spend providing oversight and support to CNAs?

    a. ☐ 10% ☐ 25% ☐ 50% ☐ more than 50%% ☐ other (specify: ____)

17. How does the number of nursing staff working with you during a given shift impact the amount of time you spend on direct care tasks versus indirect activities such as administrative tasks, documentation, and communication with clinical providers (medical director, nurse practitioner, pharmacist) and family members?

18. We know that when nursing homes are short staffed, staff take on more work than usual. Can you share about your experiences with how short staffing may your own personal health and well-being?

    Probe: Does it affect burnout, work/life balance, stress, job satisfaction?

Next we would like to ask you about the time it takes to complete some frequently performed nursing cars tasks. We would like you to base your estimates for these tasks on the residents you cared for today. If you have not cared for a resident today with the specific care need in question, please think back to the last time you performed the task.

19. For the residents you cared for today, ***on average*** how much time ***per resident*** did you spend performing wound care? This includes assessing wounds, applying treatments, dressing changes, and communication about wound care with other staff or the residents and/or their family.
    a. ***How many residents is this estimated amount of time based on?***
    b. ***What is the minimum amount of time you might spend on this task (for example, for a resident with a minor skin tear)?***
    c. ***What is the maximum amount of time you might spend on this task (for example, for a resident with a stage 4 pressure ulcer)?***

20. For the residents you cared for today, ***on average*** how much time did you spend performing medication passes? This includes providing medications (any type by any route) and any liquids needed to take medications, preparation tasks, disposing of supplies, documentation/scanning of medications, and any communication with other staff or the residents and/or their family related to the medication pass.
    d. ***How many residents is this estimated amount of time based on?***
    e. ***What is the minimum amount of time you might spend on this task (for example, for a resident with a limited number of medications)?***
    f. ***What is the maximum amount of time you might spend on this task (for example, for a resident with a significant number of medications)?***

21. For the residents you cared for today, ***on average*** how much time did you spend performing medication related assessments? This includes things like assessing and documenting pain level, assessing and documenting behavioral symptoms, assessing and documenting blood pressure or blood glucose level.
    g. ***How many residents is this estimated amount of time based on?***
    h. ***What is the minimum amount of time you might spend on this task (for example, for a resident with manageable pain or mild behavioral symptoms)?***
    i. ***What is the maximum amount of time you might spend on this task (for example, for a resident with significant pain or severe behavioral symptoms)?***

22. For the residents you cared for today, ***on average*** how much time ***per resident*** did you spend performing other assessments? This includes vital signs (e.g., heart rate, oxygen level, blood pressure, pulse, respiratory rate), or related assessments (e.g., bladder scan, blood sugar monitoring), BIMs, PHQ-9, fall risk, pain and behavioral assessments not related to medications.
    j. ***How many residents is this estimated amount of time based on?***
    k. ***What is the minimum amount of time you might spend on this task?***
    l. ***What is the maximum amount of time you might spend on this task?***

23. For the residents you cared for today, ***on average*** how much time ***per resident*** did you spend performing catheter care? Including external catheters, removing/inserting/adjusting internal catheters, cleaning catheters, emptying a resident's catheter bag, perineal care, and repositioning of the resident.
    m. ***How many residents is this estimated amount of time based on?***
    n. ***What is the minimum amount of time you might spend on this task?***
    o. ***What is the maximum amount of time you might spend on this task (for example, for a resident who is having a new catheter inserted)?***

24. For the residents you cared for today, ***on average*** how much time ***per resident*** did you spend collecting lab specimens? This includes collecting urine, nasopharyngeal swabs, preparation tasks, disposing of supplies, and documentation of lab specimens.
    p. ***How many residents is this estimated amount of time based on?***
    q. ***What is the minimum amount of time you might spend on this task?***
    r. ***What is the maximum amount of time you might spend on this task?***

Task	Average time	Minimum	Maximum	No. of residents in estimate
Wound Care				
Med Pass				
Medication assmt				
Other assmt				
Catheter care				
Collection of lab specimens				

Closing (2 minutes)

Thinking back on what we discussed, what do you think is the most important takeaway, or top priority regarding staffing in nursing homes?

Is there anything else you would like to share that we haven't already discussed?

Thank you for taking the time to speak with me today.

If you have questions after we've left this facility or you would like to offer additional feedback, please feel free to reach out to ENTER NAME//PHONE//EMAIL

Interview Guide: Certified Nursing Assistants

Introduction (3 minutes)

Hello. My name is [**interviewer name**] and this is [**note taker**] and we are with Abt Associates, a private research company. I want to thank you for taking the time to talk to us today about your role in providing care for the residents at (name of nursing home).

Abt is working on behalf of the Centers for Medicare & Medicaid Services or, CMS, to conduct a nursing home staffing study. Information collected will be used by CMS to develop minimum staffing requirements for nursing homes as part of a White House initiative. The purpose of this interview is to understand your perspectives regarding nursing home staffing, more specifically, the challenges you face related to staffing, how staffing impacts the quality of care you are able to provide to residents, and how staffing may impact your ability to complete all of your assigned care tasks on a given day.

With that being said, I want to assure you that we are not here in any survey or quality monitoring capacity, and we are not reporting on an individual's job performance, or this facility's current staffing levels.

We hope you will feel comfortable sharing your opinions openly and honestly about how staffing affects you and your co-workers and the care you provide to residents. The goal of this interview is to seek your input to help inform policy decisions related to a minimum staffing requirement for nursing homes.

I want to let you know your participation is voluntary and you do not have to answer any questions you do not want to answer. Your responses will be kept both confidential and anonymous.

We will summarize what we learn from you and other staff here, as well as from staff at many other nursing homes we are visiting across the nation, into a report to CMS. The information we learn from all the nursing homes we visit will be combined into one, large report and we will not attribute any comments directly to you or to this nursing home. However, we may be asked to share notes from our interviews with CMS. Anything that is shared with CMS will be fully redacted and will not include any individual or facility-level identifiers, and CMS will only use this information for research purposes.

There are no right or wrong answers. We are simply interested in hearing your opinions and about your own experience. This is an opportunity for you to anonymously provide feedback on your experience and opinions related to staffing and quality issues.

We would like to record the conversation today so that we can refer to the recording if we need to clarify anything we have in our notes. Only Abt staff working on the project will have access to the raw notes and recordings, and these will be destroyed at the end of this project. Do we have permission to record? (if respondent does not want to be recorded, please confirm that we will not record). We can still proceed with the interview even if you choose not to be recorded.

Out of respect for your time, we will try to limit our interview to 30 minutes. However, if you have more to say, we can continue a bit longer, as you're able.

Do you have any questions before we begin? Do I have your consent to continue this interview?
[[Turn on recorder for those who agree to be recorded]]

Questions for CNAs (20 minutes)

1. To start, please tell us about you and your position in the nursing home.
    a. What is your job title and responsibilities?
    b. How long have you worked in this nursing home?
    c. How long have you worked in similar roles in other nursing homes?

2. We'd like to understand what your typical workday is like.
    a. How many residents are you responsible for <u>today</u>?
    b. How many residents are usually assigned to you? (a range is fine)

3. What shift do you typically work?

    Weekdays: ☐ Day ☐ Evening ☐ Night

    Weekends: ☐ Day ☐ Evening ☐ Night

4. Does the number of residents assigned to you vary across shifts?
    a. If yes, please describe the difference in the number of residents assigned to you by shift.
    b. No

5. Does the type of care that residents need vary across shifts?
    a. If yes, please describe the difference in the types of care for residents assigned to you by shift.
    b. No

6. Do you feel that your typical assignment is reasonable for you to be able to provide high quality, safe care to all your assigned residents?
    a. Yes
    b. If no, what is the highest number of residents you feel you should be assigned in order to provide high quality, safe care to them? _____

7. When shifts are fully staffed, meaning all staff who were scheduled to work are present, how does that help you with your resident assignment?

   Probes: less pressed for time, less stressed, can spend more time with residents, can spend more time with staff at beginning/end of shifts, improved morale, less turnover, less burnout, can answer call lights timely, etc.

8. Thinking over the last month, how often did you work short staffed, meaning not all staff who were scheduled were present?
   a. ☐ Every other week
   b. ☐ Every week
   c. ☐ Multiple times a week
   d. ☐ Other (specify: _____)

9. When you were working short-staffed, how did your workload change?
   a. What types of changes do you have to make when a shift is short staffed?
   b. How do you prioritize the care you provide to residents when a shift is short staffed?

10. If a shift is short staffed, what kinds of tasks might be delayed? Ask staff member to list the most frequently delayed tasks.
    a. How often do these tasks get delayed (rarely, occasionally, frequently)?

Examples of delayed tasks as noted from interviewee	Rarely	Occasionally	Frequently
Bathing/Showering			
Making the bed			
Teeth brushing			
Other, specify:			
Other, specify:			

11. Are other (support) staff available to help when needed?
    a. If yes, please describe the type of staff who may be available to help

       Probes: nursing staff, dietary aides, activities staff, feeding aides, volunteers, etc.
    b. How often do these other types of staff help you with your job tasks or resident assignment?

       ☐ Rarely ☐ Occasionally ☐ Frequently

12. As you may know, CMS is working towards implementing a minimum staffing requirement for nursing homes. In your opinion, what do you think that minimum requirement should be?
    Probe for numbers of staff, number of staff by type, mix of staff

13. What would you say is the biggest challenge your facility faces with staffing?
    Probes: inadequate staffing, lack of back-up staffing, recruitment of new staff, competition from other sectors/other nursing homes, retention of existing staff, adequacy of salaries and benefits.

14. What has the facility done to address these challenges?
    Probes: increased recruitment/hiring, increased training, increased staffing on shifts, support from leadership, increased wages, increased paid time off/sick time benefits.

As a CNA, we know that your role and duties are different from other nursing staff, so we would like to ask you some specific questions about how staffing levels impact CNAs.

15. In your experience, how does the number of residents assigned to you impact your ability to meet resident needs for assistance with activities of daily living (ADLs), such as bathing, dressing, eating, getting to the bathroom, moving around the nursing home?

16. How does the number of residents assigned to you affect your ability to help residents during meals?
    Probes: impact on number of residents who eat in the dining room, impact on the time spent with each resident who needs help throughout the meal, meal is served late, meal has to be reheated, etc.

17. How do you feel the number of CNAs, LPNs and/or RNs on a shift impacts the time it takes to complete all of your assigned tasks for all of your residents?
    Probe for: ability to respond to call lights in a timely manner, ability to provide assistance to residents when they need it (e.g., toileting, boosting, transfers)

18. We know that when nursing homes are short staffed, staff take on more work than usual. Can you share how short staffing may affect your own personal health and well-being?
    Probes: staff burnout, work/life balance, stress, job satisfaction

Closing (3 minutes)

Thinking back on what we discussed, what do you think is the most important takeaway, or top priority regarding staffing in nursing homes?

Is there anything else you would like to share that we haven't already discussed?

Thank you for taking the time to speak with me today.

If you have questions after we've left this facility or you would like to offer additional feedback, please feel free to reach out to ENTER NAME//PHONE//EMAIL

Interview Guide: Families/Caregivers and/or Residents

Introduction (3 minutes)

Hello. My name is [**interviewer name**] and this is [**note taker**] and we are with Abt Associates, a private research company. I want to thank you for taking the time to talk to us today.

Abt is working on behalf of the Centers for Medicare & Medicaid Services or, CMS, to conduct a nursing home staffing study. Information collected will be used by CMS to develop minimum staffing requirements for nursing homes as part of a White House initiative to improve the safety and quality of care in these facilities. The purpose of this interview is to understand your perspectives regarding nursing home staffing, more specifically, how staffing at [name of nursing home] impacts the care you receive/provided to your family member, significant other, or resident for whom you are the legal guardian/authorized representative.

Your participation in this interview is voluntary and you do not have to answer any questions you do not want to answer. Your care/the resident's care will in no way be impacted by whether or not you choose to participate in this interview or the information you share with us.

We will summarize what we learn from you and others we have spoken to at this nursing home, as well as individuals we have spoken to at other nursing homes, in a report to CMS. The information we learn during all of our site visits will be combined into one, large report, and we will not attribute any comments directly to you or this nursing home. However, we may be asked to share notes from our interviews with CMS. Anything that is shared with CMS will be fully redacted and will not include any individual or facility-level identifiers, and CMS will only use this information for research purposes.

There are no right or wrong answers. We are simply interested in hearing your opinions and about your own experience. We hope you will feel comfortable to share openly and honestly about how staffing affects you or the resident you are visiting so your voices are a part of the policy making process. This is an opportunity for you to anonymously provide feedback on staffing and quality issues that you've experienced in this facility.

We would like to record the conversation today so that we can refer to the recording if we need to clarify anything we have in our notes. Only Abt staff working on the project will have access to the raw notes and recordings, and these will be destroyed at the end of this project. Do we have permission to record? We can still proceed with the interview, even if you choose not to be recorded.

Our interview should take about [15 minutes for residents and 20 minutes for families/caregivers], as we want to be respectful of your time. However, if you'd like to talk longer than that, we are happy to continue a bit longer.

Do you have any questions before we begin?

Do I have your consent to continue this interview?

[[Turn on recorder for those who agree to be recorded]]

Questions for Families/Caregivers (15 minutes)

Let's start with you telling us a little bit about who you are here visiting today.

1. How long has the resident been in this nursing home?
2. How often do you visit?
3. What are the main reasons you come to visit?
4. Do you visit mainly during the week or on the weekend?

5. When you think about this nursing home and the care provided to your resident, what matters the most to you?

6. From your perspective, what would you say are the best aspects of the care the resident receives?

   Probes: timely provision of care, high quality care, provision of appropriate/needed care, staff are knowledgeable, consistent assignment of staff to the resident, effective staff communication

7. Are there aspects of care that could be improved?
   a. If yes, probe for timeliness of care, amount of care provided, having enough staff, having helpful/kind staff, staff training, consistent staff.
   b. No
   c. Don't know

8. Which nursing home staff provide the most care to your resident?
   a. ☐ Nurses (RNs, LPN/LVNs)
   b. ☐ Nursing Assistants
   c. ☐ Other (specify: _____)
   d. ☐ Don't know

9. Does the resident receive care <u>when it is needed</u> for things like getting out of bed, bathing, dressing, moving around the nursing home, using the toilet?
   a. Yes
   b. No
      1) If no, what kind of care is needed but not provided?
   c. Don't know

10. How long does it typically take for staff to respond to requests for assistance?
    a. ☐ less than 5 minutes
    b. ☐ about 5-10 minutes
    c. ☐ about 15 minutes
    d. ☐ more than 15 minutes
    e. ☐ Don't know
    f. ☐ Other (specify: _____)

11. Do you think there are enough staff to meet the care needs of the resident you are visiting?
    a. Yes
    b. No
        1) If no, what resident care needs are not being met?
    c. Don't know

12. Do you notice differences in staff available during different times of the day or between the weekdays and the weekend?
    a. If yes, what kinds of differences do you notice?
    b. No
    c. Don't know

13. When you think about the resident's care needs, such as help with dressing, eating, bathing, going to the bathroom, or getting around the nursing home, how effective do you feel the nursing home staff are at meeting their needs?
    a. ☐ Very effective
    b. ☐ Somewhat effective
    c. ☐ Not effective
    d. ☐ Other (specify: _____)

14. Has the resident encountered any issues with medication administration that you're aware of?
    a. If yes, what kind of issue was encountered? Probes: wrong medication provided, wrong dose provided, wrong method of administration.
    b. No

c. Don't know

Closing (2 minutes)

Thinking back on everything we just discussed, from your perspective, what do you think is the most important takeaway, or top priority regarding staffing in this nursing home?

Those are all the questions I have for you today. Is there anything else you would like to share that we haven't already discussed?

Thank you for taking the time to speak with me today.

Questions for Residents (10 minutes)

1. From your perspective, what would you say are the best aspects of the care that you receive here? Probes: staff members are attentive and timely (i.e., care available when you need it), staff are kind/caring, same staff typically provide care (consistent assignment), staff know what they are doing (staff are well trained).

   ☐ Resident did not answer question

2. When you think about the care you receive, is there anything that you feel could be improved? Probe for timely provision of care, amount of care provided, consistent assignment of staff, staff training, having enough staff.

   ☐ Resident did not answer question

3. What is most important to you about this facility and the care you receive here?

4. Do you feel that there are enough staff to meet your day-to-day care needs?
   a. Yes
   b. No
   c. Don't know
   d. Resident did not answer question

5. When you call for help, do staff respond in a timely manner?
   a. Yes
   b. No
   c. Don't know
   d. Resident did not answer question

6. How long do you normally wait for assistance when you call?
   a. ☐ less than 5 minutes
   b. ☐ about 5-10 minutes
   c. ☐ about 15 minutes
   d. ☐ more than 15 minutes
   e. ☐ Don't know
   f. ☐ Other (specify: _____)
   g. ☐ Resident did not answer question

7. Does the length of time it takes for staff to respond to your calls vary at different times of the day?
   a. Yes, ask the resident to explain the difference in response times

b. No
c. Don't know
d. Resident did not answer

8. Is the time it takes for staff to respond to your calls different during the week compared to on the weekends?
    a. Yes, ask the resident to explain the difference in response times
    b. No
    c. Don't know
    d. Resident did not answer

9. When you think about your care needs, such as getting in and out of bed, getting dressed, eating, bathing, going to the bathroom or moving around the nursing home, do you feel the staff are meeting your needs?
    a. Yes
    b. No
        1) If no, what needs are not being met?
    c. Don't know
    d. Resident did not answer

10. Have you ever experienced any issues with getting your medications on time/when you're supposed to?
    a. Yes
    b. No
    c. Don't know
    d. Resident did not answer

11. Have you ever experienced any issues with getting the right medication/the medication that has been prescribed for you?
    a. Yes
    b. No
    c. Don't know
    d. Resident did not answer

12. Can you tell me about a time when you felt staff did a good job meeting your care needs?

13. Can you describe an experience when you felt the staff did not meet your care needs?
    Probe: What could have been done to help?

Closing (2 minutes)

Thinking back on everything we just discussed, from your perspective, what do you think is the most important takeaway, or top priority regarding staffing in this nursing home?

Those are all the questions I have for you today. Is there anything else you would like to share that we haven't already discussed?

Thank you for taking the time to speak with me today.

MISSED NURSING CARE (*The MISSCARE Survey*)
Beatrice J. Kalisch

1. Please indicate the type of unit you work on:
   1) _____Long-Term Care
   2) _____Skilled/Sub-Acute
   3) _____Alzheimer's/Dementia Care
   4) _____Other [Please specify: _____]

2. Do you spend the majority of your working time on this unit? ____Yes____No

3. What is your job title/role?
   1) _____Staff Nurse (RN)
   2) _____Staff Nurse (LPN/LVN)
   3) _____Nursing Assistant (e.g., CNA/medication tech)
   4) _____Nurse Manager (e.g., Director of Nurses, Assistant Director of Nurses, Unit Manager)
   5) _____Other [Please specify: _____]

4. Experience in your role:
   1) _____Up to 6 months
   2) _____6+ months up to 2 years
   3) _____2+ years up to 5 years
   4) _____5+ years up to 10 years
   5) _____Greater than 10 years

5. Experience on your current patient care unit:
   1) _____Up to 6 months
   2) _____6+ months up to 2 years
   3) _____2+ years up to 5 years
   4) _____5+ years up to 10 years
   5) _____Greater than 10 years

6. Number of hours usually worked per week (check only one):
   1) _____less than 30 hours per week
   2) _____30 hours or more per week

Please **turn over** *to page 2* ➔

7. Duration of shift you most often work:
   1) _____8-hour shift
   2) _____10-hour shift
   3) _____12-hour shift
   4) _____Other [Please specify: _____]

8. Time of shift you most often work
   1) _____Days
   2) _____Evenings
   3) _____Nights
   4) _____Rotates between days, evenings, nights

9. In the past 3 months, how many hours of overtime did you work?
   1) _____None
   2) _____1-12 hours of overtime
   3) _____More than 12 hours of overtime

10. In the past 3 months, how many days or shifts did you miss work due to illness, injury, extra rest, etc., (exclusive of approved days off)?
   1) _____None
   2) _____1 day or shift
   3) _____2-3 days or shifts
   4) _____4-6 days or shifts
   5) _____over 6 days or shifts

11. On your current or last shift you worked, how many residents were assigned to you? _____

   11-a. How many resident-admissions did you have (i.e., includes transfers into the unit)? _____

   11-b. How many resident-discharges did you have (i.e., includes transfers out of the unit)? _____

   11-c. How many resident emergencies did you have (i.e., falls, positive infection requiring quarantine, deteriorating clinical condition of resident, etc.)

12. How often do you feel that the unit staffing is adequate?

   _____ 100% of the time
   _____ 75% of the time
   _____ 50% of the time
   _____ 25% of the time
   _____ 0% of the time

Please turn over to page 3 ➔

Section A — Missed Care

Direct care staff frequently encounter multiple demands on their time, requiring them to reset priorities. To the best of your knowledge, how frequently are the following care tasks **MISSED** by direct care staff on your shift/unit? Check only one box for each item.

	Always missed	**Frequently** missed	**Occasionally** missed	**Rarely** missed	**Never** missed	**Not Applicable**
1) Ambulation/mobilization						
2) Pressure relieving interventions						
3) Feeding residents while food is still at the proper temperature						
4) Setting up meals for residents who can feed themselves						
5) Medications administered as scheduled						
6) Assessment of vital signs						
7) Monitoring intake/output						
8) Full documentation of all care provided						
9) Bathing/Showering						
10) Oral care						
11) Glucose monitoring as ordered						
12) IV/central line site care and assessments according to facility policy						
13) Response to call light is initiated within 5 minutes						
14) PRN medication requests acted on within 15 minutes						
15) Attend interdisciplinary care conferences when held						
16) Assist with toileting needs within 5 minutes of request						
17) Skin/Wound care						
18) Adequate surveillance of confused/impaired residents						

Please turn over to page 4 ➔

Section B—Reasons for Missed Care

Thinking about the missed care on your shift/unit by direct care staff (as you indicated in Section A above), indicate the significance of the reasons care is MISSED on your unit. *Check only one box for each item.*

	Significant reason	**Moderate** reason	**Minor** reason	NOT a reason for missed care
1) Inadequate number of staff				
2) Urgent resident situations (e.g., a resident's condition worsening, resident fall)				
3) Unexpected rise in acuity on the unit				
4) Inadequate number of assistive personnel (e.g., nursing assistants, medication techs, etc.)				
5) Unbalanced resident assignments				
6) Medications not available when needed				
7) Inadequate hand-off from previous shift or sending unit				
8) Other departments did not provide the care needed (e.g., physical therapy did not ambulate)				
9) Supplies/equipment not available when needed				
10) Supplies/equipment not functioning properly when needed				
11) Lack of back up support from team members				
12) Tension or communication breakdowns with other ancillary staff/support departments				
13) Tension or communication breakdowns within the nursing team or with the medical staff				
14) Inadequate support from nursing leadership				
15) Heavy admission and discharge activity				
16) Emotional or physical exhaustion				
17) Inadequate supervision of nursing assistants				
18) Interruptions/Multitasking				
19) Lack of cues/reminders				

THANK YOU FOR YOUR PARTICIPATION!

C.2 Site Visit Results

The main text (Section 3.1) provides an abbreviated overview of key findings. This Appendix C.2 provides additional narrative with more detailed findings from interviews at 31 nursing homes with nursing home leadership, direct care staff, residents, and family, integrated with selected findings from the Missed Nurse Care (MISSCARE) Survey. Full descriptive tables from the MISSCARE Survey analysis are provided in Appendix C.3.

C.2.1 Impact of Resident Assignment on Care Delivery

Researchers asked nursing home leadership how staffing decisions were made in the nursing home and asked direct care staff how the typical resident assignment/typical staffing level affects their ability to deliver safe and high-quality care.

How Staffing Is Determined: Two primary approaches to direct care staffing emerged from the leadership interviews: (1) top-down, where the corporate office sets staffing requirements; and (2) ground-up, where nursing managers or shift supervisors determine shift staffing with oversight from directors of nursing (DONs) and administrators. The majority of nursing homes reported that the DON and administrators were responsible for setting staffing levels. Factors that nursing home leadership considered when making decisions on staffing levels included the physical layout of the building, financial considerations/budget (including their per resident, per day reimbursement rates), daily or weekly census, and resident acuity. As one leader noted, *"You can't give one nurse all the tracheostomy patients."*

Ability to Meet Resident Care Needs: When asked whether their typical resident assignment was reasonable to be able to provide safe, high-quality care to nursing home residents, direct care respondents (RNs, LPNs, nurse aides) consistently noted that resident acuity was more important than the actual number of assigned residents. Having residents with cognitive impairment and higher levels of personal care needs could affect the staff's ability to provide care adequately and safely more so than could having a higher number of residents assigned without those same impairments and care needs.

Direct care respondents also described how increasing the number of assigned residents affects their ability to complete clinical care in a timely and safe manner, noting that often a higher resident assignment led to prioritizing competing demands rather than caring comprehensively for all residents. A high resident assignment often also led to less time for communication with family or other health providers or both, as well as less ability to proactively prevent medical and/or behavioral issues. Some respondents stated that rushing through care due to having high-acuity residents or a high resident assignment led to medication errors. **Exhibit C.1** shows summary responses on recent assignments from direct care staff interviews.

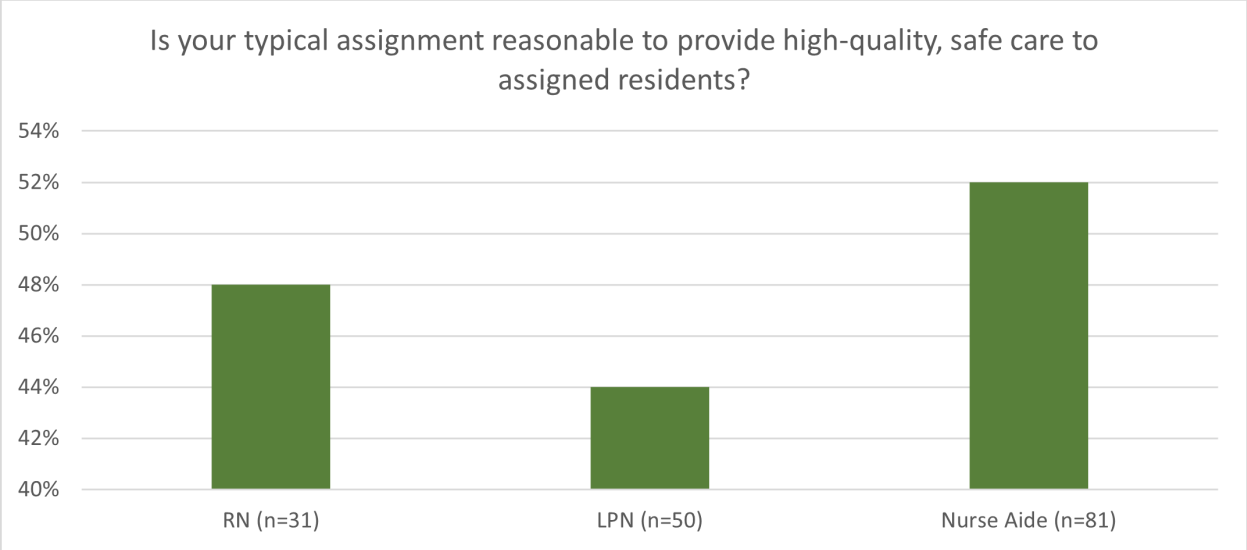
Exhibit C.1: Number of Residents Assigned on Most Recent Shift, by Staff Type

Number of Residents Assigned on Most Recent Shift	Staff Nurse (RN) [n=14]		Staff Nurse (LPN) [n=26]		Nursing Assistant [n=92]		Nurse Manager [n=11]		Other [n=8]	
	n	%	n	%	n	%	n	%	n	%
Up to 10 residents	2	14.3%	4	15.4%	25	27.2%	0	0.0%	3	37.5%
11 to 15 residents	2	14.3%	1	3.8%	32	34.8%	1	9.1%	1	12.5%
16 to 20 residents	3	21.4%	2	7.7%	14	15.2%	2	18.2%	1	12.5%
21 to 25 residents	2	14.3%	7	26.9%	19	20.7%	1	9.1%	1	12.5%
More than 25 residents	5	35.7%	12	46.2%	2	2.2%	7	63.6%	2	25.0%
Mean (SD)	*21.4*	*(9.6)*	*23.8*	*(9.1)*	*15.2*	*(6.2)*	*39.1*	*(25.5)*	*23.9*	*(24.8)*

Source: Data collected during interviews
Notes: Not all respondents provided responses to all interview questions; counts reflect total number of responses rather than total number of interviews.

Approximately half of all direct care respondents reported that their assignments were reasonable to provide high-quality, safe care to residents (**Exhibit C.2**). The other half emphasized that they believed they could provide the bare minimum of care, but that the quality of that care often suffered and negatively affected staff-resident relationships. One nurse aide described how having the right staffing and resident caseload meant "*the resident becomes central to the care provided.*"

Exhibit C.2: Resident Assignment



Source: Data collected during interviews
Notes: Not all respondents provided responses to all interview questions; counts reflect total number of responses rather than total number of interviews.

Many direct care respondents reported wishing they had more time to provide the care their residents need, and disappointment in their job performance and satisfaction when they feel pressured to rush through their assignments.

Nurse aide respondents noted that the rise in number and acuity of their resident assignments affected their ability to perform aspects of ADL care, most often bathing and daily hygiene, as well as delaying delivery of meals.

> *"When we're short staffed, residents are getting bladder infections and bed sores; sometimes they're falling on the floor trying to get to the bathroom."*
>
> –Nurse

> *"Grooming and hygiene tasks are often delayed or missed if [nurse aides] have too many residents assigned to them. There are not enough staff to physically do all the transfers out of bed in the mornings, so residents often stay in bed…staff do not have time to walk people…and then there is a loss of mobility that results over time. Call lights are not answered in a timely manner and residents become incontinent."*
>
> –Nurse aide

They also described the emotional effects of having too many residents assigned to them, including guilt and frustration from having less time to connect with residents and their families.

Nurse aide respondents reported using multiple strategies to meet the needs of their residents, such as bringing meals to more independent residents first in order to have more time with residents who needed feeding assistance, as well as working collaboratively with other staff to complete duties. This "all hands-on deck" approach was described in one nursing home where one nurse aide would bring independent residents to the dining room while another nurse aide would deliver meals to residents who dine in their rooms.

When leadership was asked how resident assignments affected the staff's ability to provide safe, high-quality care, they recognized the trend over the past 20 years of nursing homes admitting higher-acuity residents, such that staffing challenges exacerbated a decrease in quality of care for residents. Some leadership mentioned the relationship between decreased staffing, increased resident assignments, and increasing risks to resident safety. Specific examples given included increases in resident falls, agitation and other difficult behaviors, bed sores, and decreases in mobility.

> *"Inadequate staffing means the residents miss out on individualized care…you can look at them and tell."*
> –Leadership

> *"Maybe a resident is having a bad day; you can't make them feel better on a strict time frame…you rarely have time to address patient loneliness…. Some patients have family that visits regularly; some patients have no family at all. We don't have enough hours in the day to fill that void."*
> –Leadership

> *"When there is not adequate staffing, you see staff burn out and stressful situations that escalate that don't need to…. Residents are more stressed from that, and the delivery of care is not as good. You don't have happy staff and you don't have happy residents."*
> –Leadership

Leaders in some participating nursing homes believed that residents' behaviors were a result of becoming increasingly lonely and isolated, as direct care staff have heavier work assignments and less time for resident interaction and individualized care. They found their staff are increasingly unhappy with their inability to connect with residents and believe their work is solely focused on "physical survival," leading to burnout and turnover.

> *"Sometimes I press my button, pretty close to being an emergency, and it takes hours for staff to respond. Sometimes I have to use the bathroom around lunchtime, and that's their busiest time—delivering trays, picking up trays…. They just can't get to you! Almost every day, this happens."*
> –Resident

Families and residents described understanding how overworked and burdened nursing staff are; however, many expressed serious concerns about not receiving high-quality care. Residents who need toileting assistance sometimes waited a long time when they rang call bells for help because the staff were busy doing other tasks. One resident recalled having to sit in a soiled diaper for hours, causing "big sores." Timeliness of care was also frequently cited as an opportunity for improvement.

C.2.2 Impact of Shift/Unit Staffing on Care Delivery

To better understand the impact of short staffing on care delivery, researchers first inquired about the benefits, to both residents and staff, of working on shifts/units that are fully staffed.

Benefits of Working Fully Staffed: Direct care staff were asked how working fully staffed (meaning all staff who were scheduled to work were present) benefits provision of care to their resident assignment. Respondents stated that being fully staffed leads to safer and more efficient care, increased resident satisfaction with care, improved job satisfaction, and less staff burnout and turnover. Respondents agreed that being fully staffed meant that they were able to provide better care to residents, focusing on person-centered care and providing a more home-like environment to residents. Better collaboration and teamwork were mentioned consistently, since being fully staffed allows everyone to focus on the tasks and skills best suited to their role. Both licensed nurses and nurse aides described how being fully staffed increased their ability to communicate and connect more with residents, which was beneficial for everyone and an essential aspect of job satisfaction.

> *"Residents are getting quality care, and you get to leave knowing you provided good care…. Everything flows more easily, and you can do things with a positive attitude."*
> –Nurse

Licensed nurses described how being fully staffed meant having the ability to provide care to the top of their licenses (i.e., completing tasks using the full extent of their education, training, and experience, rather than completing tasks that can be done by staff with different skills, such as nurse aides), including assessing and responding to the health needs and care management of residents. RNs and LPNs spoke about how having a fully staffed shift meant they had more time to devote to medication administration and communication with other staff, residents, and families, in addition to focusing on the larger picture of resident care needs, rather than having time only for immediate or urgent needs.

> *"[Nurses] have time to carry out their tasks without being rushed. Residents get the care they need in a timely manner. It's easier on both staff and residents. Everyone can do their job."*
>
> –Nurse

For nurse aides, being fully staffed meant being able to provide more frequent and consistent ADL care, including bathing, grooming, mobility assistance, and nutrition. Nurse aides frequently related being fully staffed to giving residents "*the care they need*." This meant they could help residents ambulate more, respond faster to call lights, and maintain safer and more supportive schedules for toileting residents who relied on them for that assistance. They also described how being fully staffed gave them more time to spend with residents, which was beneficial to both staff and residents.

> *"It goes by much better. I can give the residents the care they need, and I don't get as tired. You can get them all the care they need because you're not rushing through tasks."*
>
> –Nurse aide

Nursing home leadership described that when their facility is fully staffed, residents are more likely to get the care they deserve, and staff feel better about the care they provide, all of which translates to better quality of care and better outcomes. Nursing home leaders also spoke about how being fully staffed meant their staff could be more responsive to changes in acuity among residents, prevent accidents and injuries, and provide more residents opportunities to participate in activities.

> *"I feel, with adequate staffing, there is more ability for residents to be more active and engaged. For example, we have a 'walk to dine' program where residents in our long-term unit who are primarily chairfast have the opportunity to ambulate to and from meals; and when we're fully staffed, that works fine. When we're not fully staffed, that doesn't work fine. So maybe not all the residents have the opportunity to 'walk to dine' those days."*
>
> –Leadership

Safety and timeliness of care were commonly referred to across all interview types. Being fully staffed promoted a sense of calm and satisfaction among residents and staff alike. Respondents described better staffing as leading to better morale, with one nurse noting that the amount of staffing available made "*the difference between a great day and an awful day.*" Fully staffed shifts were described as facilitating better emotional support and communication with residents. Both nurses and nurse aides detailed how more time with residents and increased communication led to better physical assessments, quicker recognition of acute changes in resident status, and speedier interventions for residents to prevent poorer outcomes.

> *"More staff prevent resident falls and hip fractures. Some falls can be fatal, since the residents don't recover. Because of the fall, their lives can be shortened."*
>
> –Nurse aide

Frequency of Short Staffing: Most direct care respondents reported working short staffed multiple times a week (**Exhibit C.3**), exemplified by one nurse saying, "*I don't know the last time we had [a full shift].*"

Exhibit C.3: "Over the Last Month, How Often Did You Work Short Staffed?"

	RN (n=37)	LPN (n=63)	Nurse Aide (n=102)
Every other week	0%	6%	8%
Every week	14%	9%	9%
Multiple times a week	57%	49%	46%
Other	19%	19%	12%

Source: Data collected during interviews

Direct care respondents noted that when they are working short staffed, multiple demands on their time mean they must make decisions about care priorities; as a result, some care could be delayed and sometimes completely missed. Respondents across all interview types noted the impact of short staffing on resident and resident care, as well as on the staff themselves, frequently citing physical exhaustion and burnout.

Prioritizing, Delaying, and Missing Care Tasks: When working short staffed, nurses and nurse aides described triaging care priorities based on resident acuity and personal needs; the highest-acuity residents and residents with a sudden change in status are typically tended to first. Medication administration is a top priority when prioritizing care. One nurse described working short staffed as only being able to prioritize care by the hour, especially given the rising acuity of residents. For nurse aides, top priorities were ensuring residents got their medication, were fed, and cleaned up if soiled.

> *"You can't have mistakes with med passes. You know what the absolutes are. If someone needs a dressing changed two times a day and you have inspected it and it looks good, you know you can save it for the next shift and focus on someone with blood pressure meds who needs it."*
>
> –Nurse

When asked about delayed or missed care, direct care staff described how they make decisions about which tasks could be handed off to the next shift.

Nurse aides also described prioritizing tasks when shifts were short staffed. Some ADL care including feeding assistance and toileting was prioritized over grooming and other hygiene tasks such as brushing hair/teeth, showering, and straightening resident rooms. Tasks related to resident mobility or engaging residents in activities were often delayed or not performed. One respondent noted that if they are short staffed, only residents who require assistance with eating, are at risk for choking, or require supervision at mealtimes are fed in the dining room, while less-dependent residents eat in their rooms.

> *"Sometimes showers don't get done because we don't have enough staffing. There are times when we get people cleaned or washed, but we can't get them out of bed because we are that far behind…. There are people who [use] lifts and Hoyers that need that much extra assistance to get them out of bed or back in…. Sometimes we leave them in bed for the day, which isn't right, but we're that short of staff."*
>
> –Nurse aide

When direct care staff were asked about which tasks were most often delayed and how frequently, they reported bathing/showering was the most frequently delayed task, followed by oral care, and making the bed (**Exhibit C.4**).

Exhibit C.4: Frequently Delayed Tasks as a Result of Short Staffing

Delayed Task	Frequently	Occasionally	Rarely
Bathing/showering	51	47	33
Oral care	43	28	35
Making the bed	34	25	41
Other[1]	37	37	11

Source: Data collected during interviews
Notes: Number of respondents who reported delayed tasks (not all respondents responded to this interview question).
[1] Other = toileting, personal care, ambulation, meals, responding to call bells, getting residents out of bed.

As another source of data on delayed/missed nursing care, the Staffing Study team analyzed responses to the MISSCARE Surveys collected from staff during site visits. The study received MISSCARE Surveys in 21 of the 31 participating nursing homes across 13 of the 14 states. The average number of completed surveys per facility was 8, with a range of 1 to 23. The majority of responses to the survey were from nurse aides (57 percent); 35 percent of responses were from licensed nurses (RNs, LPNs), including nurse managers. The remainder were other staff types, such support aides. Nearly 70 percent of responses were from staff with at least 2 years' experience on their current unit; 30 percent of responses were from staff with more than 10 years' experience on their current unit. Nearly 60 percent of all respondents indicated that staffing was adequate in their nursing home 50 percent of the time or less.

In response to the question, "How frequently are the following care tasks missed by direct care staff on your shift/unit?" the most commonly reported missed tasks included response to call lights, toileting assistance, oral care, bathing, and ambulation (**Exhibit C.5**). Across all tasks, reported frequency of missed care does not significantly vary by job type. However, across job types, there is some variation in the ranking of missed care. For example, RNs reported their top concern was missed or delayed oral care; for LPNs, it was missed attendance at interdisciplinary care conferences; for nurse aides, it was missed bathing/showering; and for nurse managers, the top concern was missed documentation of care.

Exhibit C.5: Frequently Delayed Tasks from MISSCARE Survey

Task	How Frequently Task Is Missed										Mean (0-4)
	Never (0)		Rarely (1)		Occasionally (2)		Frequently (3)		Always (4)		
	n	%	n	%	n	%	n	%	n	%	
Ambulation/mobilization	27	18.2%	33	22.3%	31	20.9%	41	27.7%	16	10.8%	1.91
Pressure-relieving interventions	27	18.5%	38	26.0%	54	37.0%	17	11.6%	10	6.8%	1.62
Feeding residents while food at proper temperature	35	23.3%	36	24.0%	47	31.3%	21	14.0%	11	7.3%	1.58
Meal set-up	61	40.4%	50	33.1%	23	15.2%	6	4.0%	11	7.3%	1.05
Medications administered as scheduled	26	24.1%	43	39.8%	22	20.4%	12	11.1%	5	4.6%	1.32
Assessment of vital signs	48	34.5%	47	33.8%	21	15.1%	15	10.8%	8	5.8%	1.19
Monitoring intake/output	40	28.4%	51	36.2%	21	14.9%	21	14.9%	8	5.7%	1.33
Full documentation of care	36	23.1%	26	16.7%	41	26.3%	41	26.3%	12	7.7%	1.79
Bathing/showering	21	14.1%	34	22.8%	44	29.5%	36	24.2%	14	9.4%	1.92
Oral care	25	16.3%	34	22.2%	38	24.8%	39	25.5%	17	11.1%	1.93
Glucose monitoring	50	50.5%	40	40.4%	6	6.1%	0	0.0%	3	3.0%	0.65
IV/central line site care	32	42.7%	30	40.0%	10	13.3%	0	0.0%	3	4.0%	0.83
Response to call light w/in 5 minutes	20	12.9%	30	19.4%	39	25.2%	58	37.4%	8	5.2%	2.03
Act on PRN med request w/in 15 minutes	19	18.1%	42	40.0%	29	27.6%	9	8.6%	6	5.7%	1.44

Task	How Frequently Task Is Missed										
	Never (0)		Rarely (1)		Occasionally (2)		Frequently (3)		Always (4)		Mean (0-4)
	n	%	n	%	n	%	n	%	n	%	
Attend interdisciplinary care conferences	23	25.8%	22	24.7%	18	20.2%	16	18.0%	10	11.2%	1.64
Toilet assist w/in 5 minutes	21	13.7%	34	22.2%	44	28.8%	41	26.8%	13	8.5%	1.94
Skin/wound care	32	27.1%	48	40.7%	26	22.0%	7	5.9%	5	4.2%	1.19
Surveillance of cognitively impaired	29	20.3%	48	33.6%	37	25.9%	20	14.0%	9	6.3%	1.52
All tasks combined	**572**	**24.1%**	**686**	**28.8%**	**551**	**23.2%**	**400**	**16.8%**	**169**	**7.1%**	**1.54**

Source: Abt analysis of MISSCARE Survey data

Most significantly, the MISSCARE Survey results show that missed care is most common when staffing is reported to be adequate only 25 percent of the time (**Exhibit C.6)**.

Exhibit C.6: Frequently Delayed Tasks and Adequate Staffing from MISSCARE Survey (n=151)

Task	Mean Frequency of Missed Care (0-4)[1]				
	How Often is Staffing Adequate[2]				
	0% of the Time	25% of the Time	50% Of the Time	75% of the Time	100% of the Time
Ambulation/mobilization	2.11	2.42	1.73	1.30	1.53
Pressure-relieving interventions	2.12	1.87	1.38	1.16	1.58
Feeding residents while food at proper temperature	1.61	1.94	1.50	1.05	1.68
Meal set-up	0.89	1.43	0.68	0.73	1.20
Medications administered as scheduled	1.07	1.84	1.25	1.03	1.07
Assessment of vital signs	1.33	1.51	1.30	0.74	1.11
Monitoring intake/output	1.35	1.67	1.37	1.03	1.21
Full documentation of care	1.78	2.27	1.67	1.27	1.80
Bathing/showering	1.89	2.48	2.13	1.28	1.53
Oral care	2.18	2.45	2.20	1.30	1.47
Glucose monitoring	0.53	0.92	0.67	0.53	0.54
IV/central line site care	0.55	1.00	0.78	0.76	1.00
Response to call light w/in 5 minutes	1.50	2.69	2.13	1.55	1.75
Act on PRN med request w/in 15 minutes	1.20	1.93	1.40	1.16	1.40
Attend interdisciplinary care conferences	1.60	2.42	2.00	1.04	0.91
Toilet assist w/in 5 minutes	1.56	2.73	1.72	1.33	1.89
Skin/wound care	1.06	1.68	1.00	0.94	1.07
Surveillance of cognitively impaired	1.67	2.12	1.36	1.10	1.28
All tasks combined	**1.48**	**2.04**	**1.51**	**1.09**	**1.38**

Source: Data collected from MISSCARE Survey

[1] Responses coded 0-4 where 0 = 0% of the time,1 = 25% of the time, 2 = 50% of the time, 3 = 75% of the time, and 4 = 100% of the time.

[2] Findings show the mean score of missed care by the reported frequency of adequate staffing; survey respondents who reported that staffing was adequate only 25% of the time had the highest mean frequency of all missed care tasks combined (2.04).

The most significant reasons reported for missed care (**Exhibit C.7**) included inadequate staff and inadequate assistive personnel, followed by an unexpected rise in acuity, emotional/physical exhaustion, and interruptions or multitasking ("most significant" = mean >1.7).

Exhibit C.7: Reasons for Missed Care from MISSCARE Survey (n=151)

Reason	Significance of Reason for Missed Care[1]								
	Not a Reason (0)		Minor Reason (1)		Moderate Reason (2)		Significant Reason (3)		*Mean (0-3)[2]*
	n	%	n	%	n	%	n	%	
Inadequate staff	21	14.1%	18	12.1%	29	19.5%	81	54.4%	*2.14*
Urgent resident situations	32	21.2%	35	23.2%	53	35.1%	31	20.5%	*1.55*
Unexpected rise in acuity	25	17.2%	32	22.1%	47	32.4%	41	28.3%	*1.72*
Inadequate assistive personnel (NA, med tech)	25	16.3%	23	15.0%	31	20.3%	74	48.4%	*2.01*
Unbalanced resident assignments	42	28.0%	39	26.0%	39	26.0%	30	20.0%	*1.38*
Medications not available when needed	54	38.0%	37	26.1%	28	19.7%	23	16.2%	*1.14*
Inadequate hand-off previous shift/unit	46	30.1%	44	28.8%	34	22.2%	29	19.0%	*1.30*
Other departments did not provide needed care	56	36.8%	51	33.6%	29	19.1%	16	10.5%	*1.03*
Supplies/equipment not available when needed	36	24.2%	52	34.9%	40	26.8%	21	14.1%	*1.31*
Supplies/equipment not functioning	47	30.9%	46	30.3%	35	23.0%	24	15.8%	*1.24*
Lack of back-up support from team	34	22.2%	38	24.8%	42	27.5%	39	25.5%	*1.56*
Tension/communication w/ other staff/departments	36	23.4%	41	26.6%	40	26.0%	37	24.0%	*1.51*
Tension/communication w/in nursing or med staff	33	21.7%	38	25.0%	40	26.3%	41	27.0%	*1.59*
Inadequate support from nursing leadership	40	26.3%	38	25.0%	35	23.0%	39	25.7%	*1.48*
Heavy admission and discharge activity	49	33.3%	46	31.3%	37	25.2%	15	10.2%	*1.12*
Emotional or physical exhaustion	29	19.3%	24	16.0%	40	26.7%	57	38.0%	*1.83*
Inadequate supervision of NAs	39	25.7%	46	30.3%	40	26.3%	27	17.8%	*1.36*
Interruptions/multitasking	24	15.7%	28	18.3%	53	34.6%	48	31.4%	*1.82*
Lack of cues/reminders	54	35.3%	45	29.4%	31	20.3%	23	15.0%	*1.15*

Source: Data collected from MISSCARE Survey
[1] Responses coded 0-3 where 0 = Not a Reason, 1 = Minor Reason, 2 = Moderate Reason, and 3 = Significant Reason for Missed Care.
[2] Mean score of the rankings across all respondents.

Evident across all direct care staff interviews was how hard nursing home staff are working to ensure that tasks get done and that their residents are safe, even when they are working short staffed. However, they report that working short so frequently has a long-term impact on staff morale, physical exhaustion, burnout, and job dissatisfaction. Direct care respondents reported they cannot keep up with the workload and give residents what they need, reporting delays in care, delays in charting, and reduced resident interaction. They believed the lack of time they have with residents was contributing to more agitated resident behaviors and more feelings of isolation and loneliness. Direct care respondents also reported their lack of time with residents led to poor physical health outcomes, since they are not as familiar with each resident and therefore are less able to detect changes in clinical status that could prevent poor health outcomes such as falls, incontinence, or hospitalizations.

Additional Help during Short Staffing: Many direct care respondents described ways in which they attempted to help one another and support resident care while working short staffed, but there was mixed feedback about the availability of other types of staff to help when a shift/unit was short staffed. The availability or willingness of others to help was not evident in all nursing homes and depended on availability of additional staff and the culture of the nursing home. Some nursing homes pulled ancillary staff such as social workers, therapists, and activity directors, as well as administrative and front desk staff, to come to the floors and support clinical and ADL care when shifts/units were short staffed.

> *"If [there are] not enough [nurse aides], I pitch in and help them with the bathing and other care tasks. Some other nurses do this, but some nurses won't. The activity staff help the residents so much; they bring water and make sure the residents are comfortable."*
>
> –Nurse

> *If you're behind on your work, you know what you have to do to catch up. You can't say, 'Hey, can you do all my paperwork?' You know what I mean?"*
>
> –Nurse

Direct care respondents acknowledged that pitching in is helpful to meet the minimum care needs of residents, but it is not a long-term solution because ancillary staff are not as familiar with clinical caregiving and resident routines. Some respondents reported that though the safety of residents might not be compromised when other staff help, the quality of that care can be diminished. "Borrowing" staff from other departments also prevents those staff from completing their own work. For example, medication administration and other administrative tasks take longer than usual if RNs are being pulled to do ADL care.

Personal Impact of Working Short Staffed: Asked how short staffing affects their personal health and well-being, the overwhelming majority of direct care respondents reported physical, emotional, and mental burnout from working short staffed, as well as lasting impacts on their well-being.

Respondents noted the lasting effects of exhaustion from the COVID-19 public health emergency have not subsided; and they reported difficulties with processing their grief from losing family, residents, and colleagues. As a result of short staffing, direct care respondents described not being able to take breaks they need, which had consequences for their physical health. Additionally, 80 percent of respondents to the MISSCARE Survey administered as part of the site visits indicated that they have worked overtime in the past three months, which also exacerbates staff exhaustion and burnout.

> *"We are all tired. Nursing post-COVID versus pre-COVID is completely different. Before we were tired, and some had insane hours, but before you felt more comfortable saying you weren't going to pick stuff up or do XYZ. Now there is a guilt with it. People are really overexerting themselves. They are tired and grumpy, and they don't realize they are. Someone might stay until 2 am because no one else would do it. You want to take care of your residents so much, so you are tired. That's when injuries happen for staff, workplace injuries."*
>
> –Nurse

Feedback about Staffing: Nursing home leadership reported that residents and families often provide feedback about short staffing in the nursing home. Residents told leadership they felt lonely, wished they had more one-on-one time with staff, and wanted more time to talk to the staff. Some families and residents told leadership they could see how hard staff were working and that staff try as best they could to be accommodating. But not all feedback was positive.

Leadership described families' frustration when trying to reach the nursing home to check on a loved one or speak to someone at the nursing home and not being able to get through. They reported that families wanted more consistent care and noted agency staff were too transient to establish relationships with residents and did not know or understand the routines of residents.

Many direct care respondents provided feedback to their leadership that "appropriate" or "adequate" staffing should not only consider the number of staff on a shift/unit but also consider the quality of staff and their willingness to provide consistent, safe, and compassionate care.

Residents provided mixed feedback about staffing. Families and residents reported empathy and kindness towards the staff at the facilities where they resided: "*Most of the staff truly enjoy and take pride in their work. They're anxious to help the residents*." Residents with consistent staff assignments reported enjoying having staff who knew their routines and preferences. Another resident described being pleased with the staff but believed the staff were held too tightly to specific tasks, wishing they were able to be more flexible in their ability to assist them: *"They are kind and helpful, but they are restricted by their roles."*

Many residents and families reported that basic care needs were being met, such as medications, but that, consistent with reports from direct care staff, needs such as showering, hygiene care, hot meals, meal options, and getting to bed in a timely manner frequently are not met, or not met when they would prefer. One family member described their disappointment with their resident's hygiene care as "*the care he's not getting. Sometimes he'll go two weeks without a bath*."

> *"We get backlash from families. Every day I wonder how many punches I'm going to get; they get so mad. When somebody is declining in health, the family gets aggressive and angry, they don't understand. The respect level is gone. I'm glad I only have eight more years in the field before I can retire."*
>
> –Leadership

> *"To me, that is one of the hardest things – when I tour the units, I talk to families and patients, I hear over and over again that [bells aren't answered] and I try to appease them without making it look like we have bad staffing."*
>
> –Leadership

Some nurse staff respondents raised concerns about agency staff brought in to provide direct care, noting they were transient and less familiar with the residents. Additionally, staff working in facilities with higher levels of agency staffing felt undervalued because agency staff have "more power" in being able to make their own schedules and earn significantly higher pay than employed staff. Families and residents also expressed concern with agency staffing, speaking to a lack of person-centered care as well as a lack of care continuity.

C.2.3 Challenges to Adequate Staffing

Asked about the biggest challenges their nursing home faces with staffing, the overwhelming majority of respondents reported it was recruitment of new staff and retention of current and newly hired staff. Leadership respondents consistently cited the lack of applicants available to fill open positions. Staffing challenges were attributed to long-standing issues related to the stigma of working in nursing homes, low pay, and difficult working conditions. Respondents noted this situation was exacerbated by COVID-19, when many direct care staff left the long-term care workforce completely due to burnout and difficult working conditions. As leadership staff described the situation, "*You have people leaving the industry faster than we can educate, hire, and onboard new staff*." Another common challenge reported was workforce competition. Nursing homes found themselves competing with better-paying jobs in other health care sectors, such as hospitals, and with staffing agencies offering better pay and more flexibility. Some respondents also cited competition with local businesses unrelated to health as particularly challenging for filling nurse aide positions.

> *"[If we are fully staffed], we don't have to stop and re-do the schedule every time we discover someone didn't show up. It's disruptive to communicate these [staffing] changes to everyone."*
> –Nurse

For leadership, working short meant constant adjustments to schedules to respond to limited staffing.

Leadership respondents also recognized that the frequency of being short staffed led to low morale among direct care staff, which often led to more call outs and staff leaving the long-term care work force altogether.

They also described short staffing as being directly related to poor outcomes and safety risks and acknowledged how frequently shifts/units are short staffed. They believed they could not overcome these staffing challenges, however.

> *"[Nurse aides] are always calling out, so the LPNs are pretty stressed. The workforce is very small, and…it is so hard to get them here"*
> –Leadership
>
> *"Falls [are] the #1 issue. It's immediate. If there's a fall, I'll grab the schedule – wasn't enough people."*
> –Leadership
>
> *"It is bad. I did increase the ratio…but I can't get it staffed…. It has been the short staffing problem over nine years. I have never been fully staffed for the nine years."*
> –Leadership

Changes Made in Response to Staffing Challenges: Asked what their nursing home has done to address staffing challenges, respondents had mixed responses. Some respondents reported that nursing homes are using multiple strategies to address short staffing, others that not enough was being done to address staffing shortages.

Some nursing homes have increased direct care staff wages and use signing bonuses to incentivize new hires. Respondents reported moderate levels of success with these strategies but reported it is not enough to fill the gaps in their nursing home workforce. One nursing home reported a multi-pronged approach of incentives for referrals, signing and retention bonuses, increasing wages for existing staff, extra pay for working shifts that were short staffed, increased advertising to attract new staff, and free courses for nursing assistants and medication aides, as well as hiring travel nurses who stay in the nursing home for 13-week assignments before moving on to another assignment. This nursing home reported only some success with increasing its staffing levels despite using all these strategies.

Another strategy nursing homes used to increase staffing was to offer their direct care staff additional educational opportunities through scholarships and tuition reimbursement. They believed these policies would make them more competitive with the hospital workforce, and it would be a positive way of giving the long-term care workforce the possibility of professional growth within the nursing home. As one respondent stated, "*I have to build my own pipeline; I want to uplift the family. Having your own dedicated staff is the best because there's buy-in*." Several leadership respondents mentioned being interested in these types of incentives but not having the resources to implement them.

> *"Mandation…they get mandated, like, 16 hours. I think it shouldn't be done because you're wearing us out. You're tearing us up by doing that—by keeping the same people working 16 hours. That's crazy."*
> –Nurse aide

To fill gaps in staffing, some nursing homes have implemented mandated overtime. This was described as unpopular and unsustainable, even when overtime pay was double or triple. Direct care respondents also reported having provided feedback to leadership that mandated overtime has a serious negative impact on their quality of life.

Agency staff are also used to fill shifts. In one nursing home, agency staff represented 75 percent of total staffing. Many direct care respondents noted that agency staff are paid significantly more per hour than employed staff, and they have much greater flexibility in choosing what shifts to work, which resulted in feelings of unfairness and resentment. Respondents noted that because of the transient nature of agency staff, they did not know residents as well as regular staff did. Many respondents perceived that even though there was a need to hire agency staff to fill staffing gaps, it did not always alleviate the workload burden. They described agency staff as calling out of work frequently and at the last minute; less committed to the work when they were on site; and delivering less effective and efficient care than did regular, employed nursing home staff.

> *"We can't compete with the amount [agencies] are paying…. Agencies have really wrecked nursing…. You find that a lot of these agency nurses show up when they want, and there is no respect for the other nurses. Nursing has gotten out of control now. After COVID, it's no holds barred, like, 'I make my own schedule!' No, there's no such thing as starting at 9:30; it's a 7am start.' They've bottled the whole system and now we can't staff."*
>
> –Leadership

C.2.4 Suggestions for a Minimum Staffing Requirement

One of the goals of the site visits was to obtain staff input on considerations for implementation of a federal minimum staffing requirement, including their perspectives on potential unintended consequences and what factors should be taken into account when developing a minimum staffing requirement.

> *"It will give a foundation for [nursing homes] to know that they need to run staffing at to take care of their residents. Some corporations dictate staffing levels that aren't adequate for the residents being served."*
>
> –Nurse

Respondents described both benefits of and concerns about implementing a minimum staffing requirement. Perceived benefits included the possibility of having a fully staffed nursing home on each shift/unit. Respondents believed that a minimum requirement would decrease staff burnout, improve person-centered care, and decrease safety concerns. Direct care respondents stated that with a minimum staffing requirement in place, administrators would be required to keep units and shifts fully staffed and to have back-up plans in place for short-staffing incidents.

Conversely, respondents reported concerns about being unable to meet a minimum staffing requirement due to existing hiring and retention challenges.

Particularly in rural areas and for nursing homes with fewer financial resources, respondents reported concerns about having a limited staffing pool to draw from, and not being able to offer competitive wages to recruit and hire new staff to meet a minimum requirement. Additional leadership concerns were lower quality ratings and financial penalties associated with not being able to meet a minimum requirement.

> *"The timing of a minimum staffing requirement couldn't be worse. On the heels of COVID and the Great Resignation, there is not enough staff to fill the open positions. The ratios for staffing will likely be unattainable and the facility won't be able to meet them. If penalties are put in place, many facilities will have to decrease the number of beds available, discharge current residents, or have fewer admissions…. Many facilities will close their doors if penalties and fines are put in place."*
>
> –Nurse

Some respondents reported concerns about a potential minimum staffing requirement being set too low, fearing that some administrators will understaff shifts, or that the minimum will become the maximum, despite staff struggling to provide high-quality, safe care at their current staffing levels. Finally, many respondents were concerned about using a "one-size-fits-all" approach for a federal staffing requirement. As one respondent described, *"I don't know if you can put a minimum on taking care of someone's loved one."*

Factors to Consider When Developing a Minimum Staffing Requirement: Respondents noted factors that should be considered when developing a minimum staffing requirement:

- Resident acuity
- Staff competence
- Shift type
- Optimum staffing, instead of minimum staffing
- Different staffing requirements for nurse aides and licensed nurses

Respondents were often unsure whether a minimum requirement is necessary, or a minimum staffing requirement would solve the root cause of the staffing problems in nursing homes.

Almost all respondents mentioned resident acuity as a primary consideration when developing a minimum staffing requirement. They emphasized that the time it takes staff to provide care is highly correlated with residents' clinical needs, which can vary significantly across residents, across units, and across nursing homes. When licensed nurses were asked about the time it took to complete six frequently performed nursing care tasks (**Exhibit C.8**), responses were highly varied, reflecting the unique nature of individual residents and their specific care needs. For example, across all responses, time to complete wound care averaged approximately 32 minutes per resident, with a range of 10 minutes to 40 minutes per resident. Respondents noted that the differences in the time it took to perform wound care varied by the type, severity, and location of the wound, as well as the mobility of the resident. Similar caveats were suggested for catheter care and collecting lab specimens. Average, minimum, and maximum time per resident needed to perform catheter care varied based on the type of catheter (e.g., indwelling, external, suprapubic) and whether the catheter was being inserted, removed, or flushed/cleaned. Similarly, the amount of time needed for collection of lab specimens varied by the type of specimen being collected (e.g., nasal swab, urine collection, blood draw).

Exhibit C.8 shows that the average, minimum, and maximum amount of time spent on each task differed significantly across respondents. Some respondents reported an average amount of time they spend on a task during their shift, but some reported only minimum and maximum times per resident. Additionally, respondents were inconsistent in their ability to answer these questions due to time constraints (not having enough time for all the interview questions) or not being comfortable providing an estimate. And further, the wide variation in responses is a reflection of the differing acuity among residents.

Exhibit C.8: Self-Reported Time on Six Nursing Care Tasks

Task	Average Time		Minimum Time		Maximum Time		# Residents Included in Estimate	
	n[1]	Mean (range)	*n*[1]	Mean (range)	*n*[1]	Mean (range)	*n*[1]	Mean (range)
Wound care	64	31.9 (1–180)	71	9.8 (0–30)	72	39.1 (2.5–120)	68	6.9 (1–80)
Medication passes	64	109.8 (1.5–600)	52	37.7 (0.5–420)	50	59.7 (3–420)	72	20.4 (1–120)
Medication-related assessments	54	57.1 (1–480)	47	14.1 (0.5–150)	41	37.7 (3–180)	65	14.8 (1–80)
Other assessments	39	34.6 (2–240)	42	13.6 (0–180)	39	33.5 (3–360)	45	10.8 (1–29)
Catheter care	46	16 (3–60)	37	11.2 (0–80)	36	28.4 (5–120)	49	3.1 (1–20)
Collecting lab specimens	25	20.9 (3–90)	26	10.7 (0–30)	25	50.2 (2–720)	25	4.4 (1–26)

Source: Data collected from interviews
[1] Number of responses.

When emphasizing the need for resident acuity to be considered in a minimum staffing requirement, respondents noted that higher-acuity residents can be at greater risk of falls; aggressive behaviors; cognitive decline; and the need for assistance with feeding, mobility, and toileting. As such, those types of residents will require more care and hence higher staffing than residents without that same acuity and morbidity. Respondents also emphasized the importance of quality, rather than quantity, of staff. One nurse noted that working fully staffed is irrelevant if the workers are inexperienced and not well trained. Another nurse cited her 28 years of experience as a reason to assign her a higher number of residents, whereas, *"Anyone who has a lack of knowledge is going to take more time to seek the right answer. It's hard to guess when it comes to nursing."* Several leadership respondents agreed that quantity of staff does not equate to success; rather than a minimum staffing requirement, they "*would like to see mandates for additional staff training or education."*

Nursing home staff respondents reported mixed perspectives on considerations that should be given to staffing by shift type. They reported higher needs for staffing across day and evening shifts compared to night shifts. Some respondents believed that all shifts should be staffed equally, in case of medical emergencies. Others believed weekends require a different staffing than weekdays because residents do not typically have out-of-nursing-home appointments or other external obligations on the weekends.

> *"I wish we could stop looking at the bare minimum; the goal is not to scrape by. But that feels like what we've had to do. We haven't had the freedom to be comfortable in such a long time. We are constantly scraping by. I wish the bare minimum didn't have to be the pinnacle of hope."*
>
> –Leadership

Respondents stated that being able to provide thorough, personalized care to residents should be more important than a specific staffing level. They noted that the staffing requirements should accommodate more than just bare minimum duties. Secondary tasks such as shaving, clipping nails, and conversing with residents about their lives should be factored into a minimum requirement.

Nurse staff frequently described collaborating with one another, but they emphasized the importance of separate staffing requirements for each type of direct care staff. They noted that nurse aides and licensed nurses constitute "two different worlds" given their unique set of responsibilities, and so there should be distinct requirements for each staff type.

Most respondents were in favor of reducing workloads by increasing staffing levels, but a few leadership respondents were concerned about the possibility of overstaffing.

> *"There's a fine line between enough staff and too many staff. Sometimes the more help, the less gets done—they're busy talking and taking longer breaks."*
>
> –Leadership

Family members and residents described their understanding of short staffing issues throughout health care, and more specifically in their nursing homes, but also consistently expressed frustration at not being able to receive the care they want and need for themselves and their loved ones. The majority of families and residents described having safe, consistent, resident-centered, timely care as the most important aspect to be considered for staffing levels. Some others included wanting to feel like they were being treated like family, that the facility was clean, and food was served warm.

Some leadership respondents believed that any staffing requirement should be a guideline instead of a mandate. That rather than penalizing nursing homes that fail to meet the minimum, the government could provide financial incentives to high-performing facilities that exceed the minimum. Alternatively, a "minimum quality of care" requirement would be a more direct measure of success. Nursing homes in states with their own staffing mandates believed that existing guidelines were sufficient, that a federal mandate was excessive.

Finally, respondents had reservations about a minimum staffing requirement being a reactionary solution. As one leader described, *"Changing the requirement is not fixing the problem; it's just putting more stipulations on the problem."* Given the shortage of applicants for permanent jobs in nursing homes, many leadership respondents emphasized the importance of addressing the pipeline problem before mandating a staffing requirement.

> *"You will see nursing homes not take admissions in order to stay compliant…. Facilities know they will make more money off certain residents and [thus] not take difficult patients."*
>
> –Leadership

Unintended Consequences of a Minimum Staffing Requirement: Some respondents reported how a minimum staffing requirement could lead to overall decreased nursing home admissions and to preferential placement of lower-acuity residents.

Additionally, nursing homes that struggle to secure enough staff might be forced to discharge their residents prematurely or close operations altogether. Respondents overall believed a minimum requirement might improve quality of care for some current nursing home residents, while precluding others from entering or staying at nursing homes altogether.

Some respondents also reported concerns that a staffing requirement might widen disparities between nursing homes, causing *"a bigger divide between the facilities that are patient-focused and money-focused."* Respondents described concern that if the minimum requirement is lower than a facility's current standards, administration might lay off some staff to save money. Other respondents believed non-profit nursing homes will suffer from a minimum requirement, whereas for-profit nursing homes will "*likely be okay*." Facilities in rural areas might struggle to meet the staff requirement.

> *"The lowest-performing facilities will hopefully close. At the end of the day, our primary function is to help the community. If those nursing homes are already terrible, then realistically the folks that are there would be better going somewhere else—if there is somewhere else to go to. For instance, this is a 150-bed facility, but we are operating at half capacity. There's something to be said for consolidation of resources if those staff choose to stay in the industry and transfer to a higher-performing nursing home."*
>
> –Leadership

C.3 Analysis of MISSCARE Surveys

This appendix presents simple descriptive statistics from the Missed Nursing Care (MISSCARE) Survey.

Exhibit C.9: Characteristics of Respondents (n=168)

Characteristic	n	%
Unit Type[1]		
Long-term care unit	132	79%
Skilled/sub-acute unit	53	32%
Alzheimer's/dementia care unit	44	26%
Other unit	7	4%
Job Title/Role		
Staff nurse (RN)	16	9.5%
Staff nurse (LPN/LVN)	29	17.3%
Nursing assistant (e.g., CNA/med tech)	96	57.1%
Nurse manager (e.g., DON/ADON, Unit Manager)	14	8.3%
Other	13	7.7%
Usual Weekly Hours		
Less than 30 hours	21	12%
30 or more hours	146	88%

Characteristic	n	%
Length of Experience in Role		
Up to 6 months	11	6.5%
6+ months up to 2 years	18	10.7%
2+ years up to 5 years	28	16.7%
5+ years up to 10 years	32	19.0%
More than 10 years	79	47.0%
Length of Experience on Current Unit		
Up to 6 months	21	12.6%
6+ months up to 2 years	28	16.8%
2+ years up to 5 years	42	25.1%
5+ years up to 10 years	23	13.8%
More than 10 years	53	31.7%
Duration of Usual Shift		
8-hour shift	91	54.2%
10-hour shift	12	7.1%
12-hour shift	48	28.6%
Other	17	10.1%
Time of Usual Shift		
Days	123	73.2%
Evenings	21	12.5%
Nights	11	6.5%
Rotates	13	7.7%
Overtime in Past 3 Months		
None	32	19.2%
1–12 hours	70	41.9%
More than 12 hours	65	38.9%
Shifts Missed in Past 3 Months		
None	84	50.3%
1 day/shift	26	15.6%
2–3 days/shifts	38	22.8%
4–6 days/shifts	13	7.8%
More than 6 days/shifts	6	3.6%
Number of Residents Assigned on Most Recent Shift		
Up to 10 residents	34	22.5%
11 to 15 residents	37	24.5%
16 to 20 residents	22	14.6%
21 to 25 residents	30	19.9%
More than 25 residents	28	18.5%
Mean (SD), range	***19.4 (12.7)***	***0-89***
How Often Is Staffing Adequate		
0% of the time	19	11.6%
25% of the time	50	30.5%
50% of the time	29	17.7%
75% of the time	45	27.4%
100% of the time	21	12.8%

Source: Data collected from MISSCARE Survey

[1] For unit type, the numbers sum to more than 168 and the percentages to more than 100% because many respondents indicated multiple units.

Exhibit C.10: Relationship of Job Title and Number of Residents Assigned

Number of Residents Assigned on Most Recent Shift	Job Title/Role									
	Staff Nurse (RN) [n=14]		Staff Nurse (LPN) [n=26]		Nursing Assistant [n=92]		Nurse Manager [n=11]		Other [n=8]	
	n	%	n	%	n	%	n	Percent	n	%
Up to 10 residents	2	14.3%	4	15.4%	25	27.2%	0	0.0%	3	37.5%
11 to 15 residents	2	14.3%	1	3.8%	32	34.8%	1	9.1%	1	12.5%
16 to 20 residents	3	21.4%	2	7.7%	14	15.2%	2	18.2%	1	12.5%
21 to 25 residents	2	14.3%	7	26.9%	19	20.7%	1	9.1%	1	12.5%
More than 25 residents	5	35.7%	12	46.2%	2	2.2%	7	63.6%	2	25.0%
Mean (SD)	***21.4***	***(9.6)***	***23.8***	***(9.1)***	***15.2***	***(6.2)***	***39.1***	***(25.5)***	***23.9***	***(24.8)***

Source: Data collected from MISSCARE Survey

Exhibit C.11: Reported Adequacy of Staffing by Respondent and Facility Characteristics

	How Often Do You Feel That Unit Staffing Is Adequate (% of Time)?		
	n	Mean	(SD)
Respondent Characteristic			
Unit Type[1]			
Long-Term Care Unit			
Yes	117	48.1	(31.3)
No	29	47.4	(33.0)
Skilled/Sub-Acute Unit			
Yes	47	46.3	(30.4)
No	99	48.7	(32.2)
Alzheimer's/Dementia Care Unit			
Yes	41	32.3	(30.7)
No	105	54.0	(29.8)
Other Unit			
Yes	5	55.0	(41.1)
No	141	47.7	(31.3)
Job Title/Role			
Staff nurse (RN)	14	46.4	(32.3)
Staff nurse (LPN/LVN)	25	44.0	(37.7)
Nursing assistant	88	44.6	(29.5)
Nurse manager	11	70.5	(27.0)
Other	8	68.8	(22.2)
Number of Residents Assigned on Most Recent Shift			
Up to 10 residents	33	58.3	(27.0)
11 to 15 residents	34	41.2	(29.4)
16 to 20 residents	22	54.5	(26.3)
21 to 25 residents	30	40.8	(31.1)
More than 25 residents	27	46.3	(40.3)

	How Often Do You Feel That Unit Staffing Is Adequate (% of Time)?		
	n	Mean	(SD)
Facility Characteristic			
Ownership			
For-profit	56	62.1	(29.0)
Non-profit	57	41.2	(31.5)
Government	33	35.6	(27.3)
Number of Certified Beds			
<80 beds	29	52.6	(27.0)
80–120 beds	62	58.9	(29.4)
>120 beds	55	33.2	(30.8)
Percent Medicaid Residents			
<50%	41	52.4	(27.3)
50–64%	26	29.8	(23.5)
65–74%	37	52.7	(29.9)
75% or more	42	50.6	(37.6)
Overall Rating			
1 star	9	33.3	(25.0)
2 stars	24	59.4	(30.2)
3 stars	29	44.8	(40.3)
4 stars	3	83.3	(14.4)
5 stars	81	46.0	(28.1)
Staffing Rating			
1 star	1	0.0	NA
2 stars	19	56.6	(29.9)
3 stars	34	58.1	(29.3)
4 stars	48	40.1	(32.1)
5 stars	44	46.0	(30.9)
Health Inspection Rating			
1 star	5	25.0	(17.7)
2 stars	49	51.5	(36.2)
3 stars	22	67.0	(29.3)
4 stars	28	50.9	(28.4)
5 stars	42	34.5	(22.7)
Quality Measure Rating			
1 star	4	43.8	(31.5)
2 stars	16	62.5	(25.8)
3 stars	11	36.4	(30.3)
4 stars	63	42.1	(28.0)
5 stars	52	53.4	(35.7)

Source: Data collected from MISSCARE Survey

[1] Unit type is presented as a series of yes/no variables because a substantial number of respondents (30%) selected more than one unit type.

Exhibit C.12: Reported Adequacy of Staffing by Job Type and Number of Residents Assigned

Number of Residents Assigned on Most Recent Shift	How Often Do You Feel That Unit Staffing Is Adequate (% of Time)?									
	Staff Nurse (RN) [n=14]		Staff Nurse (LPN) [n=26]		Nursing Assistant [n=92]		Nurse Manager [n=11]		Other [n=8]	
	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean
Up to 10 residents	2	62.5	4	43.8	25	62.0	0	0	3	50.0
11 to 15 residents	2	62.5	1	25.0	29	37.9	1	75.0	1	75.0
16 to 20 residents	3	66.7	2	75.0	14	46.4	2	62.5	1	75.0
21 to 25 residents	2	37.5	7	53.6	19	31.6	1	100.0	1	75.0
More than 25 residents	5	25.0	11	34.1	2	50.0	7	67.9	2	87.5
Overall	***14***	***46.4***	***25***	***44.0***	***89***	***44.9***	***11***	***70.5***	***8***	***68.8***

Source: Data collected from MISSCARE Survey

Exhibit C.13: Overall Frequency of Missed Care for 18 Tasks

Task	How Frequently Missed										
	Never (0)		Rarely (1)		Occasionally (2)		Frequently (3)		Always (4)		Mean (0-4)
	n	%	n	%	n	%	n	%	n	%	
Ambulation/mobilization	27	18.2%	33	22.3%	31	20.9%	41	27.7%	16	10.8%	1.91
Pressure-relieving interventions	27	18.5%	38	26.0%	54	37.0%	17	11.6%	10	6.8%	1.62
Feeding residents while food at proper temperature	35	23.3%	36	24.0%	47	31.3%	21	14.0%	11	7.3%	1.58
Meal set-up	61	40.4%	50	33.1%	23	15.2%	6	4.0%	11	7.3%	1.05
Medications administered as scheduled	26	24.1%	43	39.8%	22	20.4%	12	11.1%	5	4.6%	1.32
Assessment of vital signs	48	34.5%	47	33.8%	21	15.1%	15	10.8%	8	5.8%	1.19
Monitoring intake/output	40	28.4%	51	36.2%	21	14.9%	21	14.9%	8	5.7%	1.33
Full documentation of care	36	23.1%	26	16.7%	41	26.3%	41	26.3%	12	7.7%	1.79
Bathing/showering	21	14.1%	34	22.8%	44	29.5%	36	24.2%	14	9.4%	1.92
Oral care	25	16.3%	34	22.2%	38	24.8%	39	25.5%	17	11.1%	1.93
Glucose monitoring	50	50.5%	40	40.4%	6	6.1%	0	0.0%	3	3.0%	0.65
IV/central line site care	32	42.7%	30	40.0%	10	13.3%	0	0.0%	3	4.0%	0.83
Response to call light w/in 5 minutes	20	12.9%	30	19.4%	39	25.2%	58	37.4%	8	5.2%	2.03
Act on PRN med request w/in 15 minutes	19	18.1%	42	40.0%	29	27.6%	9	8.6%	6	5.7%	1.44
Attend interdisciplinary care conferences	23	25.8%	22	24.7%	18	20.2%	16	18.0%	10	11.2%	1.64
Toilet assist w/in 5 minutes	21	13.7%	34	22.2%	44	28.8%	41	26.8%	13	8.5%	1.94
Skin/wound care	32	27.1%	48	40.7%	26	22.0%	7	5.9%	5	4.2%	1.19
Surveillance of cognitively impaired	29	20.3%	48	33.6%	37	25.9%	20	14.0%	9	6.3%	1.52
All tasks combined	***572***	***24.1%***	***686***	***28.8%***	***551***	***23.2%***	***400***	***16.8%***	***169***	***7.1%***	***1.54***

Source: Data collected from MISSCARE Survey

Exhibit C.14: Frequency of Missed Care by Job Title/Role

Task	Mean Frequency of Missed Care (n=151)[1]				
	Staff Nurse (RN)	Staff Nurse (LPN)	Nursing Assistant	Nurse Manager	Other
Ambulation/mobilization	2.13	1.93	1.86	1.92	1.83
Pressure-relieving interventions	1.67	1.41	1.67	1.85	1.33
Feeding residents while food at proper temperature	1.50	1.58	1.52	1.92	1.80
Meal set-up	0.79	0.82	1.13	1.00	1.44
Medications administered as scheduled	1.27	0.86	1.57	1.64	1.00
Assessment of vital signs	1.33	0.79	1.28	1.43	1.20
Monitoring intake/output	1.69	1.21	1.29	1.58	1.20
Full documentation of care	2.13	1.64	1.70	2.36	1.67
Bathing/showering	1.93	1.58	2.07	1.71	1.63
Oral care	2.27	2.00	1.89	1.85	1.57
Glucose monitoring	0.60	0.34	0.92	0.57	0.75
IV/central line site care	0.82	0.65	0.97	0.90	0.50
Response to call light w/in 5 minutes	2.20	1.90	1.99	2.29	2.13
Act on PRN med request w/in 15 minutes	1.40	1.21	1.47	1.86	1.50
Attend interdisciplinary care conferences	1.73	2.11	1.60	1.15	1.40
Toilet assist w/in 5 minutes	1.93	1.85	1.90	2.31	2.13
Skin/wound care	1.13	0.96	1.28	1.25	1.50
Surveillance of cognitively impaired	1.73	1.28	1.58	1.57	1.43
All tasks combined	***1.58***	***1.33***	***1.60***	***1.63***	***1.53***

Source: Data collected from MISSCARE Survey

[1] Responses coded 0-4 where 0 = Never,1 = Rarely, 2 = Occasionally, 3 = Frequently, and 4 = Always.

Exhibit C.15: Frequency of Missed Care by Usual Shift

Task	Mean Frequency of Missed Care (n=151)[1]			
	Time of Usual Shift			
	Days	Evenings	Nights	Rotates
Ambulation/mobilization	1.86	2.00	1.63	2.45
Pressure-relieving interventions	1.56	1.76	1.90	1.82
Feeding residents while food at proper temperature	1.43	1.67	2.20	2.54
Meal set-up	0.96	1.16	1.20	1.54
Medications administered as scheduled	1.26	1.80	0.50	2.00
Assessment of vital signs	1.09	1.71	0.86	1.64
Monitoring intake/output	1.23	1.74	1.00	1.90
Full documentation of care	1.68	1.94	1.78	2.73
Bathing/showering	1.75	2.56	2.14	2.45
Oral care	1.73	2.32	2.40	2.91
Glucose monitoring	0.62	0.60	0.33	1.50
IV/central line site care	0.79	0.50	2.00	1.67
Response to call light w/in 5 minutes	1.85	2.67	1.78	3.09
Act on PRN med request w/in 15 minutes	1.33	2.14	1.50	2.20
Attend interdisciplinary care conferences	1.49	2.67	2.00	2.60
Toilet assist w/in 5 minutes	1.78	2.33	1.90	3.00
Skin/wound care	1.07	1.50	1.63	1.78
Surveillance of cognitively impaired	1.30	2.07	2.22	2.45
All tasks combined	***1.41***	***1.93***	***1.68***	***2.29***

Source: Data collected from MISSCARE Survey
[1] Responses coded 0-4 where 0 = Never,1 = Rarely, 2 = Occasionally, 3 = Frequently, and 4 = Always.

Exhibit C.16: Frequency of Missed Care by Percentage of Time Staffing Is Adequate

Task	Mean Frequency of Missed Care (n=151)[1]				
	How Often Is Staffing Adequate				
	0% of the Time	25% of the Time	50% of the Time	75% Of the Time	100% of the Time
Ambulation/mobilization	2.11	2.42	1.73	1.30	1.53
Pressure-relieving interventions	2.12	1.87	1.38	1.16	1.58
Feeding residents while food at proper temperature	1.61	1.94	1.50	1.05	1.68
Meal set-up	0.89	1.43	0.68	0.73	1.20
Medications administered as scheduled	1.07	1.84	1.25	1.03	1.07
Assessment of vital signs	1.33	1.51	1.30	0.74	1.11
Monitoring intake/output	1.35	1.67	1.37	1.03	1.21
Full documentation of care	1.78	2.27	1.67	1.27	1.80
Bathing/showering	1.89	2.48	2.13	1.28	1.53
Oral care	2.18	2.45	2.20	1.30	1.47
Glucose monitoring	0.53	0.92	0.67	0.53	0.54
IV/central line site care	0.55	1.00	0.78	0.76	1.00
Response to call light w/in 5 minutes	1.50	2.69	2.13	1.55	1.75
Act on PRN med request w/in 15 minutes	1.20	1.93	1.40	1.16	1.40
Attend interdisciplinary care conferences	1.60	2.42	2.00	1.04	0.91
Toilet assist w/in 5 minutes	1.56	2.73	1.72	1.33	1.89
Skin/wound care	1.06	1.68	1.00	0.94	1.07
Surveillance of cognitively impaired	1.67	2.12	1.36	1.10	1.28
All tasks combined	***1.48***	***2.04***	***1.51***	***1.09***	***1.38***

Correlation of Overall Average of Missed Care and Percent of Time Staffing is Adequate
Source: Data collected from MISSCARE Survey
[1] Responses coded 0-4 where 0 = 0% of the time,1 = 25% of the time, 2 = 50% of the time, 3 = 75% of the time, and 4 = 100% of the time.

Exhibit C.17: Significance of 19 Reasons for Missed Care

Reason	Significance of Factor as Reason for Missed Care (n=151)								
	Not a Reason (0)		Minor Reason (1)		Moderate Reason (2)		Significant Reason (3)		*Mean (0-3)*
	n	%	n	%	n	%	n	%	
Inadequate staff	21	14.1%	18	12.1%	29	19.5%	81	54.4%	*2.14*
Urgent resident situations	32	21.2%	35	23.2%	53	35.1%	31	20.5%	*1.55*
Unexpected rise in acuity	25	17.2%	32	22.1%	47	32.4%	41	28.3%	*1.72*
Inadequate assistive personnel (NA, med tech)	25	16.3%	23	15.0%	31	20.3%	74	48.4%	*2.01*
Unbalanced resident assignments	42	28.0%	39	26.0%	39	26.0%	30	20.0%	*1.38*
Medications not available when needed	54	38.0%	37	26.1%	28	19.7%	23	16.2%	*1.14*
Inadequate hand-off previous shift/unit	46	30.1%	44	28.8%	34	22.2%	29	19.0%	*1.30*
Other departments did not provide needed care	56	36.8%	51	33.6%	29	19.1%	16	10.5%	*1.03*
Supplies/equipment not available when needed	36	24.2%	52	34.9%	40	26.8%	21	14.1%	*1.31*
Supplies/equipment not functioning	47	30.9%	46	30.3%	35	23.0%	24	15.8%	*1.24*
Lack of back-up support from team	34	22.2%	38	24.8%	42	27.5%	39	25.5%	*1.56*
Tension/communication w/ other staff/departments	36	23.4%	41	26.6%	40	26.0%	37	24.0%	*1.51*
Tension/communication w/in nursing or med staff	33	21.7%	38	25.0%	40	26.3%	41	27.0%	*1.59*
Inadequate support from nursing leadership	40	26.3%	38	25.0%	35	23.0%	39	25.7%	*1.48*
Heavy admission and discharge activity	49	33.3%	46	31.3%	37	25.2%	15	10.2%	*1.12*
Emotional or physical exhaustion	29	19.3%	24	16.0%	40	26.7%	57	38.0%	*1.83*
Inadequate supervision of NAs	39	25.7%	46	30.3%	40	26.3%	27	17.8%	*1.36*
Interruptions/multitasking	24	15.7%	28	18.3%	53	34.6%	48	31.4%	*1.82*
Lack of cues/reminders	54	35.3%	45	29.4%	31	20.3%	23	15.0%	*1.15*

Source: Data collected from MISSCARE Survey

[1] Responses coded 0-3 where 0 = Not a Reason, 1 = Minor Reason, 2 = Moderate Reason, and 3 = Significant Reason for Missed Care.

C.4 Institutional Review Board Approval Letter

Institutional Review Board Notice of Approval

Principal Investigator/Project Director: Alan White/Allison Muma

Project Title: Nursing Home Compare IV (NH Staffing Study)

Sponsor Agency: CMS

Abt IRB #: 2174

Determination: Exempt (with Limited IRB review) per 45CFR46.104(d)(2)(iii)

Protocol Approval Date: 9/2/2022

Review Type: Limited IRB Review

Please note the following requirements:

Problems or Adverse Reactions: If any problems in treatment of human subjects or unexpected adverse reactions occur as a result of this study, you must notify the IRB Chairperson or IRB Administrator immediately.

Changes in Study: This exemption only applies to the protocol submitted to the IRB for review at this time. Should there be changes to the protocol (including the data security plan) in the future, the study changes should be submitted to determine whether further IRB review is required.

Teresa Doksum, Ph.D., M.P.H.
IRB Chair **Date: 9/2/2022**
Abt Associates Inc.
10 Fawcett Street, Suite 5
Cambridge, MA 02138
irb@abtassoc.com
617-349-2896

Cc: Teresa Mota

C.5 Addendum – Final Site Visits

C.5.1 Introduction

Following completion in early November 2022 of an initial cohort of 31 site visits, the Staffing Study team recruited an additional 16 nursing homes for site visits through December 2022. This addendum summarizes the methods, analyses, and findings from the final 16 site visits, completed between November 3, 2022, and December 22, 2022.

C.5.2 Methods

The study team used a convenience sampling framework with a purposive selection of nursing homes from CMS regions that were not represented in the original 31 nursing homes. Additionally, researchers reached out to nursing homes with whom they had existing relationships, to accommodate the restricted study timeline.

The Staffing Study team utilized the same detailed site visit protocol used in the first 31 site visits (Appendix C.1), with semi-structured interview guides designed to collect data systematically while allowing interviewers sufficient autonomy to organize their inquiries around individual question responses and staffing issues identified by the interview respondents.

C.5.3 Analysis

The coding team used the NVivo 12 codebook previously developed for the initial round of site visits, as well as a subset of the initial coding team. To code the final site visit notes, the team used one senior-level and one junior-level researcher to code each nursing home's field notes template. Framework matrices were used to examine data across interview types as well as across nursing homes.

C.5.4 Results

This section begins with summary statistics describing the demographics of the final sample of 16 nursing homes and individual respondents, followed by summaries of qualitative findings by type and domain, including MISSCARE Survey findings.

Demographics of Participating Nursing Homes

Participating nursing homes were from nine different states, including CMS Region VI, which was not represented in the original 31 site visits. This second sample consisted of urban nursing homes, with either non-profit or for-profit ownership, and bed sizes ranging from small to large (**Exhibit C.18**). Nursing homes visited ranged broadly in use of agency staff; percentage of Medicaid residents; and Nursing Home Compare Five-Star Quality Rating System overall, staffing, and quality measure ratings.

Exhibit C.18: Demographics of Nursing Homes Participating in Site Visits

Nursing Home Characteristic	*n =16*
Urbanicity	
Urban	16
Rural	0
Bed Size	
Small (0–80 beds)	4
Medium (81–119 beds)	5
Large (120+ beds)	7
Ownership Type	
Non-Profit	9
Government	0
For-Profit	7

Nursing Home Characteristic	*n =16*		
Payer mix			
0–40% Medicaid	5		
>40–70% Medicaid	8		
>70% Medicaid	3		
Use of Agency Staff			
0%	4		
1–10%	6		
>10%	5		
Missing	1		
Five-Star Quality Ratings			
	Overall Quality Rating	*Staffing Rating*	*Quality Measure Rating*
1 star	2	1	0
2 stars	2	2	2
3 stars	4	3	5
4 stars	3	9	3
5 stars	5	1	6
High Social Deprivation Index[1]	2		
High Acuity[2]	2		

Source: Nursing Home Care Compare Provider Summary (which is derived from the PROVIDERINFO files available at www.data.cms.gov)
Notes: Includes 16 nursing homes visited November-December 2022 in the following states: CO, FL, IL, MA, ME, NY, PA, RI, TX.
[1] Number of nursing homes that are in communities with a high social deprivation index score.
[2] Number of nursing homes that have >10% of residents in the Extensive Services RUG-IV group.

Demographics of Individual Respondents

Exhibit C.19 shows demographics of the 122 individual respondents across all nursing homes participating in the final 16 site visits. Staff respondents typically worked the day or evening shift; they also had a broad range of experience within each nursing home, as well as experience in long-term care. Resident respondents included those who had been in facilities for a short period to many years. Only 2 of the 16 final sample of nursing homes completed MISSCARE Surveys, with a total of 27 individual surveys collected between both nursing homes.

Exhibit C.19: Demographics of Individual Respondents

Staff Characteristic	Leadership (n=41)	RN (n=13)	LPN (n=19)	Nurse Aide (n=27)
Years in facility (mean, minimum–maximum)	4.71 (0.25–27)	9.32 (0.5–31)	6.00 (0.25–17)	8.83 (0.25–40)
Years in long-term care (mean)	14.38	12.88	14.80	15.63
Typical Shift Worked	**RN**	**LPN**	**Nurse Aide**	
All	0	1	0	
Day	8	14	19	
Day and evening	3	1	4	
Evening	0	1	3	
Night	0	1	1	
Missing	2	1	0	
Family/Resident Characteristic (n=22)	**Mean**	**Minimum**	**Maximum**	
Length of time as a resident (in years)	3.06	0.25	9	

Staff Characteristic	Leadership (n=41)	RN (n=13)	LPN (n=19)	Nurse Aide (n=27)
Frequency of Visits by Family (N=22)				
Daily	1			
Weekly	2			
Missing	19			

Source: Data collected during participant interviews
Notes: Not all participants answered all interview questions; counts reflect the total number of responses rather than total number of interviews.

Qualitative Findings by Interview Type and Domain

Qualitative analysis of interview data from the second group of 16 site visits supported previous thematic saturation, with no new themes emerging from conversations with nursing home staff, families, or residents. This section provides further details of respondents' perspectives within each interview domain.

> *"It's extremely hard when you're short staffed. You could provide more care if you had less patients. You'll dedicate less time filling out documentation and more time to provide real care."*
> –Nurse

Impact of Resident Assignment on Care Delivery

Direct care respondents described how the number of residents assigned to them influences the type of care they can provide. Throughout interviews, respondents emphasized that they could currently provide a minimum level of care, but that their residents needed and deserved more.

> *"It's hard when we are short staffed or really busy, you don't have time to clip people's nails and do the stuff that takes a lot of time. If you have the time, there is always extra stuff you could do for people."*
> –Nurse aide

Nurse aides also reported being stretched too thin to be able to spend quality time with residents. Respondents noted that this impacts the staff and the residents alike; though staff want to provide the highest quality care possible, they are unable to due to the number of tasks they need to complete in a day.

> *"As a resident, I'm thinking, 'I do not want to bother this woman.' ... That could lead to a patient being dehydrated because now they're too reluctant to ask for water. From a physical standpoint, it causes longer delays. If I have to use the bathroom, I'm holding it in. ... That's not only affecting my mental, it's affecting my physical body. When you get UTIs, you start getting behaviors, too. Now the family is asking why mom has all these behaviors, and root cause analysis could point to being short that one day"*
> –Leadership

Depending on their role, between one-quarter and close to half of direct care staff reported that their assignments were reasonable to provide high-quality, safe care to residents. Like the respondents in the first sample of interviews, for those who responded that their assignment was not reasonable, the emphasis was on the difference between high-quality and safe care. Respondents described how they could provide a minimum level of safe care, but that the quality of life for residents is reduced.

Benefits of working fully staffed. Across all staff types, respondents in the final 16 site visits reported that quality of care provided is better when they are working a fully staffed shift, confirming what was heard in the first sample of interviews.

> *"You have to try everything in your knowledge to make the patient feel comfortable. They don't need to know you're short staffed. ... If you're tired, you take a break, go to the garden, and come back. You're not supposed to show that you're tired"*
> –Nurse aide

Frequency of short staffing. The majority of direct care respondents have experience working a shift that is short staffed either every week or multiple times a week (**Exhibit C.20**). The negative impact of working short staffed was noted across all interview types. Leadership respondents described how short staffing can lead residents to be reluctant to request help, leading to negative resident outcomes. Resident respondents

reported disappointment in a lack of communication amongst staff and increased wait time for care when staff are working short.

Exhibit C.20: "Over the Last Month, How Often Did You Work Short Staffed?"

	RN (n=12)	LPN (n=18)	Nurse Aide (n=22)
Every other week	8%	11%	18%
Every week	0%	17%	27%
Multiple times a week	58%	61%	36%
Other	33%	28%	18%

Source: Data collected during participant interviews
Notes: Not all participants answered all interview questions; counts reflect the total number of responses rather than total number of interviews.

Prioritizing, delaying, and missing care tasks. Respondents in the 16 final nursing homes described how they made decisions regarding prioritizing care tasks and confirmed that they triage care delivery to provide the most-needed care first, with their highest-acuity residents typically being tended to first.

> *"Look at the actual fundamentals of medicine (e.g., medication, wound care, etc.), and who needs more individual care versus when someone else can take care of themselves"*
> –Nurse aide

Other direct care staff talked about how when they need to prioritize tasks such as medications and wound care, the basic care tasks that impact quality of life, such as grooming, dressing, and straightening up resident rooms, often fall by the wayside.

> *"Safety, cleanliness, food, and meds are top priority. There's a difference between basic needs and the 'extra' stuff, like cleaning their faces with a face cloth."*
> –Nurse

Notably, analysis of the MISSCARE Survey responses showed no significant differences between the responses from nursing home staff in the initial sample compared to the final sample. In response to the question "How frequently are the following care tasks missed by direct care staff on your shift/unit?" respondents in the final nursing homes most commonly reported missed tasks included ambulation, pressure-relieving interventions, response to call lights, toileting assistance, and bathing (**Exhibit C.21**). The most significant reasons reported for missed care included inadequate assistive personnel and inadequate staff, urgent resident situations, unexpected rise in acuity, and interruptions or multitasking (**Exhibit C.22**).

Exhibit C.21: Frequency of Missed Care by Percentage of Time Staffing Is Adequate (n=27)

Task	Mean Frequency of Missed Care (0-4 Scale)[1]				
	How Often Staffing Is Adequate				
	0% of the Time	25% of the Time	50% of the Time	75% of the Time	100% of the Time
Ambulation/mobilization	2.75	0	2.50	1.57	0.67
Pressure-relieving interventions	2.33	0	1.50	1.88	1.33
Feeding residents while food at proper temperature	2.50	1.00	2.00	1.20	1.00
Meal set-up	1.00	0.00	1.00	0.90	0.67
Medications administered as scheduled	0	1.00	2.00	1.29	0.67
Assessment of vital signs	0.33	0.33	2.00	0.60	0.33
Monitoring intake/output	0.00	2.00	1.00	1.38	1.00
Full documentation of care	0.25	1.00	1.00	1.44	1.67
Bathing/showering	2.25	2.00	1.00	1.44	1.33
Oral care	2.00	0.50	1.00	0.89	1.67

Task	Mean Frequency of Missed Care (0-4 Scale)[1] How Often Staffing Is Adequate				
	0% of the Time	25% of the Time	50% of the Time	75% of the Time	100% of the Time
Glucose monitoring	0	2.00	0.00	0.50	0.33
IV/central line site care	0	0.00	0.00	0.83	0.33
Response to call light w/in 5 minutes	1.50	1.00	2.00	2.11	1.25
Act on PRN med request w/in 15 minutes	0	0.00	1.00	1.14	1.00
Attend interdisciplinary care conferences	0	4.00	1.00	1.29	0.50
Toilet assist w/in 5 minutes	2.50	0.75	1.50	1.78	1.67
Skin/wound care	0	1.00	1.00	1.25	0.50
Surveillance of cognitively impaired	2.50	2.00	0.50	1.50	1.33
All tasks combined	**1.67**	**1.03**	**1.28**	**1.29**	**0.98**

Source: Data Collected from MISSCARE Survey
[1] Responses coded 0-4 where 0 = 0% of the time, 1 = 25% of the time, 2= 50% of the time, 3 =75% of the time, and 4 = 100% of the time.

Exhibit C.22: Significance of Reasons for Missed Care

Reason	Significance of Factor as Reason for Missed Care (n=27)[1]								
	Not a Reason (0)		Minor Reason (1)		Moderate Reason (2)		Significant Reason (3)		Mean (0-3 scale)
	n	%	n	%	n	%	n	%	
Inadequate staff	4	18.2%	3	13.6%	9	40.9%	6	27.3%	1.77
Urgent resident situations	7	29.2%	3	12.5%	8	33.3%	6	25.0%	1.54
Unexpected rise in acuity	5	23.8%	4	19.0%	11	52.4%	1	4.8%	1.38
Inadequate assistive personnel (NA, med tech)	3	12.5%	4	16.7%	6	25.0%	11	45.8%	2.04
Unbalanced resident assignments	5	21.7%	13	56.5%	3	13.0%	2	8.7%	1.09
Medications not available when needed	14	60.9%	5	21.7%	3	13.0%	1	4.3%	0.61
Inadequate hand-off previous shift/unit	7	31.8%	8	36.4%	5	22.7%	2	9.1%	1.09
Other departments did not provide needed care	11	45.8%	7	29.2%	4	16.7%	2	8.3%	0.88
Supplies/equipment not available when needed	13	56.5%	8	34.8%	1	4.3%	1	4.3%	0.57
Supplies/equipment not functioning	17	70.8%	5	20.8%	1	4.2%	1	4.2%	0.42
Lack of back-up support from team	12	52.2%	8	34.8%	1	4.3%	2	8.7%	0.70
Tension/communication w/ other staff/departments	15	60.0%	8	32.0%	2	8.0%	0	0.0%	0.48
Tension/communication w/in nursing or med staff	15	65.2%	7	30.4%	1	4.3%	0	0.0%	0.39
Inadequate support from nursing leadership	17	70.8%	4	16.7%	2	8.3%	1	4.2%	0.46
Heavy admission and discharge activity	13	59.1%	3	13.6%	6	27.3%	0	0.0%	0.68
Emotional or physical exhaustion	10	41.7%	5	20.8%	5	20.8%	4	16.7%	1.13
Inadequate supervision of NAs	16	64.0%	3	12.0%	5	20.0%	1	4.0%	0.64
Interruptions/multitasking	7	28.0%	7	28.0%	9	36.0%	2	8.0%	1.24
Lack of cues/reminders	15	60.0%	7	28.0%	3	12.0%	0	0.0%	0.52

Source: Data collected from MISSCARE Survey
[1] Responses coded 0-3 where 0 = Not a Reason, 1 = Minor Reason, 2 = Moderate Reason, and 3 = Significant Reason for Missed Care.

Additional help during short staffing. The final sample of respondents described how they received additional help in different ways (e.g., dietary staff helping set up trays for nurse aides during mealtime, or administrative staff helping on care floors) when they were working a shift that was short staffed. Some direct care staff noted that when they are working a short-staffed shift, newer staff members who are not as familiar with the nursing home and the residents would have a harder time dealing with the extra tasks they are required to complete while working a short-staffed shift. One solution described to address high staff turnover in nursing homes that used contract or agency staff was placing agency staff in a facility for longer periods of time (e.g., 13 weeks). This was noted as more successful compared to shorter installments for agency staff because it gives the agency staff more time to get to know the building, the other staff, and the residents.

> *"I know my meds for my patients, I can pass them out easily and quickly, but if I was new, it would be extremely hard for me. If you were new, 26 or 27 would be too many residents"*
>
> –Nurse

> *"Sometimes I take my work home. Work/life balance becomes imbalanced. When you're on-call the staff call you for everything. Working with residents, you build relationships with them, and you care and worry about them when you leave."*
>
> –Nurse

Personal impact of working short staffed. All direct care respondents described how difficult providing high-quality care can be, and that when they are working short staffed, it takes a toll not only on their residents' care but also on their physical and mental health.

The physical toll of taking on additional tasks trying to help coworkers provide complete care to residents was also frequently reported. As one nurse noted, *"It taxes me physically – I have to do extra work, more lifting, transferring. I stay late after sundown, and I get irritated/nervous."*

Direct care respondents described how the impact of working a short-staffed shift can make them feel rushed through the care they provide, while also trying to provide continuity in care. As one nurse said, *"I feel rushed most of the time. The other shift is waiting to give report so this increases stress because I'm trying to finish up from my shift and go home."*

Challenges to Adequate Staffing

Throughout interviews, leadership and direct care respondents alike noted the many challenges to maintaining adequate staffing levels throughout their nursing homes. Overwhelmingly, respondents raised pay and staff competency issues. Mirroring respondents from the first sample of nursing homes, workforce competition, low wages, burnout, and difficult working conditions were cited as the biggest staffing challenges. As one leadership staff commented, *"You can have an abundance of staff, but if they do a poor job, it doesn't really help."*

> *"4.1 [HPRD] is too high for the current labor pool. The government focus needs to be on building the workforce and incentivizing people to become nurses, rather than implementing an unattainable minimum that is going to penalize good facilities."*
>
> –Leadership

> *"If you don't offer money, you can't have quality staff. You only get quality staff when you offer better pay."*
>
> –Leadership

Suggestions for a Minimum Staffing Requirement

Respondents in the final sample supported a minimum staffing requirement, but many expressed concerns about their ability to meet a requirement. Issues such as a depleted labor pool and incentivizing working in the nursing home industry came up in interviews, as well as the shift in resident population to a much higher level of resident acuity. As one leadership staff member noted, though a staffing minimum could be beneficial to their residents, they expressed it would be impossible to meet and for federal and state agencies to enforce, "*There are not enough healthcare workers, and we all know that.*"

Factors to consider when developing a minimum staffing requirement. Respondents from both sets of site visits named similar factors that should be considered when developing a minimum staffing requirement. This included resident acuity and the workforce labor pool, as well as considerations of different requirements for nurse aides and licensed nurses.

Unintended consequences of a staffing requirement. Nursing home staff respondents in the final sample of nursing homes also expressed concerns regarding the potential unintended consequences of implementing a minimum staffing requirement. Some leadership respondents reported concerns that some nursing homes will not be able to stay in business with a staffing minimum requirement. Other respondents expressed concerns that some nursing homes will reduce their staffing levels to the new minimum, which would negatively impact the care that nursing home residents receive. As one leadership staff member said, *"Companies are always going to staff to the minimum; nothing more, nothing less."*

Family interviews. The final sample of 16 nursing homes had proportionally fewer family respondents than the initial sample of 31, but family members who did participate empathized with staff frequently working short staffed. Similar to the first group of family respondents, family in the last 16 visits acknowledged that the nursing home their resident resides in experiences staffing limitations, but also described wishing there were more staff for the sake of the direct care staff themselves, rather than for the sake of more care for residents.

> *"Nursing homes would not meet the minimum and go out of business if it's too high, which would leave residents homeless."*
> –Leadership

C.5.5 Conclusion

These final 16 nursing home site visit interviews provide an important validation of the previous thematic saturation across all domains. These additional site visits enabled all CMS regions to be reflected in the analysis; and they allowed more nursing home staff, residents, and family members to share their experience. Collectively, across all 47 site visits, researchers interviewed almost 500 nursing home leaders, direct care staff, residents, and their families. These respondents provided insight into challenges that nursing homes currently face in providing safe, high-quality care to residents that could potentially be mitigated by a minimum staffing requirement. They also identified potential barriers to implementing a federal requirement.

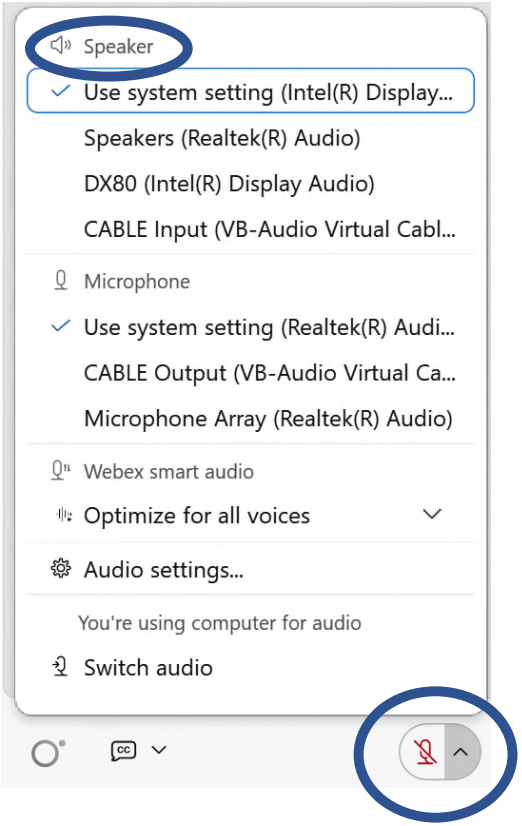
Appendix D. Public Stakeholder Listening Session

Appendix D includes the presentation slides from the August 29, 2022, listening session, open via registration to the general public, to obtain feedback on addressing disparities, making minimum staffing requirement information available, and cost and other considerations for establishing a minimum requirement.

Nursing Home Staffing Study Stakeholder Listening Session

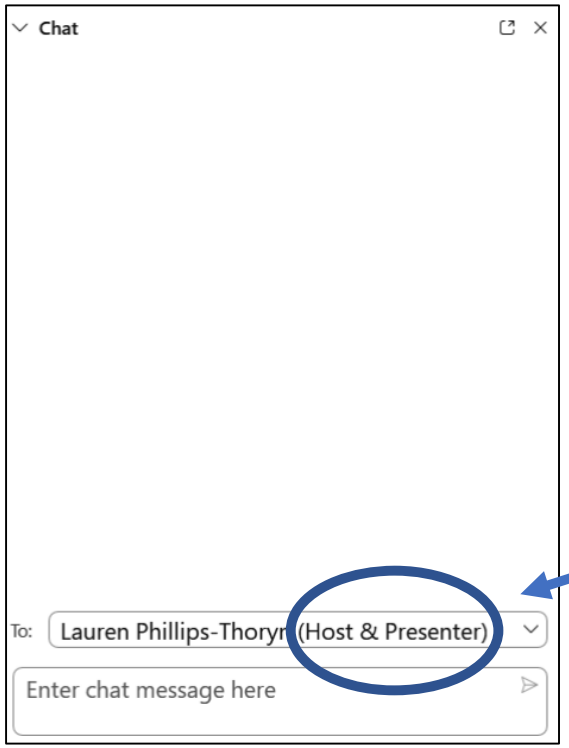
August 29, 2022
1:00 – 2:30 PM EST

Webex Platform Tips



- If you are experiencing issues with event audio, press the small arrow beside your muted microphone icon.
- Select your correct speaker output. For example, if you are using a headset, make sure that the headset is checked under **Speaker** options.
- *As a reminder, all attendees are muted automatically during this event.*

Webex Platform Tips



If you are experiencing technical difficulties, send a chat to the event Host. Someone will respond to you directly with support.

Opening Remarks

Dr. Lee Fleisher
Chief Medical Officer
Director, Center for Clinical Standards & Quality,
Centers for Medicare & Medicaid Services

CMS Nursing Home Staffing Study

Dr. Alan White
Principle Associate
Abt Associates

Agenda

- Overview of the CMS Nursing Home Staffing Study
- Stakeholder feedback on questions about minimum staffing requirements

CMS Nursing Home Staffing Study - Background

Largely a consensus that staffing levels have an impact on quality of care and patient safety.

- Many studies have found a relationship between higher staffing and improved quality.
- Little research has focused on identifying specific staffing levels below which residents are at substantially increased risk of quality problems.

CMS Nursing Home Staffing Study - Overview

As part of the White House initiative to improve the safety and quality of nursing home care, CMS will establish minimum staffing requirements for Medicare and Medicaid certified nursing homes using a multi faceted approach, which includes this staffing study.

Study - Overview

The purpose of this study, which launched in August 2022, is to identify a minimum staffing level, which would include RN, LPNs/LVNs, and CNAs, that will establish a threshold below which residents would be at substantially increased risk of not receiving the safe and quality care they deserve. Importantly, this study is on an accelerated timeline and seeks to build on, not replace, previous studies.[1]

[1]Appropriateness of Minimum Nurse Staffing Ratios in Nursing Homes, 2001: https://www.justice.gov/sites/default/files/elderjustice/legacy/2015/07/12/Appropriateness_of_Minimum_Nurse_Staffing_Ratios_in_Nursing_Homes.pdf; and the 2005 Staff Time and Resource Intensity Verification (STRIVE) Project: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/SNFPPS/TimeStudy

Study Tasks

The main study tasks include:

- Literature review
- Site visits and related analyses
- Quantitative analyses
- Cost analyses
- Stakeholder engagement

Literature Review

A review of the existing literature to:

- Summarize the evidence on the relationship between minimum nurse staffing in nursing homes and the safety and quality of resident care
- Clarify the relative strengths and weaknesses of the available literature

Site Visits and Related Analyses

Site visits will be conducted to 75 nursing homes

- Initial visits to 50 nursing homes will provide important information to guide the development of the proposed minimum staffing levels
- Visits to the remaining 25 facilities will help validate the initial findings as part of CMS's iterative policy process.

Site Visits and Related Analyses

Nursing home selection was conducted to ensure national representation, and a cross-section of size, ownership type, geographic location, Medicaid population, and Five-Star Quality Ratings for staffing and overall ratings.

Nursing homes were selected in 15 states:

California	Illinois	Missouri	Ohio	Virginia
Colorado	Massachusetts	North Carolina	Pennsylvania	Washington
Florida	Maryland	New York	Texas	Wyoming

Site Visits and Related Analyses

- Onsite interviews and surveys will provide qualitative, contextual information to inform the establishment of minimum staffing requirements

- Time data collection via direct observation of nursing home staff will enable the development of a simulation model that will provide quantitative information to inform the establishment of minimum staffing requirements

Quantitative Analyses

- Analyses will use data from Medicare Payroll-based Journal (PBJ), Minimum Data Set (MDS), Medicare claims, and the Five-Star Quality Rating System to identify staffing levels associated with improved quality of care and resident safety in nursing homes.

- Includes descriptive analyses of staffing levels, examining trends in nursing home staffing from 2018-2021, as well as identifying specific factors related to staffing levels.

Quantitative Analyses

- Analyses are being conducted at the nursing home level, using all nursing homes with valid data.

- Analysis control for resident acuity, case-mix, and selected facility characteristics.

Cost Analyses

- In considering any staffing requirement, it is important to understand associated, incremental costs that nursing homes would likely face when a minimum staffing requirement is implemented.

- Using the information described above, CMS will conduct cost analyses to estimate the cost to nursing homes that would be associated with meeting the new staffing requirement, such as increases in staffing levels or changes in the mix of staffing.

Listening Session Objectives

The objective of today's listening session is to receive stakeholder feedback on the previous (5) questions.

- Feedback should be specific to those questions.
- Limit feedback to 3 minutes total to allow others time to speak.
- Pre-registered stakeholders will be called first. **Names will be listed in the chat panel by groups of five, in their speaking order.** Time permitting, remaining stakeholders may raise hands to provide additional feedback.
- Members of the press are welcome on today's call; however, all press/media questions should be submitted using the CMS Media Inquiries Form, which may be found at **cms.gov/newsroom/media-inquiries**.

Questions for Listening Session

Question 1

How do we ensure that issues of health equity/health care disparities are addressed when establishing minimum nurse staffing levels?

Questions for Listening Session

Question 2

How do we ensure that both healthcare staff and residents are aware of their nursing home staffing levels and whether or not they're in compliance with minimum staffing requirements?

For example, if a CNA is assigned to a unit/shift and wants to confirm that their assignment meets minimum requirements (i.e., they aren't assigned too many residents), how can they verify that?

Questions for Listening Session

Question 3

Should minimum staffing requirements be displayed in nursing homes in consumer-friendly ways and be accessible for both visitors and staff?

Questions for Listening Session

Question 4

When examining the regulatory/economic impacts related to establishing minimum staffing requirements, CMS recognizes that RN/LPN/CNA salaries vary by state. How should minimum staffing requirements consider differences in costs for job categories and variations across states?

Questions for Listening Session

Question 5

What else should CMS consider as part of the staffing study?

and

What else should CMS consider in establishing minimum staffing requirements that has not been discussed?

Questions for Listening Session

Question 1 -How do we ensure that issues of health equity/health care disparities are addressed when establishing minimum nurse staffing levels?

Question 2 -How do we ensure that both healthcare staff and residents are aware of their nursing home staffing levels and whether or not they're in compliance with minimum staffing requirements?

Question 3 -Should minimum staffing requirements be displayed in nursing homes in consumer-friendly ways and be accessible for both visitors and staff?

Question 4 - When examining the regulatory/economic impacts related to establishing minimum staffing requirements, CMS recognizes that RN/LPN/CNA salaries vary by state. How should minimum staffing requirements consider differences in costs for job categories and variations across states?

Question 5 - What else should CMS consider as part of the staffing study? And what else should CMS consider in establishing minimum staffing requirements that has not been discussed?

Closing Remarks

Adam Richards
Center for Clinical Standards & Quality,
Centers for Medicare & Medicaid Services

Appendix E. Relationship of Staffing with Quality and Safety Supplemental Materials

List of Exhibits

E.1 Detailed Methods for Analyses of Relationship of Staffing With Quality and Safety

This appendix provides additional details on methods used to construct staffing, quality, and resident safety measures for multivariate regression analyses of the relationship of staffing with quality and safety as reported in Section 4.1 of the Staffing Study report.

E.1.1 Staffing Measures

Measures of staffing deciles are used as the key predictors in multivariate regression models. The primary source of staffing measures is the Centers for Medicare & Medicaid Services (CMS) Payroll Based Journal (PBJ) system. PBJ data are submitted quarterly by each Medicare- and/or Medicaid-certified nursing home and are due 45 days after the end of each reporting period. The PBJ system is the best available source of nursing home staffing data because it is based on payroll and other verifiable and auditable data that are collected in a uniform format according to established specifications (Centers for Medicare and Medicaid Services [CMS], 2022b). This section describes construction of staffing measures in hours per resident day (HPRD) from the PBJ data.

Job Codes Used to Create Staffing Measures

The specific PBJ system job codes that are used for registered nurses (RNs), licensed practical nurses/licensed vocational nurses (LPNs), and nurse aide hours are (Centers for Medicare and Medicaid Services [CMS], 2022b):

- ***RN hours:*** RN director of nursing (job code 5), RNs with administrative duties (job code 6), and RNs (job code 7).
- ***LPN hours:*** LPNs with administrative duties (job code 8) and LPNs (job code 9).
- ***Nurse aide hours:*** Certified nurse aides (job code 10), nurse aides in training (job code 11), and medication aides/technicians (job code 12).

The PBJ staffing data include both nursing home employees (full-time and part-time) and individuals under an organization (agency) contract or an individual contract. The PBJ staffing data do not include "private duty" nurse staff reimbursed by residents or their families.

Daily Resident Census

The daily resident census, used in the denominator of the reported nurse staffing ratios, is calculated by CMS and received by Abt as part of quarterly PBJ processing for Nursing Home Care Compare. It is derived from Minimum Data Set (MDS) resident assessments and is calculated as follows:

- Identify the reporting period (quarter [Q]) for which the census is calculated (e.g., Census Year [CY] 2022Q2: April 1–June 30, 2022).
- Extract MDS assessment data for all residents of a nursing home beginning one year prior to the reporting period, to identify all residents who might reside in the nursing home (i.e., any resident with an MDS assessment might still reside in the nursing home). For example, for the CY 2022Q2 reporting period, extract MDS data from April 1, 2021, through June 30, 2022.
- Identify discharged/deceased residents using the following criteria:
  - If a resident has an MDS Discharge assessment or Death in Facility tracking record, use the date reported on that assessment and assume that the resident no longer resides in the nursing home as of the date of discharge/death on the last assessment. In the case of discharges, if there is a

subsequent admission assessment, then assume that the resident re-entered the nursing home on the entry date indicated on the entry assessment.

  - For any resident with an interval of 150 days or more with no assessments, assume the resident no longer resides in the nursing home as of the 150th day from the last assessment. (This assumption is based on the requirement for nursing homes to complete MDS assessments on all residents at least quarterly). If no assessment is present, assume that the resident was discharged but the nursing home did not transmit a Discharge assessment.

- For any particular date, residents whose assessments do not meet these criteria prior to that date are assumed to reside in the nursing home. The count of these residents is the census for that particular day.

MDS assessments for a given resident are linked using the Resident Internal ID. This is a unique number, assigned by the Quality Improvement Evaluation System Assessment Submission and Processing system, that identifies a resident. The combination of state and Resident Internal ID uniquely identifies a resident in the national repository.

Calculating Hours per Resident ID

The nurse staffing hours reported through PBJ and the daily MDS census are both aggregated (summed) across the quarterly reporting period. The quarterly reported nurse staffing HPRD are then calculated by dividing the aggregate reported hours by the aggregate resident census. Only days that have at least one resident are included in the calculations.

Exclusion Criteria

The Staffing Study team next used the exclusion criteria used in calculations of CMS Nursing Home Care Compare staffing ratings to identify nursing homes with highly improbable PBJ staffing data (Centers for Medicare and Medicaid Services [CMS], 2022a).

- Total nurse staffing (job codes 5–12), aggregated over all days in the quarter with at least one resident, is zero (0 HPRD).
- Total nurse staffing (job codes 5–12), aggregated over all weekend days in the quarter with at least one resident, is zero (0 HPRD).
- Total nurse staffing (job codes 5–12), aggregated over all days in the quarter with at least one resident, is excessively high (>12 HPRD).
- Total nurse staffing (job codes 5–12), aggregated over all weekend days in the quarter with at least one resident, is excessively high (>12 HPRD).
- Nurse aide staffing (job codes 10–12), aggregated over all days in the quarter with at least one resident, is excessively high (>5.25 HPRD).
- Nurse aide staffing (job codes 10–12), aggregated over all weekend days in the quarter with at least one resident, is excessively high (>5.25 HPRD).

Nursing homes with improbable staffing data according to these criteria are excluded from analyses in this report.

Acuity Adjustment

For most analyses, the Staffing Study team used acuity-adjusted staffing measures, calculated using the same adjustment method that is used for Nursing Home Care Compare. Reported staffing levels are

adjusted for acuity using the Resource Utilization Groups-Version 4 (RUG-IV) case-mix system.[1] In particular, the team calculated case-mix adjusted HPRD for each nursing home for each staff type using this formula:

*Case-Mix Adjusted Hours = (Reported Hours/Hours Case-Mix) * National Average Hours*

The *reported hours* are those reported by the nursing home through PBJ as described above. *National average hours* for a given staff type represent the national mean of case-mix hours across all nursing homes active on the last day of the quarter that submitted valid nurse staffing data for the quarter.

The case-mix values for each nursing home are based on the daily distribution of residents by RUG-IV group in the quarter covered by the PBJ-reported staffing and estimates of daily RN, LPN, and nurse aide hours from the CMS Staff Time and Resource Intensity Verification (STRIVE) Study (2011).[2] The STRIVE Study measured the average number of RN, LPN, and nurse aide HPRD associated with each RUG-IV group (using the 66-group version of RUG-IV). A more detailed description of the methodology used to calculate the daily distribution of residents by RUG-IV group is available in the Nursing Home Five-Star Quality Rating System Technical Users Guide (Centers for Medicare and Medicaid Services [CMS], 2022a).

E.1.2 Quality and Resident Safety Measures

Dependent variables in Staffing Study multivariate regression analyses are quality threshold measures based on a composite total quality measure (QM) score incorporating individual QMs from the CMS Five-Star Quality Rating System, and resident safety threshold measures based on weighted health inspection scores. This section provides additional details on quality and safety measure construction.

Quality Measures

Individual QMs based on MDS and Medicare claims data address a broad range of function and health status indicators and were used to develop a composite total QM score. Binary measures based on 25th and 50th percentile total QM score thresholds served as the main quality threshold measures in multivariate logistic regression analyses. The remainder of this section describes development of the composite total QM score.

QMs are selected for use in the Five-Star Quality Rating System based on their validity and reliability, the extent to which nursing home practice can affect the measures, statistical performance, and the importance of the measures. For construction of the total QM score, the Staffing Study team excluded several QMs used in Five-Star that have a low prevalence (<5 percent) and a lower weight in the Five-Star Quality Rating System QM methodology.[3]

Measures used in the composite total QM score include:

Short-stay measures

- Community discharge (QM005)

---

1 CMS used a RUG-based system (first RUG-III and then RUG-IV) for Medicare Skilled Nursing Facility payment from 1998 to 2019.

2 See https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/SNFPPS/TimeStudy for details on the STRIVE study, including the Phase I and II final reports.

3 The QMs used in the Five-Star Quality Rating System but excluded from present analyses are short-stay pressure ulcer, catheter, urinary tract infection, falls with major injury, and short-stay antipsychotic medication use.

- Hospital readmissions (QM521)
- Emergency department visits (QM522)
- Functional improvement (QM471)

Long-stay measures

- Activities of daily living (ADL) decline (QM401)
- Antipsychotic medication use (QM419)
- Mobility decline (QM451)
- High-risk pressure ulcer (QM453)
- Hospitalizations (QM551)
- Emergency department visits (QM552)

For both the long- and short-stay QMs, MDS-based measures are reported if the measure can be calculated for at least 20 residents' assessments (summed across four quarters of data to enhance measurement stability). The short-stay claims-based measures are reported if the measure can be calculated for at least 20 residents over the course of the year. The long-stay claims-based measures are reported if the measure can be calculated for at least 20 nursing home stays over the course of the year.

Exhibit E.1 contains more-detailed information on these measures, including details on whether the measure is created from the MDS or Medicare claims. Technical specifications for all of the measures are available in the downloads section at https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/nursinghomequalityinits/nhqiqualitymeasures.html.

Exhibit E.1: Quality Measures Used in Analyses

Measure	Comments
MDS Long-Stay Measures	
Percentage of residents whose ability to move independently worsened	This is a change measure that reports the percentage of long-stay residents who have demonstrated a decline in independence of locomotion when the target assessment is compared to a prior assessment. Residents who lose mobility can also lose the ability to perform other ADLs, such as eating, dressing, or getting to the bathroom.
Percentage of residents whose need for help with daily activities increased	This measure reports the percentage of long-stay residents whose need for help with late-loss ADLs has increased compared to a prior assessment. This is a change measure that reflects worsening performance on at least two late-loss ADLs by one functional level or on one late-loss ADL by more than one functional level compared to in the prior assessment. The late-loss ADLs are bed mobility, transfer, eating, and toileting. Maintenance of ADLs is related to an environment in which the resident is up and out of bed and engaged in activities. The CMS Staffing Study found that higher staffing levels were associated with lower rates of increasing ADL dependence.
Percentage of high-risk residents with pressure ulcers	This measure reports the percentage of long-stay, high-risk residents with Stage II-IV or unstageable pressure ulcers. Residents at high risk for pressure ulcers are those who are impaired in bed mobility or transfer, who are comatose, or who suffer from malnutrition.
Percentage of residents who got an antipsychotic medication	This measure reports the percentage of long-stay residents who are receiving antipsychotic drugs in the target period. Reducing the rate of antipsychotic medication use has been the focus of several CMS initiatives.

Measure	Comments
Claims-Based Long-Stay Measures	
Number of hospitalizations per 1,000 resident days	This measure reports the number of unplanned inpatient admissions or outpatient observation stays that occurred among long-stay residents of a nursing home during a one-year period, expressed as the number of unplanned hospitalizations for every 1,000 days that the long-stay residents were admitted to the nursing home.
Number of outpatient emergency department visits per 1,000 resident days	This measure reports the number of outpatient emergency department visits that occurred among long-stay residents of a nursing home during a one-year period, expressed as the number of outpatient emergency department visits for every 1,000 days that the long-stay residents were admitted to the nursing home.
MDS Short-Stay Measures	
Percentage of residents who improved in their ability to move around on their own	This measure reports the percentage of short-stay residents whose independence in three mobility functions (i.e., transfer, locomotion, and walking) increases over the course of the nursing home care episode.
Claims-Based Short-Stay Measures	
Percentage of short-stay residents who were re-hospitalized after a nursing home admission	This measure reports the percentage of all new admissions or readmissions to a nursing home from a hospital where the resident was readmitted to a hospital for an inpatient or observation stay within 30 days of entry or reentry.
Percentage of short-stay residents who have had an outpatient emergency department visit	This measure reports the percentage of all new admissions or readmissions to a nursing home from a hospital where the resident had an outpatient emergency department visit (i.e., an emergency department visit not resulting in an inpatient hospital admission) within 30 days of entry or reentry.
Rate of successful return to home or community from a nursing home	This measure reports the rate at which residents returned to home or community with no unplanned hospitalizations and no deaths in the 31 days following discharge from the nursing home.

The Staffing Study team then calculated a composite measure of nursing home performance based on these individual QMs. For these calculations, the team used the methodology used in the Five-Star Quality Rating System. Two different sets of weights are used in assigning QM points to individual QMs. All but one of the individual QMs included in analyses have a maximum score of 150 points; the maximum number of points for the high-risk residents with pressure ulcers measure is 100.[4]

The weight for each QM was determined based on the opportunity for nursing homes to improve on the measure and the clinical significance of the measure based on feedback from the Five-Star Quality Rating System's Technical Expert Panel. For measures that have a maximum score of 150 points, the points are determined based on deciles. Quintiles are used for measures that have a maximum score of 100 points. For all measures, points are calculated based on performance relative to the national distribution of the measure. Points were assigned after any needed imputation of individual QM values, with the points determined using this methodology:

- For long-stay ADL worsening, long-stay antipsychotic medication, long-stay mobility decline, the two claims-based long-stay measures, the percentage of short-stay residents who improved in their ability to move around on their own, and the three claims-based short-stay measures, nursing homes are grouped into deciles based on the national distribution of the QM. Nursing homes in the lowest-

[4] For most of the MDS-derived QMs, the cut-points are based on the QM distributions averaged across the four quarters from Quarter 4 of 2017 to Quarter 3 of 2018. For short-stay pressure ulcers/pressure injuries, the cut-points are based on the national distribution of the measure calculated for the period of Quarter 1 of 2019 through Quarter 4 of 2019. For the rate of successful return to home and community from a nursing home measure, the cut-points are based on the national distribution of the measure calculated for the period of Quarter 4 of 2016 through Quarter 3 of 2017.

performing decile receive 15 points for the measure. Points are increased in 15-point intervals for each decile so that nursing homes in the highest-performing decile receive 150 points.

- For the long-stay high-risk pressure ulcer measure, nursing homes are grouped into quintiles based on the national distribution of the QM. The quintiles are assigned 20 points for the lowest-performing quintile, 100 points for the highest-performing quintile, and 40, 60, or 80 points for the second, third, and fourth quintiles, respectively.

Individual short-stay QMs were summed to create a composite short-stay QM score, and individual long-stay QMs were summed to create a composite long-stay QM score. The short-stay and long-stay composite scores are then equally weighted to produce the total QM score. QM score cutoffs at 25th and 50th percentile thresholds are then used to create binary measures for use in logistic regression analyses.

Resident Safety Measures

The Staffing Study resident safety measure is based on findings from on-site health inspection surveys. Nursing homes that participate in the Medicare and/or Medicaid programs have these on-site inspection surveys annually on average, with very rarely more than 15 months elapsing between inspections. The inspections are unannounced and are conducted by a team of health care professionals who spend several days in the nursing home to assess whether the nursing home is in compliance with federal requirements. They provide a comprehensive assessment of the nursing home, reviewing nursing home practice and policies in such areas as resident rights, quality of life, medication management, skin care, resident assessment, nursing home administration, environment, and kitchen/food services (CMS, 2022a).

Health inspections are based on federal regulations, which inspectors implement using national interpretive guidance and a federally specified survey process. Despite federal oversight designed to improve consistency in the survey process, there remains variation among states in both the inspection process and outcomes. Such variation derives from many factors, including survey management (e.g., variation among states in the skill sets of inspectors, supervision of inspectors, and the inspection processes), state licensing laws, and state Medicaid policies (e.g., nursing home eligibility rules, payment, and other policies in the state-administered Medicaid program) (CMS, 2022a). As described in greater detail below, the Staffing Study resident safety measures are therefore based on the relative health inspection performance of nursing homes within a state. This approach helps control for variation among states.

For the CMS Five-Star Quality Rating System, a health inspection score is calculated based on points assigned to deficiencies identified in each active provider's three most recent re-certification health inspections, as well as on deficiency findings from the most recent three years of complaint inspections, findings from focused infection control surveys, and any revisits (beyond the first revisit, which is not counted) needed to verify that required corrections have brought the nursing home back into compliance.

Points are assigned to individual health deficiencies according to their scope and severity—more-serious, widespread deficiencies receive more points, with additional points assigned for substandard quality of care (**Exhibit E.2**). If the status of the deficiency is "past noncompliance" and the severity is "immediate jeopardy" (i.e., J-, K-, or L-level), then points associated with a G-level deficiency are assigned.[5] Additionally, other health citations with a deficiency status code indicating that a waiver has been granted are not included in the health inspection score.

---

[5] Two types of health citations—F731 (Waiver of requirement to provide licensed nurses on a 24-hour basis) and F884 (COVID-19 reporting to the Centers for Disease Control and Prevention)—are not considered in the health inspection score calculation (nor are these reported on Nursing Home Care Compare).

Exhibit E.2: Health Inspection Score: Weights for Different Types of Deficiencies

Severity	Scope		
	Isolated	Pattern	Widespread
Immediate jeopardy to resident health or safety	**J** 50 points* (75 points)	**K** 100 points* (125 points)	**L** 150 points* (175 points)
Actual harm that is not immediate jeopardy	**G** 20 points	**H** 35 points (40 points)	**I** 45 points (50 points)
No actual harm with potential for more than minimal harm that is not immediate jeopardy	**D** 4 points	**E** 8 points	**F** 16 points (20 points)
No actual harm with potential for minimal harm	**A** 0 points	**B** 0 points	**C** 0 points

Note: Figures in parentheses indicate points for deficiencies that are for substandard quality of care.
Shaded cells denote deficiency scope/severity levels that constitute substandard quality of care. See the Electronic Code of Federal Regulations (https://www.ecfr.gov/cgi-bin/text-idx?SID=9c4d022241818fef427dc79565aba4b5&mc=true&node=pt42.5.488&rgn=div5#se42.5.488_1301) for a definition of substandard quality of care.
* If the status of the deficiency is "past noncompliance" and the severity is "immediate jeopardy," then points associated with a G-level deficiency (i.e., 20 points) are assigned.

The health inspection score also considers the number of repeat visits required to confirm that correction of deficiencies has restored compliance. No points are assigned for the first revisit; points are assigned only for the second, third, and fourth revisits and are proportional to the health inspection score for the survey cycle (**Exhibit E.3**). If a provider has failed to correct deficiencies by the time of the first revisit and then has to be revisited again, then these additional (second, third, etc.) revisit points are assigned, up to 85 percent of the health inspection score for the fourth revisit. CMS's experience is that providers that fail to demonstrate restored compliance with safety and quality of care requirements during the first revisit have lower quality of care than other nursing homes. More revisits are associated with more-serious quality problems.

Exhibit E.3: Weights for Repeat Revisits

Revisit Number	Noncompliance Points
First	0
Second	50% of health inspection score
Third	70% of health inspection score
Fourth	85% of health inspection score

Note: The health inspection score includes points from deficiencies cited on the standard health inspection and complaint inspections during a given survey cycle.

A total weighted health inspection score is calculated for each nursing home (including any repeat revisits). Note that a lower survey score corresponds to fewer deficiencies and revisits, and thus better performance on the health inspection domain. In calculating the total weighted score, more-recent surveys are weighted more heavily than earlier surveys, with the most recent period (rating cycle 1) being assigned a weighting factor of 1/2, the previous period (rating cycle 2) having a weighting factor of 1/3, and the second prior period (rating cycle 3) having a weighting factor of 1/6. The individual weighted scores for each cycle are then summed (after including complaint surveys, focused infection control surveys, and revisit points) to create the total weighted health inspection score for each nursing home.

For nursing homes missing data for one period, the health inspection score is determined based on the periods for which data are available, using the same relative weights, with the missing (third) survey weight distributed proportionately to the existing two inspections using two survey cycles. Specifically, when there are only two re-certification inspections, the most recent survey cycle receives 60 percent weight and the prior cycle receives 40 percent weight. Nursing homes with only one standard health inspection are considered to have insufficient data to determine a health inspection rating, and they do not have a health inspection score or rating.

The measure of within-state performance on health inspection surveys used in analyses is based on the percentile of the nursing home's health inspection score relative to other nursing homes in the same state. The use of within-state measures is consistent with CMS's Five-Star Quality Rating System, which is based on relative performance within a state. Binary measures indicating whether the score was above the 25^{th} and 50^{th} percentiles, respectively, were the dependent variable in logistic regression models investigating the relationship between staffing levels and safety.

E.2 Supplemental Tables from Staffing-Quality Analyses

Exhibit E.4: Average 2022Q1 Nurse Staffing Levels, by State

State	Number of Nursing Homes	Total	RN	LPN	Nurse Aide
All	**15,147**	**3.76**	**0.67**	**0.88**	**2.22**
Alabama	225	3.73	0.57	0.88	2.28
Alaska	20	7.25	2.16	0.77	4.31
Arizona	143	4.07	0.73	1.10	2.24
Arkansas	218	3.85	0.37	1.01	2.47
California	1,176	4.33	0.60	1.21	2.52
Colorado	219	3.71	0.87	0.69	2.15
Connecticut	207	3.61	0.73	0.79	2.09
D.C.	17	4.73	1.72	0.63	2.38
Delaware	45	4.33	1.07	0.95	2.32
Florida	697	4.00	0.69	0.85	2.46
Georgia	360	3.35	0.44	1.04	1.87
Guam	1	10.28	4.03	1.56	4.68
Hawaii	42	4.77	1.65	0.32	2.80
Idaho	80	4.14	0.87	0.85	2.42
Illinois	701	3.32	0.74	0.65	1.94
Indiana	523	3.51	0.62	0.80	2.08
Iowa	432	3.69	0.73	0.61	2.35
Kansas	321	3.92	0.71	0.67	2.55
Kentucky	279	3.84	0.73	0.86	2.25
Louisiana	267	3.65	0.28	1.16	2.20
Maine	90	4.37	1.05	0.47	2.85
Maryland	224	3.89	0.86	0.90	2.14
Massachusetts	359	3.75	0.68	0.94	2.13
Michigan	432	3.88	0.76	0.89	2.23
Minnesota	355	4.15	1.04	0.69	2.43
Mississippi	204	3.93	0.57	1.09	2.27
Missouri	514	3.26	0.46	0.71	2.09
Montana	71	3.82	0.87	0.60	2.35
North Carolina	424	3.72	0.58	0.91	2.23
North Dakota	77	4.45	0.94	0.61	2.90
Nebraska	189	3.98	0.73	0.69	2.56
Nevada	67	4.09	0.83	0.98	2.28
New Hampshire	73	3.85	0.75	0.80	2.30
New Jersey	351	3.81	0.77	0.92	2.12
New Mexico	68	3.62	0.67	0.67	2.28
New York	611	3.57	0.70	0.78	2.09
Ohio	949	3.58	0.62	0.94	2.01
Oklahoma	297	3.82	0.37	0.97	2.48
Oregon	130	4.91	0.74	0.95	3.22
Pennsylvania	681	3.72	0.80	0.88	2.04

State	Number of Nursing Homes	Total	RN	LPN	Nurse Aide
Puerto Rico	7	3.99	3.03	0.95	0.00
Rhode Island	76	3.59	0.82	0.43	2.34
South Carolina	187	3.94	0.65	1.04	2.24
South Dakota	101	3.53	0.81	0.46	2.26
Tennessee	313	3.45	0.53	1.04	1.88
Texas	1,204	3.40	0.38	1.05	1.98
Utah	98	4.05	1.17	0.54	2.34
Vermont	35	4.14	0.74	1.00	2.40
Virginia	288	3.56	0.61	1.00	1.95
Washington	200	4.26	0.93	0.83	2.50
West Virginia	123	3.81	0.71	0.95	2.15
Wisconsin	340	3.84	1.01	0.57	2.26
Wyoming	36	3.68	0.81	0.56	2.31

Source: Abt Associates analysis of Payroll Based Journal (PBJ) and Certification and Survey Provider Enhanced Reports (CASPER) data.

Exhibit E.5: Logistic Regression Model Estimates, Top Half on Quality Measure Score by Total Nurse Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted Total Nurse Staffing								
<3rd decile (<3.09 HPRD)	Reference				3,000	40.9%	39.0%	42.8%
3rd decile (3.09 – <3.30 HPRD)	1.054	0.921	1.207	0.4458	1,554	43.2%	40.6%	45.8%
4th decile (3.30 – <3.48 HPRD)	1.033	0.898	1.187	0.6525	1,466	42.7%	40.0%	45.4%
5th decile (3.48 – <3.67 HPRD)	1.039	0.903	1.196	0.5902	1,453	43.2%	40.6%	45.9%
6th decile (3.67 – <3.88 HPRD)	1.200	1.044	1.379	0.0104	1,482	47.9%	45.2%	50.6%
7th decile (3.88 – <4.12 HPRD)	1.458	1.267	1.678	<.0001	1,526	53.1%	50.4%	55.8%
8th decile (4.12 – <4.42 HPRD)	1.770	1.529	2.049	<.0001	1,477	58.0%	55.1%	60.8%
9th decile (4.42 – <4.92 HPRD)	1.667	1.428	1.945	<.0001	1,492	58.3%	55.3%	61.2%
10th decile (4.92 or higher)	1.717	1.427	2.066	<.0001	1,498	61.2%	57.7%	64.8%
Ownership								
For-profit	Reference				10,614	46.4%	45.4%	47.4%
Non-profit	1.018	0.918	1.129	0.7306	3,409	55.7%	53.4%	57.6%
Government	1.171	0.972	1.411	0.0972	925	53.2%	48.8%	57.5%
Special Focus Facility Status								
Neither special focus facility (SFF) nor candidate	Reference				14,428	49.7%	48.8%	50.7%
SFF	0.417	0.326	0.534	<.0001	434	26.4%	21.9%	30.9%
SFF candidate	0.473	0.278	0.806	0.0059	86	29.3%	18.7%	39.9%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	62.5%	60.7%	64.3%
Second	0.769	0.689	0.859	<.0001	3,773	51.7%	50.0%	53.4%
Third	0.588	0.526	0.659	<.0001	3,772	44.3%	42.7%	46.0%
Highest	0.442	0.391	0.500	<.0001	3,740	37.6%	35.7%	39.5%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	48.6%	47.7%	49.5%
Hospital-based	1.362	0.993	1.867	0.0551	533	59.2%	52.0%	66.3%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Continuing Care Retirement Community Status								
Not part of Continuing Care Retirement Community (CCRC)	Reference				13,365	47.4%	46.5%	48.4%
Part of CCRC	1.148	1.003	1.314	0.0454	1,583	61.8%	59.2%	64.4%
Urban vs. Rural								
Urban	Reference				10,829	52.1%	51.1%	53.1%
Rural	0.663	0.605	0.726	<.0001	4,119	40.7%	38.8%	42.5%
Number of Certified Beds (per one-bed increment)	1.002	1.001	1.002	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.6: Logistic Regression Model Estimates, Top Half on Quality Measure Score by RN, LPN, and Nurse Aide Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted RN Staffing								
<3rd decile (<0.38 HPRD)	Reference				3,028	36.6%	34.8%	38.5%
3rd decile (0.38 – <0.45 HPRD)	1.192	1.034	1.373	0.0153	1,433	42.0%	39.3%	44.6%
4th decile (0.45 – <0.52 HPRD)	1.403	1.218	1.618	<.0001	1,423	46.2%	43.4%	48.9%
5th decile (0.52 – <0.60 HPRD)	1.385	1.202	1.595	<.0001	1,465	46.1%	43.4%	48.8%
6th decile (0.60 – <0.70 HPRD)	1.719	1.493	1.981	<.0001	1,530	51.8%	49.2%	54.5%
7th decile (0.70 – <0.82 HPRD)	1.566	1.356	1.808	<.0001	1,557	50.4%	47.7%	53.1%
8th decile (0.82 – <1.00 HPRD)	1.831	1.574	2.130	<.0001	1,544	55.2%	52.4%	57.9%
9th decile (1.00 – <1.28 HPRD)	1.904	1.613	2.248	<.0001	1,473	57.8%	54.8%	60.7%
10th decile (1.28 HPRD or higher)	2.643	2.170	3.218	<.0001	1,495	67.8%	64.6%	70.9%
Case-mix Adjusted Nurse Aide Staffing								
<3rd decile (<1.76 HPRD)	Reference				2,963	43.7%	41.8%	45.6%
3rd decile (1.76-<1.89 HPRD)	0.918	0.800	1.053	0.2202	1,549	43.4%	40.8%	45.9%
4th decile (1.89 – <2.01 HPRD)	0.983	0.854	1.131	0.8059	1,508	45.3%	42.7%	48.0%
5th decile (2.01 – <2.13 HPRD)	0.903	0.782	1.044	0.1679	1,420	44.3%	41.6%	47.0%
6th decile (2.13 – <2.28 HPRD)	1.022	0.887	1.178	0.7625	1,524	48.2%	45.5%	50.8%
7th decile (2.28 – <2.44 HPRD)	1.156	1.000	1.336	0.0501	1,510	52.6%	49.9%	55.3%
8th decile (2.44 – <2.62 HPRD)	1.294	1.115	1.501	0.0007	1,466	55.4%	52.7%	58.2%
9th decile (2.62 – <2.93 HPRD)	1.274	1.094	1.484	0.0018	1,532	55.5%	52.7%	58.3%
10th decile (2.93 HPRD or higher)	1.255	1.049	1.502	0.0132	1,476	58.6%	55.2%	62.0%
Case-mix Adjusted LPN Staffing								
<3rd decile (<0.62 HPRD)	Reference				3,039	52.7%	50.7%	54.7%
3rd decile (0.62 – <0.71 HPRD)	0.970	0.836	1.125	0.6862	1,417	47.9%	45.1%	50.6%
4th decile (0.71 – <0.80 HPRD)	1.042	0.902	1.204	0.5737	1,601	49.6%	47.0%	52.3%
5th decile (0.80 – <0.87 HPRD)	0.865	0.746	1.004	0.0558	1,454	45.1%	42.4%	47.8%
6th decile (0.87 – <0.95 HPRD)	0.984	0.848	1.142	0.8322	1,478	48.2%	45.5%	50.9%
7th decile (0.95 – <1.04 HPRD)	0.895	0.773	1.036	0.1381	1,553	45.9%	43.3%	48.5%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
8th decile (1.04 – <1.14 HPRD)	0.914	0.785	1.064	0.2459	1,402	47.0%	44.2%	49.7%
9th decile (1.14 – <1.30 HPRD)	0.897	0.770	1.045	0.1626	1,486	47.3%	44.6%	50.0%
10th decile (1.30 HPRD or higher)	1.003	0.854	1.179	0.9684	1,518	53.9%	51.0%	56.8%
Ownership								
For-profit	Reference				10,614	46.4%	45.4%	47.4%
Non-profit	0.907	0.815	1.008	0.0704	3,409	55.9%	54.0%	57.8%
Government	1.116	0.923	1.348	0.2568	925	54.2%	50.0%	58.3%
SFF Status								
Neither SFF nor candidate	Reference				14,428	49.9%	48.9%	50.8%
SFF	0.419	0.326	0.537	<.0001	434	26.6%	22.0%	31.1%
SFF candidate	0.496	0.290	0.848	0.0105	86	29.5%	18.8%	40.1%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	62.8%	61.1%	64.6%
Second	0.792	0.709	0.885	<.0001	3,773	51.9%	50.2%	53.6%
Third	0.622	0.555	0.698	<.0001	3,772	44.4%	42.7%	46.01%
Highest	0.469	0.414	0.531	<.0001	3,740	37.5%	35.6%	39.4%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	48.7%	47.8%	49.6%
Hospital-based	1.297	0.943	1.784	0.1098	533	59.9%	52.9%	66.9%
CCRC Status								
Not part of CCRC	Reference				13,365	47.5%	46.6%	48.5%
Part of CCRC	1.126	0.983	1.290	0.0867	1,583	62.0%	59.5%	64.5%
Urban vs. Rural								
Urban	Reference				10,829	52.2%	51.1%	53.2%
Rural	0.644	0.587	0.706	<.0001	4,119	41.0%	39.1%	42.8%
Number of Certified Beds (per one-bed increment)	1.002	1.001	1.003	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.7: Logistic Regression Model Estimates, Top Half on Quality Measure Score by Licensed Nurse and Nurse Aide Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted Licensed Staffing								
<3rd decile (< 1.22 HPRD)	Reference				2,941	39.0%	37.1%	40.9%
3rd decile (1.22 – <1.33 HPRD)	0.998	0.867	1.149	0.9779	1,496	39.8%	37.1%	42.4%
4th decile (1.33 – <1.43 HPRD)	1.137	0.988	1.308	0.0739	1,512	43.7%	41.1%	46.4%
5th decile (1.43 – <1.53 HPRD)	1.296	1.123	1.496	0.0004	1,473	48.2%	45.4%	50.9%
6th decile (1.53 – <1.63 HPRD)	1.400	1.212	1.616	<.0001	1,477	51.0%	48.2%	53.7%
7th decile (1.63 – <1.76 HPRD)	1.361	1.181	1.568	<.0001	1,624	50.6%	47.9%	53.2%
8th decile (1.76 – <1.93 HPRD)	1.668	1.433	1.942	<.0001	1,447	57.3%	54.4%	60.1%
9th decile (1.93 – <2.22 HPRD)	1.570	1.339	1.839	<.0001	1,465	57.7%	54.8%	60.6%
10th decile (2.22 HPRD or higher)	1.666	1.378	2.015	<.0001	1,513	63.1%	59.8%	66.4%
Case-mix Adjusted Nurse Aide Staffing								
<3rd decile (<1.76 HPRD)	Reference				2,963	43.7%	41.8%	45.6%
3rd decile (1.76-<1.89 HPRD)	0.923	0.805	1.058	0.2499	1,549	43.4%	40.9%	46.0%
4th decile (1.89 – <2.01 HPRD)	0.970	0.843	1.115	0.6660	1,508	45.2%	42.5%	47.8%
5th decile (2.01 – <2.13 HPRD)	0.891	0.771	1.028	0.1147	1,420	44.1%	41.4%	46.9%
6th decile (2.13 – <2.28 HPRD)	1.013	0.880	1.167	0.8547	1,524	48.1%	45.4%	50.7%
7th decile (2.28 – <2.44 HPRD)	1.141	0.988	1.318	0.0719	1,510	52.5%	49.8%	55.2%
8th decile (2.44 – <2.62 HPRD)	1.245	1.074	1.444	0.0037	1,466	55.2%	52.4%	58.0%
9th decile (2.62 – <2.93 HPRD)	1.231	1.058	1.433	0.0073	1,532	55.3%	52.5%	58.1%
10th decile (2.93 HPRD or higher)	1.249	1.045	1.493	0.0146	1,476	58.1%	54.7%	61.5%
Ownership								
For-profit	Reference				10,614	46.4%	45.4%	47.4%
Non-profit	0.987	0.889	1.095	0.7998	3,409	55.6%	53.7%	57.6%
Government	1.146	0.950	1.382	0.1542	925	53.4%	49.1%	57.6%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
SFF Status								
Neither SFF nor candidate	Reference				14,428	49.7%	48.8%	50.7%
SFF	0.422	0.329	0.540	<.0001	434	26.4%	21.8%	31.0%
SFF candidate	0.485	0.284	0.828	0.0080	86	29.4%	18.8%	40.0%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	62.5%	60.6%	64.3%
Second	0.776	0.694	0.866	<.0001	3,773	51.7%	50.0%	53.3%
Third	0.599	0.534	0.671	<.0001	3,772	44.3%	42.6%	46.0%
Highest	0.454	0.401	0.514	<.0001	3,740	37.6%	35.7%	39.5%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	48.6%	47.7%	49.5%
Hospital-based	1.347	0.982	1.848	0.0644	533	59.1%	52.0%	66.2%
CCRC Status								
Not part of CCRC	Reference				13,365	47.4%	46.4%	48.4%
Part of CCRC	1.141	0.996	1.307	0.0570	1,583	61.7%	59.2%	64.3%
Urban vs. Rural								
Urban	Reference				10,829	52.1%	51.0%	53.1%
Rural	0.674	0.615	0.738	<.0001	4,119	40.7%	38.9%	42.5%
Number of Certified Beds (per one-bed increment)	1.002	1.001	1.002	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.8: Logistic Regression Model Estimates, Top 75 Percent on Quality Measure Score by Total Nurse Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted Total Nurse Staffing								
<3rd decile (<3.09 HPRD)	Reference				3,000	66.9%	65.1%	68.7%
3rd decile (3.09 – <3.30 HPRD)	1.093	0.944	1.266	0.2349	1,554	69.8%	67.4%	72.2%
4th decile (3.30 – <3.48 HPRD)	1.074	0.923	1.249	0.3547	1,466	69.7%	67.2%	72.2%
5th decile (3.48 – <3.67 HPRD)	1.104	0.948	1.287	0.2029	1,453	70.6%	68.1%	73.1%
6th decile (3.67 – <3.88 HPRD)	1.280	1.093	1.497	0.0021	1,482	74.7%	72.4%	77.1%
7th decile (3.88 – <4.12 HPRD)	1.390	1.182	1.633	<.0001	1,526	76.6%	74.3%	78.9%
8th decile (4.12 – <4.42 HPRD)	1.731	1.452	2.063	<.0001	1,477	80.5%	78.2%	82.8%
9th decile (4.42 – <4.92 HPRD)	1.803	1.487	2.185	<.0001	1,492	82.6%	80.3%	84.8%
10th decile (4.92 or higher)	1.930	1.511	2.465	<.0001	1,498	85.1%	82.4%	87.8%
Ownership								
For-profit	Reference				10,614	71.5%	70.6%	72.4%
Non-profit	1.239	1.091	1.406	0.0009	3,409	81.8%	80.2%	83.3%
Government	1.414	1.128	1.772	0.0027	925	79.5%	76.0%	83.0%
SFF Status								
Neither SFF nor candidate	Reference				14,428	75.1%	74.3%	75.5%
SFF	0.465	0.372	0.583	<.0001	434	54.4%	49.2%	59.6%
SFF candidate	0.428	0.261	0.701	0.0007	86	52.6%	40.7%	64.5%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	85.8%	84.5%	87.1%
Second	0.72	0.625	0.829	<.0001	3,773	77.6%	76.2%	79.0%
Third	0.5	0.435	0.576	<.0001	3,772	70.0%	68.4%	71.5%
Highest	0.386	0.333	0.446	<.0001	3,740	64.2%	62.4%	66.1%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	74.1%	73.3%	74.9%
Hospital-based	1.179	0.796	1.747	0.4104	533	81.6%	76.0%	87.2%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
CCRC Status								
Not part of CCRC	Reference				13,365	73.0%	72.2%	73.9%
Part of CCRC	1.153	0.967	1.376	0.1128	1,583	85.3%	83.4%	87.1%
Urban vs. Rural								
Urban	Reference				10,829	77.2%	76.4%	78.1%
Rural	0.614	0.557	0.678	<.0001	4,119	66.7%	65.0%	68.5%
Number of Certified Beds (per one-bed increment)	1.002	1.001	1.003	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.

Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.9: Logistic Regression Model Estimates, Top 75 Percent on Quality Measure Score by RN, LPN, and Nurse Aide Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted RN Staffing								
<3rd decile (<0.38 HPRD)	Reference				3,028	60.8%	58.9%	62.7%
3rd decile (0.38 – <0.45 HPRD)	1.313	1.131	1.523	0.0003	1,433	68.1%	65.6%	70.7%
4th decile (0.45 – <0.52 HPRD)	1.633	1.399	1.906	<.0001	1,423	72.7%	70.2%	75.1%
5th decile (0.52 – <0.60 HPRD)	1.697	1.454	1.982	<.0001	1,465	73.7%	71.3%	76.1%
6th decile (0.60 – <0.70 HPRD)	1.961	1.672	2.301	<.0001	1,530	76.7%	74.4%	79.0%
7th decile (0.70 – <0.82 HPRD)	1.835	1.559	2.160	<.0001	1,557	76.3%	74.0%	78.6%
8th decile (0.82 – <1.00 HPRD)	2.214	1.850	2.648	<.0001	1,544	80.2%	77.9%	82.5%
9th decile (1.00 – <1.28 HPRD)	2.715	2.201	3.350	<.0001	1,473	84.3%	82.0%	86.5%
10th decile (1.28 HPRD or higher)	4.024	3.054	5.302	<.0001	1,495	89.8%	87.7%	91.9%
Case-mix Adjusted Nurse Aide Staffing								
<3rd decile (<1.76 HPRD)	Reference				2,963	69.4%	67.6%	71.1%
3rd decile (1.76-<1.89 HPRD)	1.008	0.866	1.173	0.9195	1,549	71.5%	69.2%	73.8%
4th decile (1.89 – <2.01 HPRD)	0.993	0.849	1.161	0.9303	1,508	71.4%	69.0%	73.8%
5th decile (2.01 – <2.13 HPRD)	0.852	0.728	0.998	0.0477	1,420	69.4%	66.9%	71.9%
6th decile (2.13 – <2.28 HPRD)	1.078	0.917	1.266	0.3631	1,524	74.8%	72.5%	77.1%
7th decile (2.28 – <2.44 HPRD)	1.085	0.917	1.283	0.3425	1,510	76.4%	74.1%	78.7%
8th decile (2.44 – <2.62 HPRD)	1.340	1.121	1.602	0.0013	1,466	79.9%	77.6%	82.1%
9th decile (2.62 – <2.93 HPRD)	1.254	1.045	1.505	0.0148	1,532	79.3%	77.0%	81.6%
10th decile (2.93 HPRD or higher)	1.230	0.983	1.539	0.0708	1,476	82.0%	79.3%	84.6%
Case-mix Adjusted LPN Staffing								
<3rd decile (<0.62 HPRD)	Reference				3,039	77.1%	75.4%	78.8%
3rd decile (0.62 – <0.71 HPRD)	1.031	0.867	1.225	0.7314	1,417	73.8%	71.4%	76.2%
4th decile (0.71 – <0.80 HPRD)	1.109	0.936	1.314	0.2340	1,601	75.0%	72.7%	77.3%
5th decile (0.80 – <0.87 HPRD)	1.055	0.888	1.255	0.5405	1,454	73.9%	71.5%	76.3%
6th decile (0.87 – <0.95 HPRD)	1.050	0.883	1.247	0.5824	1,478	73.7%	71.3%	76.0%
7th decile (0.95 – <1.04 HPRD)	1.029	0.869	1.220	0.7374	1,553	73.2%	70.8%	75.5%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
8th decile (1.04 – <1.14 HPRD)	0.977	0.819	1.165	0.7956	1,402	72.7%	70.2%	75.1%
9th decile (1.14 – <1.30 HPRD)	0.886	0.744	1.055	0.1745	1,486	71.4%	68.9%	73.8%
10th decile (1.30 HPRD or higher)	0.911	0.754	1.102	0.3387	1,518	75.5%	73.0%	78.0%
Ownership								
For-profit	Reference				10,614	11.48	10.93	12.02
Non-profit	-0.459	-0.729	-0.188	0.0009	3,409	10.60	9.99	11.21
Government	-0.281	-0.766	0.204	0.2567	925	11.44	10.69	12.19
SFF Status								
Neither SFF nor candidate	Reference				14,428	75.1%	74.3%	75.9%
SFF	0.465	0.370	0.585	<.0001	434	54.5%	49.4%	59.6%
SFF candidate	0.453	0.274	0.747	0.0019	86	52.7%	41.2%	64.3%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	86.0%	84.7%	87.3%
Second	0.744	0.645	0.858	<.0001	3,773	77.8%	76.4%	79.2%
Third	0.535	0.464	0.616	<.0001	3,772	70.0%	68.5%	71.5%
Highest	0.417	0.359	0.484	<.0001	3,740	63.9%	62.1%	65.8%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	74.1%	73.3%	74.9%
Hospital-based	1.118	0.750	1.667	0.5825	533	81.8%	76.4%	87.2%
CCRC Status								
Not part of CCRC	Reference				13,365	73.0%	72.2%	73.9%
Part of CCRC	1.115	0.933	1.332	0.2303	1,583	85.4%	83.5%	87.2%
Urban vs. Rural								
Urban	Reference				10,829	77.2%	76.3%	78.0%
Rural	0.596	0.540	0.659	<.0001	4,119	67.0%	65.3%	68.7%
Number of Certified Beds (per one-bed increment)	1.003	1.002	1.004	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.10: Logistic Regression Model Estimates, Top 75 Percent on Quality Measure Score by Licensed Nurse and Nurse Aide Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted Licensed Staffing								
<3rd decile (<0.38 HPRD)	Reference				2,941	65.5%	63.6%	67.4%
3rd decile (0.38 – <0.45 HPRD)	0.922	0.796	1.067	0.2753	1,496	64.7%	62.1%	67.3%
4th decile (0.45 – <0.52 HPRD)	1.252	1.075	1.460	0.0040	1,512	71.9%	69.5%	74.4%
5th decile (0.52 – <0.60 HPRD)	1.362	1.159	1.601	0.0002	1,473	74.6%	72.2%	77.1%
6th decile (0.60 – <0.70 HPRD)	1.435	1.218	1.690	<.0001	1,477	76.3%	74.0%	78.7%
7th decile (0.70 – <0.82 HPRD)	1.391	1.184	1.634	<.0001	1,624	76.2%	73.9%	78.4%
8th decile (0.82 – <1.00 HPRD)	1.500	1.256	1.792	<.0001	1,447	79.1%	76.7%	81.4%
9th decile (1.00 – <1.28 HPRD)	1.619	1.336	1.961	<.0001	1,465	81.6%	79.3%	83.9%
10th decile (1.28 HPRD or higher)	2.106	1.629	2.723	<.0001	1,513	87.4%	85.1%	89.8%
Case-mix Adjusted Nurse Aide Staffing								
<3rd decile (<1.76 HPRD)	Reference				2,963	69.5%	67.8%	71.3%
3rd decile (1.76-<1.89 HPRD)	1.028	0.884	1.195	0.7190	1,549	71.6%	69.2%	73.9%
4th decile (1.89 – <2.01 HPRD)	0.988	0.846	1.154	0.8785	1,508	71.4%	68.9%	73.8%
5th decile (2.01 – <2.13 HPRD)	0.857	0.732	1.003	0.0539	1,420	69.3%	66.8%	71.8%
6th decile (2.13 – <2.28 HPRD)	1.078	0.919	1.265	0.3583	1,524	74.7%	72.3%	77.0%
7th decile (2.28 – <2.44 HPRD)	1.082	0.916	1.278	0.3519	1,510	76.4%	74.1%	78.7%
8th decile (2.44 – <2.62 HPRD)	1.290	1.080	1.539	0.0049	1,466	79.7%	77.5%	82.0%
9th decile (2.62 – <2.93 HPRD)	1.206	1.007	1.444	0.0421	1,532	79.2%	76.8%	81.5%
10th decile (2.93 HPRD or higher)	1.208	0.967	1.509	0.0954	1,476	81.7%	78.9%	84.4%
Ownership								
For-profit	Reference				10,614	71.5%	70.5%	72.4%
Non-profit	1.200	1.056	1.364	0.0051	3,409	81.7%	80.2%	83.3%
Government	1.385	1.104	1.737	0.0048	925	79.6%	76.2%	83.0%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
SFF Status								
Neither SFF nor candidate	Reference				14,428	75.0%	74.2%	75.8%
SFF	0.470	0.375	0.589	<.0001	434	54.3%	49.2%	59.5%
SFF candidate	0.446	0.272	0.733	0.0014	86	52.7%	41.1%	64.3%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	85.8%	84.5%	87.1%
Second	0.729	0.632	0.841	<.0001	3,773	77.6%	76.2%	79.0%
Third	0.511	0.444	0.589	<.0001	3,772	69.9%	68.4%	71.5%
Highest	0.397	0.343	0.460	<.0001	3,740	64.2%	64.2%	62.3%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	74.0%	73.2%	74.8%
Hospital-based	1.135	0.765	1.683	0.5303	533	81.7%	76.2%	87.2%
CCRC Status								
Not part of CCRC	Reference				13,365	73.0%	72.2%	73.9%
Part of CCRC	1.129	0.946	1.348	0.1778	1,583	85.2%	83.4%	87.1%
Urban vs. Rural								
Urban	Reference				10,829	77.2%	76.3%	78.0%
Rural	0.627	0.568	0.692	<.0001	4,119	66.7%	65.0%	68.4%
Number of Certified Beds (per one-bed increment)	1.002	1.001	1.003	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.11: Logistic Regression Model Estimates, Top Half on Within-State Health Inspection Performance by Total Nurse Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted Total Nurse Staffing								
<3rd decile (<3.09 HPRD)	Reference				3,000	37.8%	36.1%	39.5%
3rd decile (3.09 – <3.30 HPRD)	1.233	1.086	1.399	0.0012	1,554	44.6%	42.2%	47.0%
4th decile (3.30 – <3.48 HPRD)	1.079	0.948	1.229	0.2487	1,466	42.4%	39.9%	44.9%
5th decile (3.48 – <3.67 HPRD)	1.220	1.071	1.389	0.0027	1,453	46.3%	43.8%	48.8%
6th decile (3.67 – <3.88 HPRD)	1.259	1.106	1.432	0.0005	1,482	47.8%	45.3%	50.3%
7th decile (3.88 – <4.12 HPRD)	1.348	1.185	1.532	<.0001	1,526	50.6%	48.1%	53.0%
8th decile (4.12 – <4.42 HPRD)	1.409	1.236	1.607	<.0001	1,477	53.7%	51.2%	56.2%
9th decile (4.42 – <4.92 HPRD)	1.669	1.457	1.911	<.0001	1,492	61.1%	58.7%	63.5%
10th decile (4.92 or higher)	2.252	1.936	2.619	<.0001	1,498	72.7%	70.6%	74.9%
Ownership								
For-profit	Reference				10,614	44.4%	43.5%	45.4%
Non-profit	1.441	1.316	1.579	<.0001	3,409	63.2%	61.7%	64.8%
Government	1.272	1.097	1.476	0.0014	925	56.9%	53.8%	60.1%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	65.0%	63.6%	66.5%
Second	0.684	0.619	0.756	<.0001	3,773	48.7%	47.1%	50.3%
Third	0.605	0.547	0.671	<.0001	3,772	43.5%	41.9%	45.0%
Highest	0.544	0.490	0.603	<.0001	3,740	41.1%	39.6%	42.6%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	48.7%	47.9%	49.5%
Hospital-based	1.263	1.027	1.553	0.0269	533	69.8%	66.3%	73.6%
CCRC Status								
Not part of CCRC	Reference				13,365	47.5%	46.6%	48.3%
Part of CCRC	1.196	1.055	1.357	0.0053	1,583	66.6%	64.5%	68.8%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Urban vs. Rural								
Urban	Reference				10,829	47.7%	46.8%	48.6%
Rural	1.188	1.098	1.285	<.0001	4,119	54.3%	52.8%	55.8%
Number of Certified Beds (per one-bed increment)	0.996	0.995	0.996	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.

Exhibit E.12: Logistic Regression Model Estimates, Top Half on Within-State Health Inspection Performance by RN, LPN, and Nurse Aide Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted RN Staffing								
<3rd decile (<0.38 HPRD)	Reference				3,028	36.6%	34.9%	38.3%
3rd decile (0.38 – <0.45 HPRD)	0.945	0.827	1.079	0.4017	1,433	36.9%	34.5%	39.4%
4th decile (0.45 – <0.52 HPRD)	1.328	1.165	1.514	<.0001	1,423	45.0%	42.4%	47.4%
5th decile (0.52 – <0.60 HPRD)	1.299	1.140	1.480	<.0001	1,465	45.5%	43.0%	48.0%
6th decile (0.60 – <0.70 HPRD)	1.549	1.361	1.762	<.0001	1,530	51.0%	48.6%	53.5%
7th decile (0.70 – <0.82 HPRD)	1.497	1.313	1.705	<.0001	1,557	51.1%	48.7%	53.6%
8th decile (0.82 – <1.00 HPRD)	1.667	1.457	1.907	<.0001	1,544	55.6%	53.2%	58.1%
9th decile (1.00 – <1.28 HPRD)	2.017	1.743	2.333	<.0001	1,473	63.0%	60.6%	65.4%
10th decile (1.28 HPRD or higher)	2.503	2.123	2.951	<.0001	1,495	72.8%	70.7%	75.1%
Case-Mix Adjusted Nurse Aide Staffing								
<3rd decile (<1.76 HPRD)	Reference				2,963	42.0%	40.3%	43.7%
3rd decile (1.76-<1.89 HPRD)	1.075	0.946	1.222	0.2687	1,549	45.3%	42.9%	47.7%
4th decile (1.89 – <2.01 HPRD)	0.994	0.873	1.132	0.9276	1,508	44.8%	42.3%	47.2%
5th decile (2.01 – <2.13 HPRD)	0.968	0.847	1.106	0.6284	1,420	45.7%	43.2%	48.2%
6th decile (2.13 – <2.28 HPRD)	1.033	0.906	1.177	0.6290	1,524	49.7%	47.3%	52.1%
7th decile (2.28 – <2.44 HPRD)	1.029	0.902	1.175	0.6678	1,510	51.5%	49.1%	53.9%
8th decile (2.44 – <2.62 HPRD)	0.999	0.873	1.143	0.9831	1,466	52.2%	49.7%	54.6%
9th decile (2.62 – <2.93 HPRD)	1.058	0.925	1.212	0.4105	1,532	56.1%	53.7%	58.4%
10th decile (2.93 HPRD or higher)	1.161	1.002	1.345	0.0465	1,476	65.5%	63.2%	67.9%
Case-Mix Adjusted LPN Staffing								
<3rd decile (<0.62 HPRD)	Reference				3,039	51.9%	50.2%	53.5%
3rd decile (0.62 – <0.71 HPRD)	0.954	0.835	1.091	0.4941	1,417	45.2%	42.7%	47.7%
4th decile (0.71 – <0.80 HPRD)	1.067	0.938	1.214	0.3251	1,601	47.3%	44.9%	49.6%
5th decile (0.80 – <0.87 HPRD)	1.054	0.922	1.205	0.4384	1,454	46.6%	44.2%	49.1%
6th decile (0.87 – <0.95 HPRD)	1.086	0.950	1.241	0.2287	1,478	46.5%	44.0%	48.9%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
7th decile (0.95 – <1.04 HPRD)	1.152	1.010	1.316	0.0355	1,553	47.1%	44.7%	49.5%
8th decile (1.04 – <1.14 HPRD)	1.166	1.016	1.338	0.0288	1,402	47.9%	45.4%	50.4%
9th decile (1.14 – <1.30 HPRD)	1.236	1.078	1.417	0.0023	1,486	49.8%	47.4%	52.2%
10th decile (1.30 HPRD or higher)	1.566	1.362	1.802	<.0001	1,518	60.4%	58.1%	62.8%
Ownership								
For-profit	Reference				10,614	44.4%	43.5%	45.3%
Non-profit	1.329	1.211	1.459	<.0001	3,409	63.2%	61.7%	64.8%
Government	1.217	1.047	1.413	0.0103	925	56.9%	53.9%	60.0%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	65.0%	63.6%	66.5%
Second	0.704	0.637	0.779	<.0001	3,773	48.7%	47.2%	50.3%
Third	0.642	0.579	0.713	<.0001	3,772	43.5%	41.9%	45.0%
Highest	0.589	0.530	0.655	<.0001	3,740	41.1%	39.6%	42.7%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	48.7%	48.0%	49.5%
Hospital-based	1.241	1.009	1.526	0.0410	533	69.8%	66.2%	73.6%
CCRC Status								
Not part of CCRC	Reference				13,365	47.5%	46.6%	48.3%
Part of CCRC	1.171	1.031	1.329	0.0148	1,583	66.6%	64.4%	68.9%
Urban vs. Rural								
Urban	Reference				10,829	47.7%	46.8%	48.6%
Rural	1.194	1.103	1.293	<.0001	4,119	54.3%	52.8%	55.8%
Number of Certified Beds (per one-bed increment)	0.996	0.995	0.997	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.13: Logistic Regression Model Estimates, Top Half on Within-State Health Inspection Performance by Licensed Nurse and Nurse Aide Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted Licensed Staffing								
<3rd decile (< 1.22 HPRD)	Reference				2,941	36.0%	34.3%	37.8%
3rd decile (1.22 – <1.33HPRD)	1.288	1.123	1.466	0.0001	1,496	43.9%	41.4%	46.4%
4th decile (1.33 – <1.43 HPRD)	1.767	1.033	1.340	0.0143	1,512	42.7%	40.3%	45.2%
5th decile (1.43 – <1.53 HPRD)	1.293	1.133	1.475	0.0001	1,473	45.8%	43.3%	48.3%
6th decile (1.53 – <1.63 HPRD)	1.459	1.278	1.665	<.0001	1,477	49.4%	46.9%	51.9%
7th decile (1.63 – <1.76 HPRD)	1.363	1.198	1.552	<.0001	1,624	49.1%	46.7%	51.5%
8th decile (1.76 – <1.93 HPRD)	1.592	1.389	1.825	<.0001	1,447	54.7%	52.2%	57.2%
9th decile (1.93 – <2.22 HPRD)	1.984	1.722	2.856	<.0001	1,465	62.6%	60.2%	65.0%
10th decile (2.22 HPRD or higher)	2.537	2.157	2.983	<.0001	1,512	74.3%	72.2%	76.5%
Case-mix Adjusted Nurse Aide Staffing								
<3rd decile (<1.76 HPRD)	Reference				2,963	42.0%	40.3%	43.7%
3rd decile (1.76-<1.89 HPRD)	1.082	0.953	1.223	0.2249	1,549	45.3%	42.9%	47.7%
4th decile (1.89 – <2.01 HPRD)	1.001	0.879	1.139	0.9934	1,508	44.8%	42.3%	47.2%
5th decile (2.01 – <2.13 HPRD)	0.983	0.861	1.123	0.8009	1,420	45.7%	43.2%	48.2%
6th decile (2.13 – <2.28 HPRD)	1.050	0.922	1.197	0.4620	1,524	49.7%	47.3%	52.2%
7th decile (2.28 – <2.44 HPRD)	1.056	0.925	1.205	0.4179	1,510	51.5%	49.1%	54.0%
8th decile (2.44 – <2.62 HPRD)	1.012	0.884	1.158	0.8661	1,466	52.2%	49.7%	54.6%
9th decile (2.62 – <2.93 HPRD)	1.071	0.935	1.226	0.3233	1,532	56.1%	53.7%	58.5%
10th decile (2.93 HPRD or higher)	1.183	1.021	1.369	0.0250	1,475	65.6%	63.25	67.9%
Ownership								
For-profit	Reference				10,614	44.4%	43.5%	45.4%
Non-profit	1.387	1.266	1.521	<.0001	3,409	63.2%	61.7%	64.8%
Government	1.245	1.073	1.445	0.0039	924	56.9%	53.9%	60.0%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Percentage Medicaid Residents (Quartiles)								
Lowest (<48.5%)	Reference				3,662	65.0%	63.6%	66.5%
Second (48.5–<64.3%)	0.706	0.638	0.780	<.0001	3,773	48.7%	47.2%	50.3%
Third (64.3%–<76.2%)	0.633	0.571	0.702	<.0001	3,772	43.5%	41.9%	45.0%
Highest (76.2% or higher)	0.573	0.515	0.636	<.0001	3,740	41.1%	39.6%	42.7%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	48.7%	48.0%	49.5%
Hospital-based	1.206	0.979	1.486	0.0780	532	69.9%	66.2%	73.6%
CCRC Status								
Not part of CCRC	Reference				13,364	47.5%	46.6%	48.3%
Part of CCRC	1.164	1.025	1.321	0.189	1,583	66.6%	64.4%	68.9%
Urban vs. Rural								
Urban	Reference				10,829	47.7%	46.8%	48.6%
Rural	1.218	1.126	1.318	<.0001	4,118	54.3%	52.8%	55.8%
Number of Certified Beds (per one-bed increment)	1.250	1.082	1.445	0.0024				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.14: Logistic Regression Model Estimates, Top 75 Percent on Within-State Health Inspection Performance by Total Nurse Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted Total Nurse Staffing								
<3rd decile (<3.09 HPRD)	Reference				3,000	64.5%	62.8%	66.2%
3rd decile (3.09 – <3.30 HPRD)	1.239	1.083	1.418	0.0018	1,554	70.8%	68.6%	73.1%
4th decile (3.30 – <3.48 HPRD)	1.287	1.119	1.479	0.0004	1,466	72.5%	70.3%	74.8%
5th decile (3.48 – <3.67 HPRD)	1.219	1.060	1.402	0.0055	1,453	72.2%	70.0%	74.4%
6th decile (3.67 – <3.88 HPRD)	1.324	1.149	1.526	0.0001	1,482	74.5%	72.3%	76.7%
7th decile (3.88 – <4.12 HPRD)	1.465	1.268	1.693	<.0001	1,526	77.0%	74.9%	79.1%
8th decile (4.12 – <4.42 HPRD)	1.524	1.311	1.772	<.0001	1,477	79.1%	77.1%	81.1%
9th decile (4.42 – <4.92 HPRD)	1.667	1.418	1.959	<.0001	1,492	82.8%	81.0%	84.7%
10th decile (4.92 or higher)	2.334	1.913	2.848	<.0001	1,498	89.7%	88.3%	91.3%
Ownership								
For-profit	Reference				10,614	70.7%	69.8%	71.5%
Non-profit	1.682	1.498	1.888	<.0001	3,409	85.7%	84.5%	86.8%
Government	1.466	1.220	1.761	<.0001	925	81.7%	79.2%	84.2%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	86.0%	84.9%	87.1%
Second	0.661	0.583	0.749	<.0001	3,773	75.4%	74.0%	76.7%
Third	0.581	0.513	0.658	<.0001	3,772	71.1%	69.7%	72.5%
Highest	0.479	0.423	0.543	<.0001	3,740	66.9%	65.4%	68.4%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	74.3%	73.6%	75.0%
Hospital-based	1.284	0.966	1.708	0.0853	533	88.2%	85.7%	91.0%
CCRC Status								
Not part of CCRC	Reference				13,365	73.3%	72.6%	74.0%
Part of CCRC	1.249	1.057	1.477	0.0091	1,583	87.1%	85.5%	88.7%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Urban vs. Rural								
Urban	Reference				10,829	73.3%	72.5%	74.1%
Rural	1.227	1.119	1.345	<.0001	4,119	78.6%	77.4%	79.9%
Number of Certified Beds (per one-bed increment)	0.997	0.996	0.997	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.

Exhibit E.15: Logistic Regression Model Estimates, Top 75 Percent on Within-State Health Inspection Performance by RN, LPN, and Nurse Aide Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted RN Staffing								
<3rd decile (<0.38 HPRD)	Reference				3,028	63.2%	61.6%	64.9%
3rd decile (0.38 – <0.45 HPRD)	1.080	0.943	1.236	0.2651	1,433	66.5%	64.1%	68.9%
4th decile (0.45 – <0.52 HPRD)	1.378	1.198	1.585	<.0001	1,423	71.7%	69.4%	74.1%
5th decile (0.52 – <0.60 HPRD)	1.446	1.255	1.666	<.0001	1,465	73.4%	71.2%	75.7%
6th decile (0.60 – <0.70 HPRD)	1.636	1.416	1.890	<.0001	1,530	76.5%	74.4%	78.6%
7th decile (0.70 – <0.82 HPRD)	1.659	1.432	1.921	<.0001	1,557	77.5%	75.4%	79.5%
8th decile (0.82 – <1.00 HPRD)	1.706	1.462	1.990	<.0001	1,544	79.2%	77.2%	81.2%
9th decile (1.00 – <1.28 HPRD)	2.493	2.077	2.991	<.0001	1,473	86.2%	84.5%	88.0%
10th decile (1.28 HPRD or higher)	2.678	2.163	3.316	<.0001	1,495	89.7%	88.2%	91.3%
Case-Mix Adjusted Nurse Aide Staffing								
<3rd decile (<1.76 HPRD)	Reference				2,963	69.3%	67.7%	70.9%
3rd decile (1.76-<1.89 HPRD)	0.973	0.847	1.117	0.6962	1,549	70.6%	68.4%	72.8%
4th decile (1.89 – <2.01 HPRD)	0.962	0.836	1.108	0.5945	1,508	71.4%	69.2%	73.6%
5th decile (2.01 – <2.13 HPRD)	0.988	0.853	1.144	0.8731	1,420	73.2%	70.9%	75.4%
6th decile (2.13 – <2.28 HPRD)	1.007	0.869	1.166	0.9281	1,524	75.5%	73.4%	77.6%
7th decile (2.28 – <2.44 HPRD)	1.043	0.896	1.214	0.5862	1,510	77.6%	75.6%	79.7%
8th decile (2.44 – <2.62 HPRD)	0.925	0.794	1.078	0.3195	1,466	76.6%	74.5%	78.7%
9th decile (2.62 – <2.93 HPRD)	0.993	0.848	1.163	0.9316	1,532	79.6%	77.6%	81.5%
10th decile (2.93 HPRD or higher)	1.005	0.839	1.203	0.9608	1,476	84.7%	83.0%	86.5%
Case-Mix Adjusted LPN Staffing								
<3rd decile (<0.62 HPRD)	Reference				3,039	76.1%	74.6%	77.5%
3rd decile (0.62 – <0.71 HPRD)	0.977	0.841	1.135	0.7582	1,417	71.6%	69.3%	73.8%
4th decile (0.71 – <0.80 HPRD)	1.058	0.915	1.224	0.4473	1,601	72.7%	70.6%	74.8%
5th decile (0.80 – <0.87 HPRD)	1.054	0.907	1.224	0.4943	1,454	72.3%	70.1%	74.5%
6th decile (0.87 – <0.95 HPRD)	1.082	0.932	1.258	0.3004	1,478	72.2%	70.0%	74.4%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
7th decile (0.95 – <1.04 HPRD)	1.199	1.033	1.393	0.0174	1,553	73.5%	71.3%	75.6%
8th decile (1.04 – <1.14 HPRD)	1.181	1.011	1.380	0.0360	1,402	73.5%	71.3%	75.8%
9th decile (1.14 – <1.30 HPRD)	1.366	1.166	1.600	0.0001	1,486	76.4%	74.3%	78.5%
10th decile (1.30 HPRD or higher)	1.718	1.446	2.041	<.0001	1,518	83.1%	81.2%	84.9%
Ownership								
For-profit	Reference				10,614	70.7%	69.8%	71.5%
Non-profit	1.537	1.365	1.730	<.0001	3,409	85.7%	84.5%	86.8%
Government	1.410	1.172	1.696	0.0003	925	81.7%	79.3%	84.1%
Percentage Medicaid Residents (Quartiles)								
Lowest	Reference				3,663	86.0%	84.9%	87.1%
Second	0.688	0.607	0.780	<.0001	3,773	75.4%	74.0%	76.7%
Third	0.623	0.549	0.707	<.0001	3,772	71.1%	69.7%	72.5%
Highest	0.527	0.465	0.599	<.0001	3,740	66.9%	65.4%	68.4%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	74.3%	73.6%	75.0%
Hospital-based	1.255	0.944	1.669	0.1177	533	88.2%	85.7%	91.0%
CCRC Status								
Not part of CCRC	Reference				13,365	73.3%	72.6%	74.0%
Part of CCRC	1.218	1.029	1.441	0.0216	1,583	87.1%	85.5%	88.7%
Urban vs. Rural								
Urban	Reference				10,829	73.3%	72.5%	74.1%
Rural	1.235	1.126	1.355	<.0001	4,119	78.6%	77.4%	79.8%
Number of Certified Beds (per one-bed increment)	0.997	0.996	0.998	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

Exhibit E.16: Logistic Regression Model Estimates, Top 75 Percent on Within-State Health Inspection Performance by Licensed Nurse and Nurse Aide Staffing Decile

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Case-mix Adjusted Licensed Staffing								
<3rd decile (< 1.22 HPRD)	Reference				2,941	63.1%	61.4%	64.8%
3rd decile (1.22 – <1.33 HPRD)	1.211	1.058	1.387	0.0055	1,496	69.1%	66.8%	71.4%
4th decile (1.33 – <1.43 HPRD)	1.279	1.114	1.467	0.0005	1,512	71.0%	68.7%	73.2%
5th decile (1.43 – <1.53 HPRD)	1.384	1.201	1.596	<.0001	1,473	73.1%	70.9%	75.3%
6th decile (1.53 – <1.63 HPRD)	1.647	1.420	1.910	<.0001	1,477	76.9%	74.8%	79.0%
7th decile (1.63 – <1.76 HPRD)	1.448	1.256	1.670	<.0001	1,624	75.5%	73.4%	77.6%
8th decile (1.76 – <1.93 HPRD)	1.673	1.430	1.958	<.0001	1,447	79.4%	77.4%	81.5%
9th decile (1.93 – <2.22 HPRD)	2.169	1.824	2.578	<.0001	1,465	84.7%	82.9%	86.5%
10th decile (2.22 HPRD or higher)	3.120	2.500	3.895	<.0001	1,513	91.5%	90.2%	93.0%
Case-mix Adjusted Nurse Aide Staffing								
<3rd decile (<1.76 HPRD)	Reference				2,963	69.3%	67.7%	70.9%
3rd decile (1.76-<1.89 HPRD)	0.980	0.853	1.125	0.7720	1,549	70.6%	68.3%	72.8%
4th decile (1.89 – <2.01 HPRD)	0.968	0.841	1.115	0.6533	1,508	71.4%	69.2%	73.6%
5th decile (2.01 – <2.13 HPRD)	1.005	0.868	1.164	0.9468	1,420	73.2%	70.9%	75.4%
6th decile (2.13 – <2.28 HPRD)	1.027	0.887	1.189	0.7196	1,524	75.5%	73.4%	77.6%
7th decile (2.28 – <2.44 HPRD)	1.070	0.920	1.245	0.3807	1,510	77.6%	75.6%	79.7%
8th decile (2.44 – <2.62 HPRD)	0.938	0.805	1.093	0.4135	1,466	76.6%	74.5%	78.7%
9th decile (2.62 – <2.93 HPRD)	1.003	0.856	1.174	0.9752	1,532	79.6%	77.6%	81.5%
10th decile (2.93 HPRD or higher)	1.008	0.842	1.206	0.9316	1,476	84.7%	83.0%	86.5%
Ownership								
For-profit	Reference				10,614	70.7%	69.8%	71.5%
Non-profit	1.608	1.431	1.806	<.0001	3,409	85.7%	84.5%	86.8%
Government	1.428	1.188	1.716	0.0001	925	81.6%	79.3%	84.1%

Variable	Odds Ratios				Predicted Probability of Outcome*			
	Adjusted Odds Ratio	95% Confidence Interval—Lower	95% Confidence Interval—Upper	p-Value (vs. ref)*	N	Probability	95% Confidence Interval—Lower	95% Confidence Interval—Upper
Percentage Medicaid Residents (Quartiles)								
Lowest (<48.5%)	Reference				3,663	86.0%	84.9%	87.1%
Second (48.5–<64.3%)	0.691	0.610	0.784	<.0001	3,773	75.4%	74.0%	76.7%
Third (64.3%–<76.2%)	0.616	0.544	0.699	<.0001	3,772	71.1%	69.7%	72.5%
Highest (76.2% or higher)	0.515	0.454	0.583	<.0001	3,740	66.9%	65.4%	68.4%
Freestanding vs. Hospital-based								
Freestanding	Reference				14,415	74.3%	73.6%	75.0%
Hospital-based	1.177	0.883	1.569	0.2669	533	88.2%	85.7%	91.0%
CCRC Status								
Not part of CCRC	Reference				13,365	73.3%	72.6%	74.0%
Part of CCRC	1.204	1.017	1.424	0.0307	1,583	87.1%	85.5%	88.7%
Urban vs. Rural								
Urban	Reference				10,829	73.3%	72.5%	74.1%
Rural	1.262	1.151	1.384	<.0001	4,119	78.6%	77.4%	80.0%
Number of Certified Beds (per one-bed increment)	0.997	0.996	0.998	<.0001				

* Predicted probabilities include nursing homes that have a missing value for the observed outcome but known values for staffing. Only nursing homes with both short-stay and long-stay quality measures have a total quality measure score.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,948).

E.3 Non-Nurse Staffing

To inform decisions about whether non-nurse staffing should be included in federal minimum staffing requirements, the Staffing Study team examined use of non-nurse staff, using 2022Q1 data from the PBJ Daily Non-Nurse Staffing Public Use File.[6] The team examined three measures:

- The percentage of nursing homes reporting any use of the staff
- Total hours worked by staff type (overall and for nursing homes that reported any hours worked for the staff type)
- Average HPRD by staff type (overall and for nursing homes that reported any hours worked for the staff type)

Some non-nurse staff types are not used in most nursing homes. For example, only 1.6 percent of nursing homes reported any hours for clinical nurse specialists, 7.7 percent reported any use of paid feeding assistants, and 4.7 percent reported any use of mental health specialists (**Exhibit E.17**). More than 90 percent of nursing homes reported hours for administrators, occupational therapists, and physical therapists; almost 90 percent reported hours for speech-language pathologists.

The hours worked pattern for feeding assistants is particularly interesting. Though most nursing homes do not use paid feeding assistants, the nursing homes that used feeding assistants tended to make heavy use of them. Among nursing homes that used paid feeding assistants, average hours were 0.53 HPRD Though feeding assistants supplement the services provided by nurse aides, they do not provide the full range of care that nurse aides provide. Therefore, the Staffing Study team does *not* recommend that they be counted with nurse aides in a minimum staffing requirement.

Based on this analysis, the Staffing Study team dropped the following non-nurse job categories because of their low use in nursing homes: clinical nurse specialist, feeding assistant, mental health service worker, medical director, nurse practitioner, occupational therapy aide, physical therapy aide, pharmacist, respiratory therapist, respiratory technician, and therapeutic recreation specialist.

[6] This is available at https://data.cms.gov/quality-of-care/payroll-based-journal-daily-non-nurse-staffing.

Exhibit E.17: Use of Non-Nurse Staff, 2022Q1

Staff Type	% of Nursing Homes Reporting Any Hours	Total Hours Worked in Quarter		Average HPRD	
		All Nursing Homes	Nursing Homes with Any Use of Staff	All Nursing Homes	Nursing Homes with Any Use of Staff
Administrator	92.4%	628.2	680.1	0.11	0.12
Clinical nurse specialist	1.6%	4.2	254.1	0.00	0.04
Dietician	74.3%	210.2	282.9	0.03	0.04
Feeding assistant	7.7%	256.4	3344.4	0.04	0.53
Mental health services worker	4.7%	24.2	515.5	0.00	0.05
Medical director	63.9%	34.4	53.8	0.01	0.01
Nurse practitioner	9.3%	21.2	229.4	0.00	0.03
Occupational therapist	91.6%	473.0	516.1	0.07	0.08
Occupational therapy aide	3.8%	19.0	506.0	0.00	0.06
Occupational therapy assistant	82.4%	505.2	612.7	0.08	0.09
Other activities staff	72.5%	706.7	975.1	0.10	0.14
Other physician	9.6%	13.5	140.5	0.00	0.02
Other social worker	41.5%	253.0	609.1	0.04	0.09
Physician assistant	2.1%	3.4	164.8	0.00	0.03
Physical therapist	92.5%	485.9	525.0	0.07	0.08
Physical therapy aide	15.7%	60.5	385.4	0.01	0.06
Physical therapy assistant	86.7%	596.9	688.3	0.09	0.10
Pharmacist	61.8%	35.0	56.6	0.01	0.01
Qualified activities professional	71.6%	372.0	519.9	0.07	0.09
Qualified social worker	70.4%	399.1	567.0	0.06	0.09
Respiratory technician	0.9%	7.9	866.8	0.00	0.11
Respiratory therapist	11.0%	140.7	1275.7	0.02	0.18
Speech-language pathologist	88.9%	292.4	329.1	0.04	0.05
Therapeutic recreation specialist	7.8%	46.6	597.0	0.01	0.08

Source: Abt Associates analysis of 2022Q1 data from PBJ Daily Non-Nurse Staffing Public Use File (N= 14,752).

For the non-nurse categories that the Staffing Study team did not drop based on low use in nursing homes, the team examined the relationship between use of the staff (measured based on HPRD for all nursing homes as reported in **Exhibit E.17** above) and quality (based on the total QM score). Based on these analyses, there is only one non-nurse job category—qualified social workers—that seems like it might be appropriate for a minimum staffing requirement. Given the aggressive timeline for developing proposed minimum nurse staffing requirements, the Staffing Study team recommends that CMS delay consideration of minimum staffing requirements for qualified social workers, as the team believes that this should be a lower priority than development of minimum staffing requirements for nurse staffing given the important link between nurse staffing levels and quality.

Detailed results by non-nurse staff type are as follows:

Administrator: The Staffing Study team observed an inconsistent relationship between administrator staffing levels and quality. Facility administration practices are covered by F-Tag 835, which requires that "a facility must be administered in a manner that enables it to use its resources effectively and efficiently to attain or maintain the highest practicable physical, mental, and psychosocial well-being of each

resident." The Staffing Study team does not believe that it would be appropriate to have any minimum staffing requirement for administrators.

Dietician: The Code of Federal Regulations (42 CFR § 483.60) requires that nursing facilities employ "a qualified dietitian or other clinically qualified nutrition professional either full-time, part-time, or on a consultant basis." Given that current regulations address dietician staffing requirements, the Staffing Study team recommends that dieticians not be part of a minimum staffing requirement, although the team did find evidence of a modest relationship between dietician staffing and quality.

Medical Director: CMS has an F-Tag (F841) that is related to the responsibilities of the medical director. Nursing homes are required to designate to serve as medical director a physician who is responsible for implementation of resident care policies and the coordination of medical care in the facility. Given this existing requirement and the lack of a relationship between medical director staffing and quality, the Staffing Study team does not recommend including medical directors in a minimum staffing requirement, particularly given the inconsistent relationship between medical director staffing and quality.

Occupational and Physical Therapists: The Staffing Study team generally finds evidence of a relationship between both occupational and physical therapist staffing levels and quality. One prior study identified a relationship between therapist staffing levels and QMs used in the Five-Star Quality Rating System (Livingstone et al., 2019). Despite these relationships, the Staffing Study team does not recommend specifying minimum staffing requirements for occupational and physical therapists. Short-stay residents have much higher use of therapy services than do long-stay residents, and the team finds that payor mix is a very strong predictor of therapist staffing levels. The Patient-Driven Payment Model (PDPM) that CMS uses for Medicare payments includes physical and occupational therapy components, and the team speculates that monitoring therapy use through the payment system is the better approach. For example, Rahman et al. (2022) found that the implementation of PDPM was associated with a decrease in the volume of use of rehabilitation therapy.

Occupational and Physical Therapist Assistants: The Staffing Study team found inconsistent relationships between staffing levels for occupational and physical therapist assistants and quality. For reasons similar to those given above for occupational and physical therapists, the team does not recommend including occupational and physical therapist assistants in a minimum staffing requirement.

Qualified Activities Professional: Given the inconsistent relationship between qualified activities professional staffing levels and quality, it is difficult to support including qualified activities professionals in a minimum staffing requirement. In addition, there are two F-Tags (F679 and F680) that include formal requirements of daily practice with which qualified activity professionals must comply in the delivery of the care. F-Tag 679 requires nursing homes to provide activities to meet and support the physical, mental, and psychosocial well-being of each resident; F-Tag 680 specifies that a qualified professional must direct the activities program. Given these existing regulations, the Staffing Study team does not recommend that qualified activities professionals be included in a minimum staffing requirement.

Qualified Social Worker: There was some evidence of higher quality for nursing homes with moderately high social worker hours (between 0.13 and 0.16 HPRD), but the relationships between social worker staffing and quality were generally small and inconsistent. Current CMS regulation requires one social services staff member only in nursing homes with the capacity to care for more than 120 residents (42 CFR § 483.70(p)). Nursing homes that care for 120 or fewer residents are not required to employ social services staff. Federal regulations also do not require facilities caring for more than 120 residents to increase social services staffing in response to either resident census or acuity.

Some stakeholders have advocated for CMS to require nursing homes to employ at least one social worker. They have cited studies showing that social services staff with higher qualifications improve behavioral symptoms, reduce the use of antipsychotic medications, and play an important role in facilitating resident interactions. Using data from 2022Q1, the Staffing Study team does not find evidence

of a relationship between social worker staffing levels and performance on the antipsychotic medication use measures. Some states have staffing requirements for social workers—for example, Connecticut requires that nursing homes have at least one full-time social worker for every 60 residents.

Speech-Language Pathologist: The relationship between speech-language pathologist staffing and quality was generally inconsistent, although average QM scores were highest for nursing homes with the highest levels of speech-language pathologist staffing. The Staffing Study team does not recommend that speech-language pathologists be included in a minimum staffing requirement.

Appendix F. Simulations of Delayed/Omitted Clinical Care Supplemental Materials

List of Exhibits

Section 4.2 of the report provided a summary of methodology and findings for the Staffing Study simulation models, which use on-site observational data on duration of common clinical care tasks performed by licensed nurses (registered nurses [RNs] and licensed practical nurses/licensed vocational nurses [LPNs]) to simulate levels of delayed or omitted clinical care in nursing homes. This appendix provides additional details on methods (Appendix F.1) and full findings (Appendix F.2), including separate results from alternative simulation software.

F.1 Methods

The simulations were intended to identify adequate levels of licensed nurse staffing needed for timely, consistent completion of common clinical care tasks. This study used discrete event simulation (DES) to estimate the impact of different licensed nurse staffing levels on two outcomes: delayed care and omitted care.

F.1.1 Background on Discrete Event Simulation

DES is a modeling technique that imitates a real-world system in which events occur at a distinct point in time. It generates an artificial system history and observes this history to draw inferences about characteristics of the real system (Banks et al., 2005). A nursing home can be thought of as a system in which health care devices, professionals, and residents interact to respond to resident needs. Systems can be thought of as either continuous or discrete. In a continuous system, events within the system occur in perpetuity; for example, a river is a continuous system, as erosion and water levels are changing continuously through time. In a discrete system, events occur at distinct points in time. A nursing home is a discrete system because individual health care events happen at measurable points. For instance, a nurse is providing catheter care not in perpetuity but as needed. For this reason, discrete event simulation modeling is most appropriate to the nursing home context.

The logistics of scheduling and carrying out medical care require highly specific assumptions that DES can incorporate into rules. DES has been used before to model health care delivery scenarios, as it allows a simplified representation of real-world care situations that can assist in operational planning and decision-making. For example, DES models have been used in studies of outpatient clinics (Weerawat et al., 2013), operating room units (Ferrin et al., 2004), emergency rooms (Ferrin et al., 2007), intensive care unit management (DeRienzo et al., 2017), and inpatient facilities (El-Darzi et al., 1998). Most notably, previous work simulated staffing levels in nursing homes and serves as a foundation for the Staffing Study approach (Abt Associates, 2001; Schnelle et al., 2016). Many of these applications aim to optimize patient flow through a facility; others, including the Staffing Study application, focus on the allocation of resources such as staffing, beds, or rooms (Fone et al., 2003; Jacobson et al., 2006).

DES focuses on when and for how long events occur, lending itself to exploring the question of minimum staffing levels for clinical care in nursing homes. A similar question motivated the 2001 Abt report for the Centers for Medicare & Medicaid Services (CMS): *Is there some ratio of nurses to residents below which nursing home residents are at substantially increased risk of quality problems?* That report simulated a series of scenarios with different nurse-to-resident ratios to determine the level of quality care achieved across a range of staffing levels. More than a decade later, Schnelle and colleagues (2016) posed a similar question exploring nurse aide staffing needs in nursing homes. Those authors used DES because it "does not involve creating mock data or predicting theoretical outcomes but, instead, takes known data and/or defined assumptions about care delivery to predict outcomes about care occurrence" (p. 971). In examining licensed nurse staffing in long-term care facilities, the Staffing Study leverages the transparency benefits of DES, while also taking into account other scholarly considerations relevant for understanding adequate nursing home staffing that previous work did not incorporate, such as collective resident acuity (Harrington et al., 2020).

F.1.2 Methods Overview

A "scenario" refers to a set of simulations with the same input parameters; a "replication" identifies a single run of a scenario. The Staffing Study team developed scenarios considering 10 different licensed nurse staffing levels (1 to 10 nurses) on one simulated day across three different resident acuity mixes (25th, 50th, and 75th percentiles based on Minimum Data Set acuity levels), for a total of 30 scenarios in all. The study team then ran at least 3,996 replications for each scenario.

Exhibit F.1 describes input types and data sources used to estimate, calculate, or select each simulation model parameter. It also details which parameters were held constant across scenarios and repetitions and how licensed nurse staffing levels and resident acuity mix were experimentally varied across scenarios. By estimating rates of delayed and omitted care across simulation scenarios, the Staffing Study team was able to identify the minimum level of licensed nurse staffing needed to ensure timely performance of core clinical care tasks.

Exhibit F.1: Overview of Simulation Parameters

Topic	Parameter(s)	Data Sources	Variation
Direct clinical care tasks	• Triangular distributions for task duration • Number of hours in "care windows" for on-time, delayed, and omitted tasks Task frequency varies by simulation: • Poisson or Bernoulli distribution for Abt simulations • Uniform distribution of time between tasks for the simulations conducted by MOSIMTEC	Original observational data and expert consultations	• Distributions held constant for all scenarios • Distribution draws vary for each replication • Care windows held constant across scenarios and replications
Indirect care time	Triangular distribution	Original observational data	• Distributions held constant for all scenarios • Values drawn from distributions vary for each replication
Break time	One 30-minute break and two 15-minute breaks per eight-hour shift	Labor regulations	• Held constant across all scenarios and replications
Travel time	Varies by simulation software: • 30 seconds per direct and indirect care instance for Simul8 • Variable walking time per direct care instance for ProModel • 30–90 seconds per direct care instance for MOSIMTEC (ProModel)	Varies by simulation software: • Assumption based on parity with ProModel and observational data for Simul8 • Walking times as a function of assumed H–shaped layout for the nursing home in ProModel	• Held constant for all scenarios (varies by simulation software) • Varies for each replication in both ProModel and Simul8
Nursing home population	Number of residents=70	Approximate median from Payroll Based Journal system	Held constant across all scenarios and replications
Resident acuity mix	Proportional representation of four acuity classes in the U.S. nursing home population	Minimum Data Set	Varied experimentally across scenarios, by resident acuity mix: • 25th percentile • 50th percentile • 75th percentile
Staffing levels	Number of licensed nurses on staff during the simulated day	State-level regulations consulted for initial levels	Varied experimentally across scenarios: • 1–10 licensed nurses, shifts of eight hours each

F.1.3 Observational Data Collection

Direct observation of nursing care provided simulation input parameters on the frequency and duration of clinical care tasks for residents. Observations focused on the time it took for licensed nurses to perform six types of core clinical tasks: medication passes, resident assessments, wound care, catheter and device care, collecting lab specimens, and ventilator management. The study team also measured preparation time for each task. These direct observations of typical tasks performed by licensed nurses provide an objective metric of nursing home resident care needs.

The Staffing Study team observed 8,249 unique care tasks in a purposive sample of 20 nursing homes over a six-week period in September and October of 2022. Included nursing homes were distributed across seven states in the Northeast, South, and West U.S. Census regions. At each nursing home, two observers spent five days on site collecting data. Each day, observers shadowed a single nurse on an 8- to 12-hour shift. For the first week of observations, both observers shadowed the same nurse, enabling calculation of inter-rater reliability between observers. Data were collected on a mix of weekdays and weekends, but ultimately only weekday data were used in the simulation. Observers shadowed nurses during different shifts and throughout different times of the day. Observations were generally tracked from 5 a.m. to 9 p.m. and did not include some hours contained within overnight shifts, when residents were presumably asleep. More than two-thirds of observed care tasks (n=5,624, or 68 percent) were conducted during day shifts (typically between 7am and 3pm).

Observation Sites

The study team partnered with two Quality Improvement Network–Quality Improvement Organizations (QIN-QIOs)—Alliant Health Solutions and TMF Health Quality Institute—to identify nursing homes to participate in the on-site observations. The Staffing Study collected observational data only from high-quality nursing homes, those with a four- or five-star Nursing Home Care Compare rating in September 2022. This ensured that observed times for typical care tasks would reflect time needed to deliver high-quality resident care. In addition, high-quality nursing homes typically have sufficient staffing of nurse aides (Hyer et al., 2011), reducing the likelihood that licensed nurses would be interrupted or required to assist with activities of daily living (ADL) provision during observations. Restricting data collection to high-quality nursing homes thus ensures that the observational input data reflect acceptable care quality for residents' clinical care needs.

Observation Subjects

This observational research focused on care provided by licensed nurses, including RNs and LPNs. Earlier studies have acknowledged that nurse roles vary across nursing homes, and that some level of interchangeability in terms of care planning and care activities is often present (McCloskey et al., 2015; Mueller et al., 2018). Though previous research has evaluated minimal nurse aide staffing levels needed to perform ADL care tasks (Schnelle et al., 2016), no existing simulation studies have similarly assessed minimal licensed nurse staffing levels needed to perform clinical care tasks in U.S.-based nursing homes. The Staffing Study focused on clinical care only because licensed nurses rarely contribute to ADL tasks (Schnelle et al., 2004; Schnelle et al., 2016); in addition, a minimum staffing requirement should assume cost-effective use of staffing resources, with licensed nurses dedicating their time to care tasks that nurse aides could not otherwise perform.

Observer Training and Research Instruments

The Staffing Study's QIN-QIO partners provided trained clinicians to observe and time care provision as part of nursing home observations. All clinician-observers underwent a three-hour training on hardware, software, and the clinical protocol, as well as best practices to avoid disrupting resident care while conducting observations. The study team obtained informed consent from all residents and nursing staff

for participation. The Abt Associates IRB reviewed and approved consent and data collection materials for the observations.

Data collectors used iPads with a stopwatch-type data collection software tool called TimerPro, with Excel as a backup. Ultimately 7,932 observations were collected with the TimerPro stopwatch software, with an additional 317 observations collected via the Excel backup system. Data cleaning was required to prepare the more than 8,000 observations for analysis, in part because of particularities of the TimerPro software and human data entry errors.

Observation Protocol

The study team identified a set of six clinical care tasks that licensed nurse staff generally perform, with tasks chosen for being the most frequent, most time-consuming to complete, or both:

1. Medication pass
2. Resident assessment
3. Wound care
4. Catheter and device care
5. Collecting lab specimens
6. Ventilator management

The intention was to capture the majority of direct care tasks for which licensed nurses are responsible. In consultation with four licensed nurses and physicians with experience in nursing homes and/or acute care settings, the study team developed clinical protocols with definitions for each of these care types. These detailed protocols ensured consistency during observational data collection, such as excluding instances when care tasks were performed by external providers such as phlebotomists.

Observers also collected data on the preparation time for each task. For instance, licensed nurses often prepare a cart for a medication pass for their residents in advance. Preparation time was measured, including time spent donning and doffing personal protective equipment, as was the number of residents for whom preparations were made. Once a nurse began providing care to an individual resident, all time required to acquire additional supplies or medications was included in the total time for care provision to that resident. **Exhibit F.2** summarizes the number and frequency of observations for each direct care activity, including prep time.

Exhibit F.2: Number and Frequency of Observations by Licensed Nurse Activity

Clinical Care Activity	Task	Number of Observations	Percentage of Observations
Medication pass	Direct care	2,989	36.20%
	Preparation	2,715	32.90%
Resident assessment	Direct care	1,177	14.20%
	Preparation	577	7.00%
Wound care	Direct care	265	3.20%
	Preparation	230	2.80%
Catheter/device care	Direct care	119	1.40%
	Preparation	77	0.90%
Collecting lab specimens	Direct care	54	0.70%
	Preparation	42	0.50%
Ventilator management	Direct care	1	0.01%
	Preparation	3	0.04%

In addition to direct clinical care, RNs and LPNs perform many indirect care tasks that require advanced training, such as care planning, nutritional planning, and care coordination with doctors and other care providers. Indirect care involves additional tasks that licensed nurses must complete on behalf of residents during their shift while they are physically away from the resident. The study team elected not to measure indirect care via observation, given the ambiguity involved in defining indirect care tasks, concerns over inter-rater reliability, and concerns that frequent task switching could affect data quality. Instead, the study assumes that any time a nurse was not engaged with direct care, preparation time, travel, or breaks was devoted to indirect care.

Inter-rater Reliability

To measure inter-rater reliability, two observers followed the same nurse each day during the first week of data collection, September 27 to October 3, 2022. The team then quantified the inter-rater reliability for two measurements: care task type and duration. First, the team measured the percentage of time that the two observers categorized the *care task type* similarly, using percentage agreement and Cohen's Kappa. Results show 79.5 percent agreement and a Cohen's Kappa equal to 0.728, indicating substantial agreement between the two observers (Cohen, 1960, 1968; Fleiss et al., 1969). Second, the team quantified the inter-rater reliability by calculating the intraclass correlation coefficient for the agreement between the two observers' recorded *duration* of care (Bartko, 1966; McGraw & Wong, 1966; Shrout & Fleiss, 1979). For this measurement, the intraclass correlation coefficient is equal to 0.72, which shows high consistency between the two observers.

F.1.4 Secondary Data Sources

In addition to the clinical care task duration measures developed from the primary observational data described above, the simulation used parameters from secondary data sources for the nursing home resident census (i.e., the number of residents in the nursing home) and for resident acuity (i.e., the extent of residents' clinical and other care needs).

In particular, the study team used fourth-quarter extracts from Minimum Data Set (MDS) Active Resident Episode Table (MARET) data from 2012 through 2021 to construct resident acuity classes. The MARET data contains a single record per year for each resident in a Medicare- or Medicaid-certified nursing home on December 31 of the given year who had not been discharged and who had had an assessment within the last 150 days. If the initially selected assessment was an entry record, and therefore contained no clinical data, the next assessment for that resident in the following calendar year was selected as a replacement, provided that the assessment was conducted prior to February 28 of the following year; otherwise, residents were dropped from the sample. The study team used clinical information from the MARET data to construct the acuity classes, as discussed in the following section, F.1.5 Resident Acuity Classes.

The study team used Payroll Based Journal (PBJ) data to inform the simulation parameter for the number of residents within each simulated nursing home. Using the MDS resident census as reported in the PBJ data for January 1, 2021, to March 31, 2022, the team estimated the daily median resident census across nursing homes to range between 64 and 70 residents, with approximately 70 residents being the most common median. Thus, the team assumed the nursing home census was 70 residents for each simulation. The team additionally used reported PBJ hours by staff type to validate its simulation output (see Appendix F.2 Simulation Modeling Detailed Results and Discussion).

Additionally, the team reviewed state-level regulations on nursing home staffing standards (Consumer Voice, 2022) to inform initial staffing parameters. Regulatory information was also the source of assumptions on nurse break times, such as the minimum length of meal period, as required under state law for adult employees in the private sector (Wage and Hour Division, 2022).

F.1.5 Resident Acuity Classes

Clinical information from the MARET data was used to construct four resident acuity classes. Though much of the Staffing Study approach was influenced by Schnelle's (Schnelle et al., 2016) prior work with certified nursing assistants (CNAs), the current research question required a slightly different acuity approach, namely in identification of acuity. Schnelle evaluated CNA staffing requirements, and a CNA's primary role is to manage residents' ADL care needs. Thus, the acuity classes that CNAs would treat varied by the magnitude of ADL care needs. Using the ADL items from MDS, Schnelle (Schnelle et al., 2016) identified seven ADL acuity classes and estimated the proportions of each class. Because the Staffing Study research question investigates licensed nurse staffing requirements, the team identified acuity classes based on direct clinical care needs rather than on ADL needs.

As shown in **Exhibit F.3**, the team used MDS items to estimate the proportion of residents in each acuity class. For medication pass (MP) & resident assessment (RA) tasks, almost all residents received daily care regardless of acuity. Thus, to differentiate between residents, the study team assumed acuity would depend on the specific types of medications the residents have taken in the past seven days. Consistent with existing literature (Umpierrez et al., 2012) the team assumed that residents requiring insulin will require more time for their care because these residents will require regular glucose monitoring and injections. Similarly, the team assumed that residents requiring antipsychotics might be more likely to exhibit behavioral problems and, as a result, might require more time for their care (Dys & Carder, 2022; Ma et al., 2020). Lastly, the team assumed that residents taking five or more drug classes exhibit both polypharmacy and multiple comorbidities, which would suggest that more time for care is needed (George et al., 2004; Boyd et al., 2005). Thus, a resident was flagged as high-acuity for MP & RA if they required insulin, an antipsychotic, or five or more other drugs.

Exhibit F.3: MDS Items for Identifying Acuity Class Membership from the MARET Data

Group	MDS Item	Item Description	Qualifying Criterion*
High MP & RA	N0350A	Numbers of days insulin received in the past seven days	1 to 7
	N0410A	Number of days antipsychotic received in the past seven days	1 to 7
	N0410B, N0410C, N0410D, N0410E, N0410F, N0410G	Number of days antianxiety, antidepressant, hypnotic, anticoagulant, antibiotic, diuretic received in the past seven days	Five or more items with a value of 1 to 7
High CDC & WC	H0100A, H0100B, H0100C, H0100D	Indwelling catheter, external catheter, ostomy, intermittent catheterization used in the past seven days	Any item ≥1
	M0300B1, M0300C1, M0300D1, M0300E1, M0300F1, M0300G1	Number of Stage 2, Stage 3, Stage 4, unstageable because of non-removable dressing, unstageable deep tissue, unstageable eschar pressure injuries	Any item ≥1
	M1040A, M1040B, M1040C, M1040D, M1040E, M1040F, M1040G	Presence of infection of the foot, diabetic foot ulcer(s), other open lesion(s) on the foot, surgical wound(s), burn(s), skin tear(s) in the last seven days	Any item ≥1

Abbreviations: CDC=catheter/device care. MP=medication pass. RA=resident assessment. WC=wound care.
*Qualifying responses for any MDS item within the category indicate membership in the high-acuity group.

For catheter/device care (CDC) & wound care (WC), only about a quarter of residents required care. Thus, the team assumed that the intensity of care would depend on whether the resident needed the care, and so flagged any resident as high-acuity CDC & WC if the resident exhibited the use of a catheter or a wound that presumably required care.

After flagging, the team then estimated the proportion of residents in each of the four acuity classes (low-low, low-high, high-low, and high-high) to estimate the proportions shown later in **Exhibit F.7**. Note that these acuity classes attempt to capture distinct differences in the frequency and duration of care between different groups of residents; however, there will still be variation in frequency and duration within each acuity class. For example, a high-acuity CDC & WC resident with a Stage 2 pressure injury will likely require less care than a high-acuity CDC & WC resident with a Stage 4 pressure injury. This difference within acuity class will be captured by the variation in the duration of wound care.

By applying the above criteria to the MARET data, the team calculated the number of residents in each acuity class. The team then assumed the same share of residents appear in the simulation, modeling different care assumptions for residents in each class. The team also derived the conditional probabilities of needing catheter/device care and/or wound care from the MARET data after identifying acuity class.

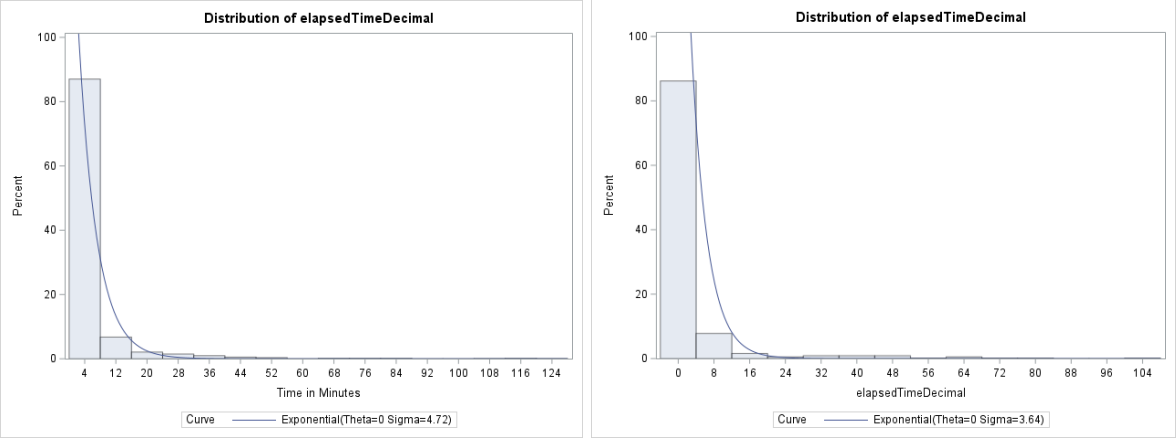
For WC and CDC, the duration and frequency of both care tasks is omitted with a degenerate distribution at zero in the low-acuity class. The high-acuity class distribution for both of these activities is estimated from the observational data.

Identifying appropriate acuity classes for the MP & RA group is not as straightforward. Resident-level information is not available, and there is not a clear acuity class indicator in the data, as there is for WC & CDC. The first step for determining acuity classes was examining the MDS and looking for variables that could be predictors of the high and low MP & RA acuity classes for a resident. Once these variables were determined, the team calculated the percentage of residents in the MDS that fell into the high- and low-acuity classes. This was 36.3 percent for the high MP & PA acuity class, and 73.4 percent for the low.

Using the observational data, the team then fit a finite mixture model with two mixtures to the duration observations to either MP or RA. Note that separate models are fit for each of these care tasks. No attempt was made to fit a joint model for both care tasks' duration and frequency. Using this univariate model, the team attempted to determine whether the data supported two mixtures. This involved using different distributions such as normal, lognormal, and exponential for duration and examining the fit statistics to determine the "best" model. If the fit statistics supported two mixtures, then the team examined the mixing probability and checked to see whether it was near to the MDS estimated value of 36.3 percent. If yes to the preceding criterion, the team then proceeded to create a high and low distribution based on the two mixtures from the model. An additional goal was to preserve the mean from the observed data. This was done by making sure the weighted mean for the two mixtures summed to the observed mean from the collected data. However, if neither of the above two criteria were satisfied, then the team assumed that the distributions of duration for the high- and low-acuity classes were identical. The team proceeded to estimate this distribution using all the data available for that care task.

The two histograms in **Exhibit F.4** show the duration distribution for resident assessment on the left and preparation time for resident assessment on the right. An exponential distribution is fit to the data. This pattern was typical for the duration of the care types.

Exhibit F.4: Duration Distribution for Resident Assessment and Preparation Time for Resident Assessment



To determine the distribution used for the simulations for a care task, the preparation duration distribution and the care task duration distribution were combined. Estimation of preparation distribution used the same procedure that was used to estimate the duration distribution for a care task. Next, the frequency of preparation and care task in the observational data was obtained, and the ratio was used to weight the two distributions when determining the simulation distribution. In general, there is not a preparation task for every care task. Finally, travel time was added to represent traveling between the preparation area and the resident's room.

A similar exercise was used to estimate frequency for the low- and high-acuity classes for MP and RA. For frequency, however, the team used only Poisson distributions in the finite mixture model. The frequency distribution was based on the number of care tasks only and did not include any information from the preparation task. To estimate frequency, the team estimated the number of residents per nurse in a facility (the actual value was unknown).

Because MDS items do not exist for collecting lab specimens—one of the directly observed clinical tasks—the team assumed the distributions for frequency and duration of this care task are identical across all four acuity classes.

F.1.6 Simulation Software & Services

The Staffing Study team conducted analyses using two commercially available simulation software packages, ProModel and Simul8. The team considered software speed, parallelization capability, availability of documentation, reputation, quality assurance, cost, and direct applicability to the nursing home staffing use case in selecting simulation software. The team selected two simulation software partners rather than one to allow comparison of results between different approaches for validation and quality assurance purposes.

Simulating Tasks

Broadly, each simulation approach followed a similar design: simulations of randomly generated tasks needing to be performed by nurses, the number of whom was set in staffing parameters prior to the start of each simulation run. Tasks generated by the simulation included direct clinical care tasks, indirect care tasks, travel time, and breaks. Scheduling for each type of task was governed by a combination of rules and random processes. For example, break times are given highest priority in the queue; this ensures that in every simulation, each nurse is taking their mandated break time in compliance with relevant workplace regulations. As another example, the number of needed medication passes for a resident on a

given day was drawn from a Poisson distribution, with each medication pass occurring at randomized points within scheduled windows. This ensured the simulation would vary the precise timing and order of events while still spacing medication passes throughout the day.

When the scheduled time for a care task arrived, a brief period of travel time would ensue, after which a nurse would perform the care task, including time for preparation. This was represented in the simulations by the nurse remaining in one place for the length of time required to perform care. The duration of each direct care instance was drawn randomly from a triangular distribution informed by the observational data collection results. Nurses could perform only one task at a time.

Measuring Delayed and Omitted Care Outcomes

Delays and omissions of care were determined based on input parameters called care windows. Each care task was assigned a care window during which the care would ideally be performed. For example, medication passes had a care window of two hours, so if a resident had medication due at 4 p.m., then the care would be considered completed on time if it was begun between 4 p.m. and 6 p.m.. Care begun after 6 p.m. in this example would be considered delayed. If not begun within an additional two hours, by 8 p.m., the care would be considered omitted.

Quality Assurance

When developing the simulation software, the Staffing Study team deployed a three-part strategy for ensuring consistent simulation approaches (ProModel versus Simul8). This strategy consisted of a requirements document, simulation-specific designs, and cross-software testing.

First, the requirements document specified output, nursing home-level input parameters, direct clinical care and indirect care parameters, and reporting requirements. The primary outcomes specified in the requirements document are delayed and omitted care for each staffing ratio. For direct clinical care tasks, the team assumed each task required a frequency of occurrence and a duration of care. The parameters for frequency and duration were drawn from the collected observational data and are discussed in the next sub-section.

Next, the team tested that the behavior of ProModel and Simul8 simulations aligned, by running test simulations with each using a set of input parameters that were fixed to known constants (degenerate distributions). Unlike the actual simulation runs, events in this scenario are not randomly generated, as all events have the same expected frequency and duration. The ProModel and Simul8 teams verified that each test simulation was producing the expected number of events for each care type given these fixed frequencies. The two teams then compared output to ensure that ProModel and Simul8 were producing the same results in number of instances of omitted and delayed care for each care type. This process was repeated for several sets of constant input parameters. The two teams also compared results when input parameters allowed a small amount of variation.

In addition to verifying that the models' behavior was true to the specifications and to each other, the process of comparing across models highlighted differences in the assumptions and method of operation between ProModel and Simul8. For example, examining time series output of both models demonstrated that ProModel allowed travel time to vary whereas Simul8 held travel time constant. This was particularly striking when many residents had care instances scheduled at the same time, as in some of the constant-input scenarios used for testing, because ProModel nurses would move from one room to the adjacent room, resulting in a very short travel time, whereas Simul8 nurses would always take 30 seconds in between care deliveries.

On the other hand, ProModel simulated nurses—unlike Simul8 simulated nurses—spent some time on travel, even when care was omitted, because of a limitation of the ProModel software that made it impossible to mark care as omitted unless a nurse arrived to mark it as such. Though the accumulation of

travel time to omit care was typically very small for each care instance, and thus unlikely to make a difference with realistic simulation inputs, some of the more extreme testing scenarios revealed that it could add up to approximately 10 minutes of simulation time when 70 care instances were omitted in a row.

Finally, Simul8 direct care events were addressed by nurses exactly in the order in which they were scheduled. ProModel nurses did this in many cases, as well; but when a ProModel resident had two or more direct care events due or overdue at once, the resident would prioritize requesting whichever of those events would soonest reach the end of its care window, regardless of the time that event had been originally scheduled to start.

As an additional quality assurance step, the Staffing Study procured the services of MOSIMTEC, a professional simulation modeling consulting firm. To verify robustness of results, MOSIMTEC built a third simulation, also using ProModel software, so that its output could be compared to the two simulations that the Staffing Study team built. The MOSIMTEC team made several technical decisions that differed from the Staffing Study ProModel team's decisions, including the following:

1. MOSIMTEC used a uniform distribution of travel time, whereas the Staffing Study ProModel team used a floorplan-based model in which travel time varied as a function of distance.

2. MOSIMTEC scheduled care based on uniform distributions of the amount of time between care instances, whereas the Staffing Study ProModel team used Poisson and/or Bernoulli distributions of care frequency.

3. MOSIMTEC modeled care instances directly as entities, with a frequency adjusted to reflect a census of 70 residents, whereas the Staffing Study ProModel team modeled residents as entities and modeled care instances as requests submitted by those entities.

Especially given the differences in underlying assumptions, comparing results across these models and analysis teams provides additional confidence that models are performing as intended.

F.1.7 Simulation Parameters

Simulation parameters are the inputs of the simulation, such as distributions of care task duration and nursing home characteristics. For the simulation, the team gathered data on input parameters of the following types: direct clinical care tasks, indirect care tasks, break time, travel time, nursing home population, and resident acuity. This section describes precisely how each simulation parameter was derived.

The Staffing Study team solicited feedback from nurses in several nursing homes previously participating in observational data collection. For each clinical care task, the team shared minimum, maximum, and mode duration values from the observational data with the nurses who volunteered to give feedback. Feedback sessions were conducted by videoconference on November 9 and November 14, 2022. Nurse feedback confirmed these measures were representative of their own professional experience and in turn reasonable for use to inform simulation parameters.

Additional nurse feedback during these sessions centered around the limitations of discretizing complex care for which nurses are required to multitask while also providing compassionate care to residents in their primary living quarters. The participating nurses also said that indirect care often includes informal consolations and conversations with a resident's family members and other important social interactions. Though the Staffing Study simulations combined social interactions with other forms of indirect care, the study team acknowledges this limitation. Several nurses (who all came from high-quality nursing homes) expressed the hope that the proposed staffing ratios would enable them to continue to provide personalized, high-quality care to residents.

Weekday vs. Weekend Staffing

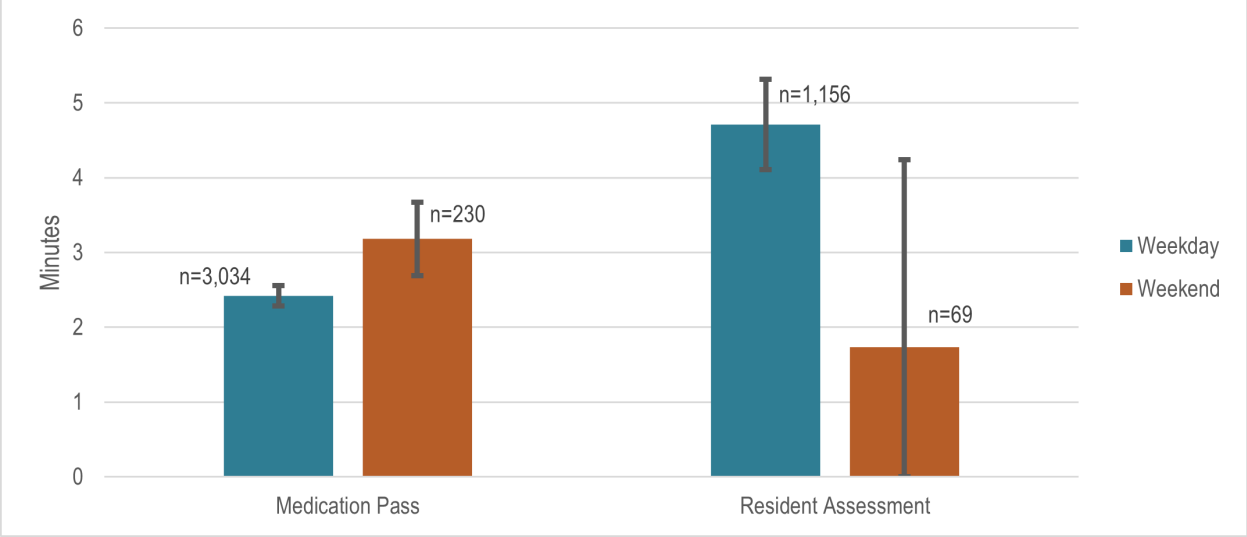
The simulation does not differentiate its parameters based on observed differences in weekday versus weekend staffing: instead, *only weekday data were used to compute care parameters*. There are differences in staffing ratios in nursing homes for weekends versus weekdays (Geng et al., 2019), and such variability is highly related to quality measures (Mukamel et al., 2022). In fact, the empirical evidence points towards worse care outcomes on the weekends because of the staffing discrepancies. For example, weekends predicted more serious falls and increased hospital transfers for women nursing home residents (Büchele et al., 2014) and increased use of physical bed restraints (Bourbonniere et al., 2003).

Beyond this, nursing homes often attempt to overcome this discrepancy by using staffing agencies, but this approach is also associated with overall worse quality outcomes (Castle et al., 2008). In hospital settings, the weekday/weekend staffing discrepancy is significantly related to higher mortality for residents with serious medical conditions admitted on weekends (Bell & Redelmeier, 2001).

For this reason, the Staffing Study team relied only on observations completed on weekdays to ensure the parameters reflected a high level of care quality rather than care performed with fewer or outsourced agency staff on a weekend.

Exhibit F.5 shows the mean duration for medication pass and resident assessment for the weekend and for weekdays. These durations are statistically different, with medication pass duration increasing on the weekend and resident assessment decreasing. The black bar indicates the 95 percent confidence interval; for resident assessment, this confidence interval contains 0.0. Though there does appear to be sufficient weekend data for medication pass, the amount of weekend data available for the remaining four care tasks was insufficient to accurately estimate a distribution suitable for simulation purposes.

Exhibit F.5: Mean Duration of Care Tasks by Weekday vs. Weekend



Direct Clinical Care Parameters

The simulations define each instance of direct care as the time a licensed nurse spent on a single clinical care task, including preparation time and travel time. The Staffing Study team specified requirements for five out of six observed direct clinical care tasks. Ventilator care was excluded from the simulation models because of the very low number of observations in the data (n=4). The simulation does not differentiate its parameters based on observed differences in weekday and weekend staffing: instead, only weekday data were used to compute care parameters.

Task Duration

The simulations use an augmented triangular distribution for the duration of a given direct care instance. Generally, triangular distributions are used in DES when data collection is limited and data are able to be collected only qualitatively (e.g., through interviews). Because of data privacy and cybersecurity constraints,[1] the team was not able to use the empirical data distributions in the simulations. Initially the team planned to use empirical triangular distributions instead, with observed minimums, maximums, and modes defining the distributions. However, the team discovered that using observed minimums and modes resulted in distributions that differed significantly from the observed empirical data distributions. Therefore, minimums were set at the 5th percentile level to broadly exclude observations of less than approximately 10 seconds, which were presumed to be data entry errors. The mode was set approximately equal to the minimum to create a triangular distribution that matched that extremely left-skewed distributions of care duration. Maximums were set to equal the mean multiplied by three, which removed outliers in the long tail of the distributions of care duration.

Most care type duration distributions showed a heavy right skew and could be well approximated by an exponential distribution or a lognormal distribution. Converting this type of distribution to a triangular distribution and preserving the moments was problematic, as it required making the minimum value negative and therefore unacceptable for purposes of simulating care tasks durations. The team's solution was to attempt to preserve the mean of the duration distribution and keep the variance as close as possible to what was observed in the data. For a triangular distribution, the mean is equal to the average of the minimum, mode, and maximum. To preserve the mean, the minimum and mode are set equal, as described above, and the maximum equal to three times the mean (minus the minimum and mode). The overall result is that the expected duration of a care task for the simulations is equal to what is observed in the TimerPro data. However, the use of the triangular distribution makes it impossible to simulate events that have long duration times.

Task Frequency

For the frequency of clinical care activities that could occur more than once per shift or day—medication passes, resident assessments, and catheter/device care—the team chose to use the Poisson distribution, as it is a commonly used distribution for modeling occurrences. The Poisson allows for multiple visits and can correctly model situations where an activity is rarely performed.

For the frequency of clinical care activities that could occur at most once during a shift or day, the Staffing Study team used Bernoulli distributions to ensure a maximum of one occurrence. Activities whose frequency was determined with Bernoulli distributions included wound care and collecting lab specimens.

The MOSIMTEC simulation team determined frequency of clinical care activities based on uniform distributions of interarrival time instead of generating a number of occurrences directly.

Care Windows

Finally, each clinical care task was assigned a care window to be used in determining delayed and omitted care. Periods of time referred to as "care windows" were assigned first for the on-time completion of a given task. The delayed care window is the period of time after the one-time care window has expired in which a simulated nurse can still carry out a care task without it being classified as omitted. For example, a medication pass carried out after three hours would be considered delayed care: the on-time care

---

[1] All observational data generated by this research was considered sensitive; therefore, the study team was unable to transfer or use the data measurements outside of a FISMA Moderate environment. Because the simulation software that was used for this work was not able to be fully evaluated for cybersecurity risk given the project's compressed timeline, the Staffing Study team opted to use only aggregated data as inputs for simulation.

window for medication passes is two hours in duration, and hour three is within the delayed care window. The care windows for the six tasks are shown in **Exhibit F.6**.

Exhibit F.6: Input by Clinical Care Task and Parameter

Direct Care Instance	Duration	Frequency (Staffing Team Simulations)	Frequency (MOSIMTEC Simulations)	On-time Care Window	Delayed Care Window	Omitted Care Window
Medication pass	Triangular distribution of observed durations	Poisson	Uniform	2 hours	0–2 hours after on-time window	>2 hours after on-time window
Resident assessment						
Wound care		Bernoulli		15 hours	N/A	Any time after on-time window
Catheter/device care		Poisson		2 hours	0–2 hours after on-time window	>2 hours after on-time window
Collecting lab specimens		Bernoulli		4 hours		

Ventilator care was excluded from the simulation models because of the very low number of observations in the data (n=4).

Other Time Parameters

Simulation parameters also included assumptions for time spent on tasks not related to direct clinical care, including indirect care, travel time, and breaks. The team used a series of informed assumptions to estimate time not spent on direct clinical care into these three categories.

First, the team noted that time in between direct clinical care tasks took two forms: short intervals and long intervals. Short intervals were assumed to be travel time. On average, these intervals approximated about 28 seconds; over the course of a shift, the data suggest that a licensed nurse spends 10 minutes per shift traveling between direct clinical care tasks. Long intervals were assumed to be either indirect care or breaks; the team further assumed, based on regulatory guidance, that breaks consisted of two 15-minute breaks and one 30-minute meal break.

For each shift, time assumed to be spent on indirect care was then defined as the total shift time not spent in direct care, less the sum of travel time and 60 minutes of breaks.

Indirect Care

Indirect care includes documentation ("charting"), communication with family members and other care providers, supervision of other staff, and coordinating admissions, among many other skilled tasks that licensed nurses perform while away from residents.

To estimate indirect care time, the Staffing Study team first used the observational data to identify residual time during each nurse's shift that was not spent on direct clinical care. To calculate a triangular distribution for indirect care time, the team first estimated the percentage of time spent on indirect care for each nurse shift in the observed data using the assumptions described above. The team used percentage rather than actual time, as shift lengths varied.

From these percentages, the team estimated the minimum, mode, and maximum of the triangular distribution, showing that roughly half of a nurse's shift is dedicated to indirect care. The triangular distribution for the amount of time spent on indirect care for a nurse in the simulations is then calculated

by multiplying these percentages by the length of the nurse's shift (e.g., by 480 minutes for an 8-hour shift or 720 for a 12-hour shift).

Travel Time

Travel time refers to the time licensed nurses spend traveling between residents or between residents and care task preparations. Based on differences in software, the team used slightly different approaches to estimate travel time in the simulations.

For the Simul8 software, the Staffing Study team assumed an expected travel time of 30 seconds for each instance of direct/indirect care. For the ProModel software, the Staffing Study team assumed an H-shaped nursing home layout with a nursing station positioned centrally, as did Schnelle (Schnelle et al., 2016), and calculated travel time as a function of distance and walking speed. Thus, travel time in ProModel varies, with a maximum time of approximately 30 seconds from the nursing station to the farthest resident location. As a result, ProModel's travel time distribution is right-skewed, with a lower mean than Simul8 but a higher maximum. As described above, the MOSIMTEC team instead used a uniform distribution for travel time in their independently conducted ProModel simulation.

Break Time

Break times in all simulations consisted of one 30-minute meal break and two 15-minute breaks per eight-hour shift based on break times required under state law for adult employees in the private sector (Wage and Hour Division, 2022).

Nursing Home Population

Whereas the median number of residents in observation sample nursing homes was 101, the simulation team opted instead to use the median resident count from the PBJ data—70 residents—as the simulation parameter for number of residents. This decision ensures the findings reflect the median U.S. nursing home, not just the purposive sample of 20 nursing homes participating in observational data collection.

Resident Acuity Mix

All else equal, nursing homes with greater proportions of residents requiring complex and/or intensive clinical care need more care time from licensed nurses. In terms of the simulation, variation in the acuity of nursing homes' resident case-mix thus affects the number of licensed nurse hours that are required per day.

Resident acuity for the population of residents within the simulated nursing homes in this study mimics that in the population of residents within U.S.-based nursing homes, as in prior work by Schnelle (Schnelle et al., 2016). First, the Staffing Study team identified four mutually exclusive acuity classes that both could influence the intensity of care provided by licensed nurses and could be approximated with items from the MDS data. Then the team used MDS data from the last decade to find the proportion of U.S. nursing home residents in each category (**Exhibit F.7**).

Exhibit F.7: Acuity Class Membership of U.S. Nursing Home Residents, 2012–2021

		Medication Pass & Resident Assessment (MP & RA)	
		Low	High
Catheter/Device Care & Wound Care (CDC & WC)	Low	49.3%	27.6%
	High	14.9%	8.2%

The simulation applies observed proportions to the 70-resident census. In other words, a simulation mimicking mean resident acuity for the population of U.S. nursing home residents as described in **Exhibit F.7** would include four types of residents by acuity class: (1) 35 low-low (low MP & RA and low CDC & WC) residents, (2) 10 low-high residents, (3) 19 high-low residents, and (4) six high-high

residents. The simulations consider acuity proportions for three different acuity mix scenarios based on the 25th, 50th, and 75th percentile acuity mixes in the MDS data. An exception was the MOSIMTEC simulation, which included only the 50th percentile acuity mix. **Exhibit F.8** shows the associated numbers of simulated residents by acuity class across these three percentile levels.

Exhibit F.8: Number of Simulation Nursing Home Residents by Acuity Class for Each Percentile

Percentile	High MP & RA High CDC & WC	High MP & RA Low CDC & WC	Low MP & RA High CDC & WC	Low MP & RA Low CDC & WC
25th	4	20	8	38
50th	5	21	9	35
75th	6	20	11	33

Abbreviations: CDC=catheter/device care. MP=medication pass. RA=resident assessment. WC=wound care.

We opted to explore three different "low" (25th percentile), "average" (50th percentile), and "high" (75th percentile) acuity mixes in the simulations. The methodology for determining the resident acuity mix is described here:

1. Calculate the expected care time per resident for all care types for each of the four acuity classes described in **Exhibits F.7** and **F.8**: Assumed simulated care by acuity class.
2. Generate 2,000,000 simulated nursing homes, randomly assigning 70 residents to the four acuity classes using the percentages shown in **Exhibit F.7**.
3. Within a simulated nursing home, multiply the number of residents in each acuity class by the expected care time.
4. Sum the expected care times over the four acuity classes to get the total expected care time for that simulated nursing home.
5. Determine a percentile for each simulated nursing home based on the expected care time.
6. For nursing homes that fall in the 25th percentile, average the number of residents in each acuity class.
7. Round these numbers to nearest integers and adjust, if necessary, so that the number of residents in the nursing home is 70. This is the resident mix for Scenario 1.

Repeat steps 6 and 7 using the 50th and 75th percentiles to create a resident acuity mix for the 50th and 75th percentiles.

Simulated care needs and durations are then assumed to vary across acuity classes (**Exhibit F.9**).

Exhibit F.9: Assumed Simulated Care by Acuity Class

<table>
<tr><th>Activity</th><th>High MP & RA
High CDC & WC</th><th>High MP & RA
Low CDC & WC</th><th>Low MP & RA
High CDC & WC</th><th>Low MP & RA
Low CDC & WC</th></tr>
<tr><td>Medication passes (frequency does not vary)</td><td colspan="2">High duration</td><td colspan="2">Low duration</td></tr>
<tr><td>Resident assessments (frequency does not vary)</td><td>High duration</td><td>Low duration</td><td>High duration</td><td>Low duration</td></tr>
<tr><td>Wound care</td><td>Expected (Pr=78.5%)</td><td rowspan="2">Omitted</td><td>Expected (Pr=77.2%)</td><td rowspan="2">Omitted</td></tr>
<tr><td>Catheter/device care</td><td>Expected (Pr=36.3%)</td><td>Expected (Pr=36.3%)</td></tr>
<tr><td>Collecting lab specimens</td><td colspan="4">Does not vary</td></tr>
</table>

Abbreviations: CDC=catheter/device care. MP=medication pass. RA=resident assessment. WC=wound care.
Pr=an abbreviation of mathematical probability expressed as a percentage.

F.1.8 Simulation Scenarios and Replications

As noted above, a "scenario" refers to a simulation with a fixed set of parameters characterizing residents and licensed nurse staff. The simulation scenarios consider three alternative resident acuity mixes (25th, 50th, and 75th percentile) and 10 possible licensed nurse staffing levels (1 to 10 nurses on duty each simulated day), for a total of 30 distinct scenarios. A "replication" refers to a single run of a specific scenario's simulated day. The study team aimed to complete 6,000 replications per scenario, with a lower bound of 2,500 replications when computational resources were a limiting factor.

To calculate an appropriate number of replications required for a reliable estimate for each scenario and staffing level, the team performed two analyses. Unlike in clinical trials with an expected effect, determining how much data is required for simulations is not yet systematic (see Mundform et al., 2011 for a discussion for Monte Carlo statistical simulations). Therefore, the team determined the number of replications to run based on a typical power analysis approach and a stability in means estimation. The power analysis estimated the required number of observations in order to statistically distinguish a rate of 10.0 percent delayed/omitted care, from either 9.0 percent or 11.0 percent. A power analysis of a hypothesis of H_0 p=.10 versus H_1 $p\neq$.10 with a two-tailed test at α=0.05 and power=0.8 reported that 6,345 replications are needed per scenario to ensure the margin of error is within 1 percent. A second analysis focused on when the running average of independent binomial draws of 10 percent from a set of 150 events converged to the true mean of 0.10 after 2,500 replications.

F.2 Simulation Modeling Detailed Results and Discussion

This section of the appendix first discusses smoothing estimates and the options table before presenting detailed results for the pooled analysis. Detailed results for Abt's Simul8 and ProModel simulations and for MOSIMTEC's ProModel simulations are then presented. Finally, limitations and future work are discussed.

F.2.1 Smoothing Estimates

The team tested various functional forms of the smoothing estimator and settled on a binomial distribution with a logit link, which converts the percentage into a log-odds metric.

This specification had the attractive property of not estimating a percentage greater than 100 for low numbers of nurse staff. The team also experimented with the form of the prediction matrix, including a

linear relationship with number of staff, a polynomial function, and a logarithmic function of the number of staff. The team found that the number of staff and its square provided the best fit to the data through a series of likelihood ratio tests.

The model takes the form of

$$g(Y_i) = b_0 + b_1 STAFF_i + b_2 STAFF_i^2$$

where Y_i is the proportion of delayed care, omitted care, or either delayed or omitted, and g is a link function that converts the proportion of delayed, omitted, or delayed/omitted care into the log-odds. **Exhibit F.10** shows the regression coefficients for the pooled simulation results.

Exhibit F.10: Regression Coefficients from Binomial Regression Models Predicting Delayed and Omitted Care for Different Staffing Levels Based on the Pooled Simulation Results

		Acuity 25th	Acuity 50th	Acuity 75th
		Estimate	Estimate	Estimate
Delayed	b0	-2.78	-2.71	-2.68
	b1	3.05	2.84	2.64
	b2	-0.87	-0.79	-0.71
Omitted	b0	0.70	0.95	1.22
	b1	0.09	-0.26	-0.58
	b2	-0.73	-0.58	-0.47
Delayed/omitted	b0	2.70	2.68	2.65
	b1	-0.62	-0.63	-0.68
	b2	-0.27	-0.24	-0.20

To convert the regression parameters (b_0, b_1, and b_2) for any metric and scenario model, the reader can enter the number of staff (as a decimal) into the following formula

$$\eta = b_0 + b_1 STAFF + b_2 STAFF^2$$

and convert the result into a percentage metric with

$$\text{Percent} = 100 \times \frac{\exp[\eta]}{1 + \exp[\eta]}$$

F.2.2 Delayed/Omitted Care Associated with Alternative Minimum Staffing Requirement Staffing Levels

The team's predicted metrics representing the expended percentage of omitted or delayed care events under alternative minimum staffing requirement options (see **Exhibit 5.1** in the main report) were based on the smoothed functions that are graphically presented in **Exhibit 4.21** in the main report. These functions use three coefficients in the log-odds scale, which are different for each outcome metric and scenario; see **Exhibit F.11** later. These coefficients are noted as b_0, b_1, and b_2, representing the intercept, coefficient for number of nurses, and coefficient for number of nurses squared, respectively, from the

following model[2] that relates the observed percentage of delayed or omitted care, P, to the number of nurses, RN:

$$\ln\left(\frac{P}{100-P}\right) = b_0 + b_1 \times RN + b_2 \times RN^2$$

As the smoothed function uses the number of RNs as the predictor, this metric is converted into the hours per resident day (HPRD) metric with

$$HPRD = RN \times \frac{24}{70}$$

And the predicted value of delayed/omitted care for any HPRD is

$$\hat{P}(HPRD, b_0, b_1, b_2) = 100 \times \frac{\exp\left[b_0 + b_1 \times \left(x \times \frac{70}{24}\right) + b_2 \times \left(x \times \frac{70}{24}\right)^2\right]}{1 + \exp\left[b_0 + b_1 \times \left(x \times \frac{70}{24}\right) + b_2 \times \left(x \times \frac{70}{24}\right)^2\right]}$$

Each row in **Exhibit F.11** represents a predicted percentage of delayed or omitted care associated with a particular staffing level.

To compute averages for the options table (see **Exhibit 5.1** in the main report), the team used the frequencies associated with each staffing level in the PBJ data for 2022Q2 as a weight, w, to compute a weighted average of the set of predictions. The weighted average for a set, S, of HPRD levels is then

$$\hat{\mu}_{S|b_0,b_1,b_2} = \frac{\sum_{HPRD} w_{HPRD} \hat{P}(HPRD, b_0, b_1, b_2)}{\sum_{HPRD} w_{HPRD}}$$

For scenarios in which a subset of facilities would need to increase staffing levels, the team replaced the current predictions with predictions associated with the higher staffing level for that subset and recomputed the weighted average.

F.2.3 Pooled Results

As there is no "ground truth" against which to evaluate the results of the ProModel and Simul8 simulations, the team provides pooled results combining metrics from both. The weighting procedure gave each replication a weight equal to the inverse of the number of replications per staffing level and scenario. Thus, the total weight for each software for each staffing level and nurse sums to one. This weighting procedure was important for the smoothing averages, as the team combined data from ProModel and Simul8 to estimate statistical models.

Why not conduct a meta-analysis? Abt used two different simulation models to estimate the percentage of omitted and delayed care. One of these models used ProModel and one used Simul8. Each model used the same set of input parameters derived from the observational data Abt collected. For purposes of inference, the team would wish to determine which model has the "best" fit to the actual system (nursing home).

---

[2] Note that the smoothing model for the combined delayed or omitted care was estimated separately, and thus the predictions for delayed or omitted care will not exactly replicate the sum of the prediction for delayed care and the sum of the predictions for omitted care.

Unfortunately, standard methods used to select models, such as fit statistics, validation, or likelihood-based methods, are not applicable to the simulation study that Abt conducted. This prevented the team from selecting a "best" single model or conducting a variance-weighted average of the results from the three different models. **Exhibit F.11** shows delayed and omitted care outcomes at intervals of 0.1 licensed nurses on staff.

Exhibit F.11: Predicted Delayed and Omitted Care Percentages for Different Staffing Levels Based on a Second-degree Binomial Model Fitted to the Pooled Results

	Delayed			Omitted			Delayed or Omitted		
Staff per 70 Residents	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th
1 licensed nurse (0.34 HPRD)	35.2	34.2	32.2	51.5	52.6	54.4	86.0	85.9	85.4
1.1 licensed nurses (0.38 HPRD)	38.0	36.9	34.8	47.9	48.9	50.5	84.5	84.5	84.0
1.2 licensed nurses (0.41 HPRD)	40.5	39.3	37.1	44.0	45.0	46.4	82.8	82.8	82.4
1.3 licensed nurses (0.45 HPRD)	42.6	41.4	39.2	39.8	40.8	42.1	80.8	81.0	80.6
1.4 licensed nurses (0.48 HPRD)	44.3	43.1	41.0	35.4	36.4	37.7	78.6	78.9	78.6
1.5 licensed nurses (0.51 HPRD)	45.6	44.5	42.4	30.9	32.0	33.3	76.2	76.6	76.4
1.6 licensed nurses (0.55 HPRD)	46.5	45.4	43.5	26.5	27.7	28.9	73.4	74.1	74.0
1.7 licensed nurses (0.58 HPRD)	46.9	46.0	44.3	22.2	23.6	24.8	70.4	71.2	71.3
1.8 licensed nurses (0.62 HPRD)	46.9	46.2	44.7	18.3	19.7	20.9	67.0	68.1	68.4
1.9 licensed nurses (0.65 HPRD)	46.5	46.0	44.8	14.7	16.1	17.3	63.3	64.7	65.3
2 licensed nurses (0.69 HPRD)	45.6	45.4	44.6	11.6	13.0	14.2	59.3	61.0	61.9
2.1 licensed nurses (0.72 HPRD)	44.3	44.5	43.9	8.9	10.3	11.4	55.1	57.1	58.3
2.2 licensed nurses (0.75 HPRD)	42.6	43.1	43.0	6.7	8.0	9.0	50.7	53.0	54.5
2.3 licensed nurses (0.79 HPRD)	40.5	41.3	41.7	5.0	6.1	7.1	46.1	48.7	50.5
2.4 licensed nurses (0.82 HPRD)	38.0	39.3	40.0	3.6	4.6	5.4	41.4	44.3	46.5
2.5 licensed nurses (0.86 HPRD)	35.1	36.8	38.1	2.6	3.4	4.1	36.8	39.8	42.4
2.6 licensed nurses (0.89 HPRD)	32.0	34.1	35.9	1.8	2.5	3.1	32.2	35.5	38.3
2.7 licensed nurses (0.93 HPRD)	28.7	31.2	33.4	1.3	1.8	2.3	27.9	31.2	34.2
2.8 licensed nurses (0.96 HPRD)	25.3	28.0	30.7	0.9	1.3	1.7	23.9	27.1	30.3
2.9 licensed nurses (0.99 HPRD)	21.8	24.8	27.8	0.6	0.9	1.2	20.1	23.4	26.6
3 licensed nurses (1.03 HPRD)	18.5	21.6	24.9	0.4	0.6	0.9	16.8	19.9	23.2
3.1 licensed nurses (1.06 HPRD)	15.3	18.4	21.9	0.2	0.4	0.6	13.9	16.7	19.9
3.2 licensed nurses (1.1 HPRD)	12.4	15.4	19.0	0.2	0.3	0.4	11.3	13.9	17.0
3.3 licensed nurses (1.13 HPRD)	9.8	12.7	16.2	0.1	0.2	0.3	9.1	11.5	14.4
3.4 licensed nurses (1.17 HPRD)	7.6	10.2	13.5	0.1	0.1	0.2	7.3	9.4	12.1
3.5 licensed nurses (1.2 HPRD)	5.8	8.0	11.1	0.0	0.1	0.1	5.8	7.6	10.0
3.6 licensed nurses (1.23 HPRD)	4.3	6.2	9.0	0.0	0.1	0.1	4.5	6.1	8.3
3.7 licensed nurses (1.27 HPRD)	3.1	4.7	7.1	0.0	0.0	0.1	3.5	4.9	6.8
3.8 licensed nurses (1.3 HPRD)	2.2	3.5	5.6	0.0	0.0	0.0	2.7	3.9	5.5
3.9 licensed nurses (1.34 HPRD)	1.5	2.6	4.3	0.0	0.0	0.0	2.1	3.0	4.5
4 licensed nurses (1.37 HPRD)	1.1	1.8	3.2	0.0	0.0	0.0	1.6	2.4	3.6
4.1 licensed nurses (1.41 HPRD)	0.7	1.3	2.4	0.0	0.0	0.0	1.2	1.8	2.9
4.2 licensed nurses (1.44 HPRD)	0.5	0.9	1.7	0.0	0.0	0.0	0.9	1.4	2.3
4.3 licensed nurses (1.47 HPRD)	0.3	0.6	1.3	0.0	0.0	0.0	0.7	1.1	1.8
4.4 licensed nurses (1.51 HPRD)	0.2	0.4	0.9	0.0	0.0	0.0	0.5	0.8	1.4
4.5 licensed nurses (1.54 HPRD)	0.1	0.3	0.6	0.0	0.0	0.0	0.4	0.6	1.1

Staff per 70 Residents	Delayed			Omitted			Delayed or Omitted		
	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th
4.6 licensed nurses (1.58 HPRD)	0.1	0.2	0.4	0.0	0.0	0.0	0.3	0.5	0.9
4.7 licensed nurses (1.61 HPRD)	0.0	0.1	0.3	0.0	0.0	0.0	0.2	0.4	0.7
4.8 licensed nurses (1.65 HPRD)	0.0	0.1	0.2	0.0	0.0	0.0	0.1	0.3	0.5
4.9 licensed nurses (1.68 HPRD)	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.4
5 licensed nurses (1.71 HPRD)	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.3
5.1 licensed nurses (1.75 HPRD)	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.2
5.2 licensed nurses (1.78 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
5.3 licensed nurses (1.82 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
5.4 licensed nurses (1.85 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
5.5 licensed nurses (1.89 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
5.6 licensed nurses (1.92 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
5.7 licensed nurses (1.95 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.8 licensed nurses (1.99 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.9 licensed nurses (2.02 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 licensed nurses (2.06 HPRD) to 10 licensed nurses (3.43 HPRD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Abbreviations: HPRD = hours per 24-hour resident day.

F.2.4 Simul8 Results

Abt's Simul8 simulation showed a drop in levels of delayed or omitted care from about 21 percent for three licensed nurses (1.03 HPRD) to 2 percent for four licensed nurses (1.37 HPRD), suggesting that an ideal staffing ratio would fall between 1.03 and 1.37 HPRD.

Smoothing Function Predictions

The simulations tested staffing levels only in increments of one licensed nurse per 8-hour shift in a 24-hour simulation day. To find the effect of intermediate levels of staffing on delayed and omitted care, the team fit a smoothing function to the data and predicted outcomes at 0.1 increments of staffing level per 8-hour shift. **Exhibits F.12**, **F.13**, and **F.14** show the smoothing function fit to the data for delayed care, omitted care, and delayed care summed with omitted care. (See also **Exhibit F.15** for a table of the numeric predictions used to generate these plots.) **Exhibit F.14** shows that delayed and omitted care falls below a frequency of 10 percent at between 3.4 and 3.7 licensed nurses, or 1.17 and 1.27 HPRD. See **Exhibit F.16** for regression coefficients from these models. (Additional details of the regression process can be found in Section F.2.3, "Pooled Results.")

Exhibit F.12: Predicted Delayed Care Across Staffing Levels Based on a Second-degree Binomial Model of the Simul8 Simulation Results

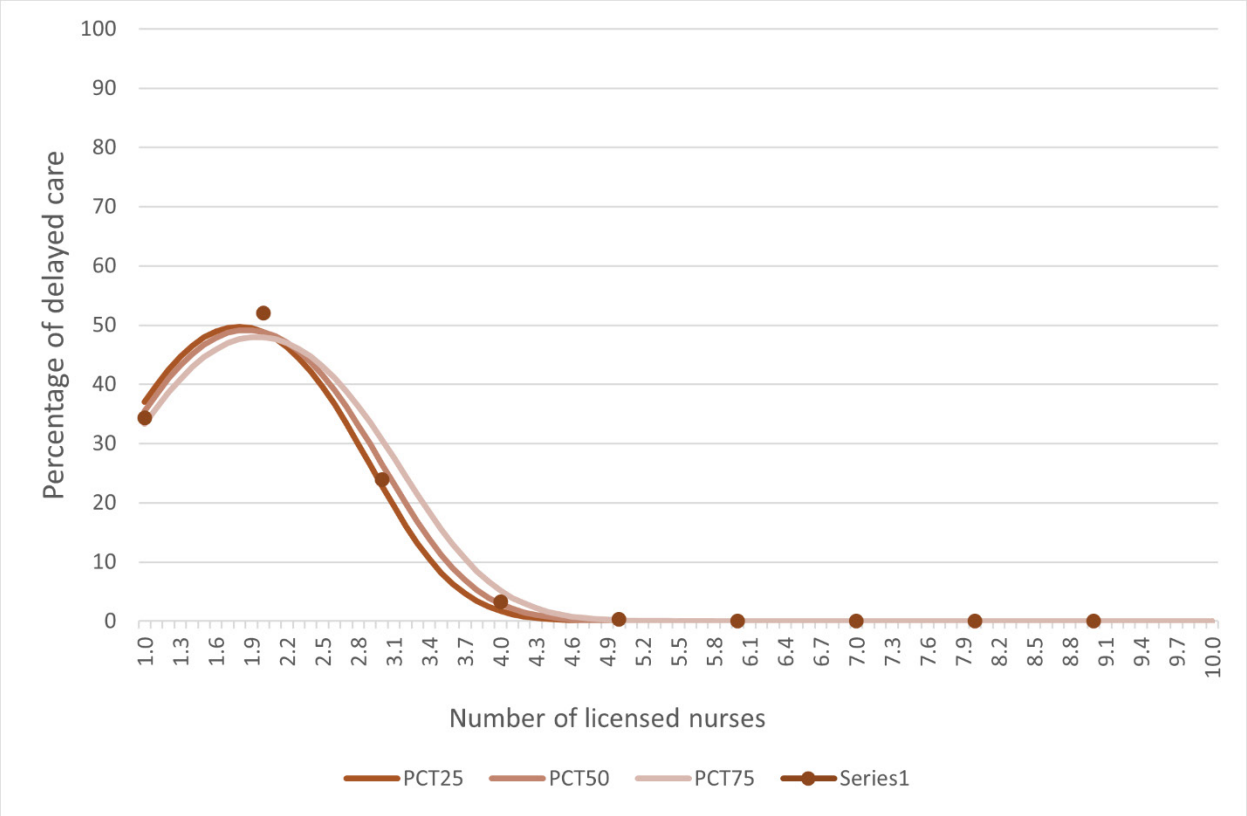


Exhibit F.13: Predicted Omitted Care Across Staffing Levels Based on a Second-degree Binomial Model of the Simul8 Simulation Results

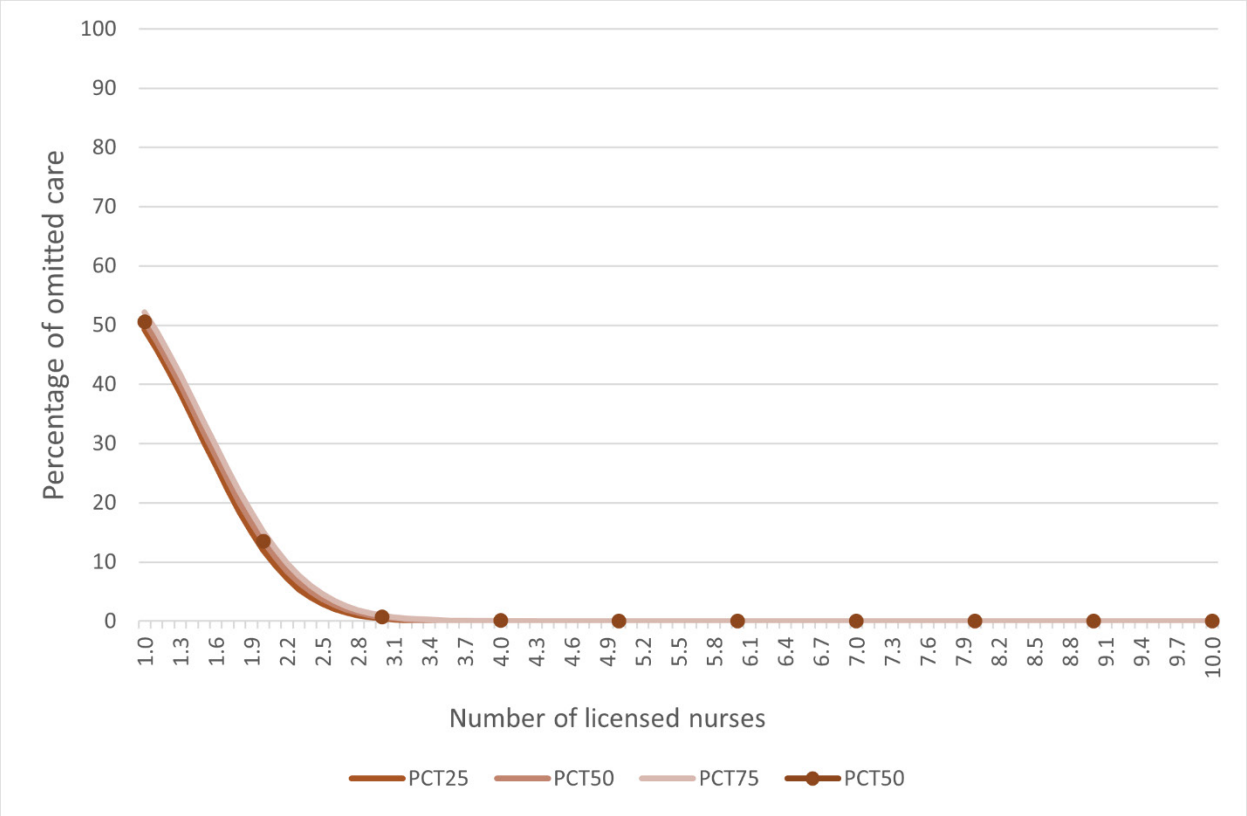


Exhibit F.14: Predicted Delayed and Omitted Care Across Staffing Levels Based on a Second-degree Binomial Model of the Simul8 Simulation Results

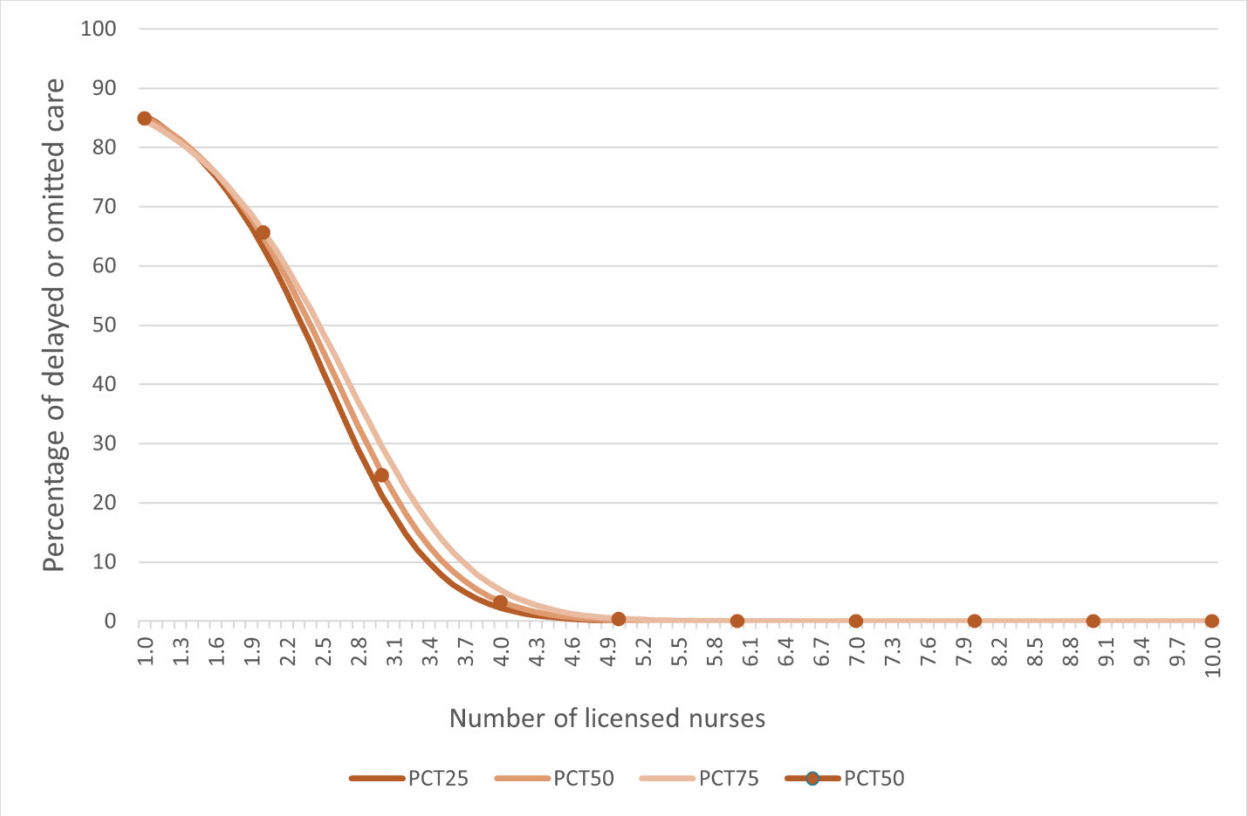


Exhibit F.15: Predicted Delayed and Omitted Care Across Staffing Levels for Each Acuity Mix Percentile Based on a Second-degree Binomial Model of the Simul8 Simulation Results

		Delayed			Omitted			Omitted or Delayed		
LN	HPRD	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th
1.0	0.34	36.99	35.48	33.32	49.21	50.58	52.22	85.41	85.18	84.51
1.1	0.38	39.9	38.36	36.09	45.92	47.27	48.92	84.18	84.03	83.41
1.2	0.41	42.48	40.95	38.63	42.32	43.69	45.35	82.79	82.73	82.17
1.3	0.45	44.69	43.22	40.9	38.46	39.87	41.57	81.2	81.26	80.79
1.4	0.48	46.52	45.14	42.89	34.42	35.88	37.63	79.4	79.61	79.24
1.5	0.51	47.93	46.7	44.56	30.29	31.82	33.6	77.37	77.75	77.53
1.6	0.55	48.94	47.88	45.91	26.18	27.76	29.57	75.09	75.67	75.62
1.7	0.58	49.54	48.69	46.93	22.2	23.82	25.62	72.53	73.35	73.51
1.8	0.62	49.72	49.11	47.62	18.46	20.07	21.85	69.69	70.77	71.19
1.9	0.65	49.49	49.16	47.97	15.04	16.62	18.34	66.55	67.94	68.64
2.0	0.69	48.84	48.83	47.99	12.01	13.51	15.13	63.12	64.83	65.87
2.1	0.72	47.78	48.11	47.66	9.4	10.79	12.29	59.39	61.46	62.87
2.2	0.75	46.31	47.02	47	7.22	8.46	9.82	55.41	57.83	59.65
2.3	0.79	44.44	45.55	46.01	5.43	6.53	7.72	51.2	53.98	56.23
2.4	0.82	42.18	43.72	44.69	4.02	4.95	5.98	46.82	49.94	52.62
2.5	0.86	39.56	41.54	43.04	2.92	3.7	4.57	42.33	45.75	48.86
2.6	0.89	36.61	39.02	41.08	2.08	2.72	3.44	37.83	41.49	45
2.7	0.93	33.38	36.21	38.82	1.46	1.97	2.55	33.39	37.22	41.08
2.8	0.96	29.96	33.15	36.3	1.01	1.41	1.87	29.09	33.01	37.15
2.9	0.99	26.42	29.91	33.56	0.69	0.99	1.35	25.03	28.95	33.27
3.0	1.03	22.87	26.56	30.63	0.46	0.69	0.97	21.26	25.08	29.51
3.1	1.06	19.41	23.19	27.58	0.3	0.47	0.68	17.83	21.48	25.92
3.2	1.10	16.14	19.89	24.47	0.2	0.32	0.48	14.77	18.19	22.53
3.3	1.13	13.14	16.74	21.38	0.13	0.21	0.33	12.09	15.23	19.4
3.4	1.17	10.47	13.82	18.39	0.08	0.14	0.23	9.79	12.61	16.54
3.5	1.20	8.16	11.18	15.55	0.05	0.09	0.15	7.84	10.34	13.97
3.6	1.23	6.23	8.88	12.92	0.03	0.06	0.1	6.22	8.39	11.69
3.7	1.27	4.66	6.91	10.56	0.02	0.04	0.07	4.88	6.74	9.7
3.8	1.30	3.41	5.28	8.48	0.01	0.02	0.04	3.8	5.37	7.98
3.9	1.34	2.45	3.95	6.69	0.01	0.01	0.03	2.93	4.25	6.51
4.0	1.37	1.73	2.91	5.19	0	0.01	0.02	2.25	3.33	5.28
4.1	1.41	1.2	2.1	3.96	0	0.01	0.01	1.71	2.59	4.25
4.2	1.44	0.81	1.49	2.98	0	0	0.01	1.29	2	3.39
4.3	1.47	0.54	1.04	2.2	0	0	0	0.96	1.53	2.69
4.4	1.51	0.36	0.72	1.6	0	0	0	0.72	1.17	2.12
4.5	1.54	0.23	0.49	1.15	0	0	0	0.53	0.88	1.66
4.6	1.58	0.15	0.32	0.81	0	0	0	0.39	0.66	1.3
4.7	1.61	0.09	0.21	0.57	0	0	0	0.28	0.5	1.01
4.8	1.65	0.06	0.14	0.39	0	0	0	0.21	0.37	0.77
4.9	1.68	0.03	0.09	0.26	0	0	0	0.15	0.27	0.59
5.0	1.71	0.02	0.05	0.18	0	0	0	0.11	0.2	0.45

Abbreviations: HPRD = hours per 24-hour resident day. LN=number of licensed nurses.

Exhibit F.16: Regression Coefficients from Binomial Regression Models Predicting Delayed and Omitted Care for Different Staffing Levels Based on the Simul8 Simulation Results

		Acuity 25th	Acuity 50th	Acuity 75th
		Estimate	Estimate	Estimate
Delayed	b0	-2.67	-2.67	-2.66
	b1	2.97	2.83	2.64
	b2	-0.83	-0.76	-0.68
Omitted	b0	0.50	0.67	0.81
	b1	0.18	-0.03	-0.18
	b2	-0.71	-0.62	-0.55
Delayed/omitted	b0	2.38	2.32	2.25
	b1	-0.31	-0.28	-0.31
	b2	-0.31	-0.28	-0.24

Simulation Results

For the 50th percentile acuity mix with a single nurse on staff (0.34 HPRD), delayed care was 34.3 percent, omitted care was 50.6 percent, and delayed/omitted care was 84.9 percent (**Exhibit F.17**). With two nurses on staff (0.69 HPRD), delayed care increased to 52.1 percent, whereas omitted care decreased to 13.5 percent. The increased delayed care is the care that was being omitted with one nurse that is now being delayed instead of being omitted with two nurses. With three nurses (1.03 HPRD), both delayed and omitted care decreased, to 23.9 percent and 0.69 percent, respectively. With four nurses (1.37 HPRD), omitted care was almost 0.0 percent and delayed care was 3.3 percent—or about five care events. Starting with five nurses (1.71 HPRD), both delayed and omitted care fall close to zero.

Exhibit F.17: Delayed and Omitted Care in Abt's Simul8 Simulation Results

	Delayed			Omitted			Delayed/Omitted		
	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th
1 licensed nurse (0.34 HPRD)	35.93%	34.3%	32.00%	49.21%	50.58%	52.22%	85.14%	84.88%	84.22%
2 licensed nurses (0.69 HPRD)	51.85%	52.07%	51.45%	12.01%	13.51%	15.14%	63.86%	65.58%	66.59%
3 licensed nurses (1.03 HPRD)	20.17%	23.9%	28.13%	0.46%	0.69%	0.96%	20.63%	24.59%	29.09%
4 licensed nurses (1.37 HPRD)	2.36%	3.27%	5.16%	0.00%	0.01%	0.02%	2.36%	3.27%	5.18%
5 licensed nurses (1.71 HPRD)	0.13%	0.28%	0.52%	0.00%	0.00%	0.00%	0.13%	0.28%	0.52%
6–10 licensed nurses (2.06 HPRD)	0.02%	0.03%	0.06%	0.00%	0.00%	0.00%	0.02%	0.03%	0.06%
7–10 licensed nurses (2.40+ HPRD)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Abbreviations: HPRD = hours per 24-hour resident day.

Descriptives

The Simul8 simulations included 6,000 replications for each of the 30 scenarios. The team kept the same random number sequence across staffing levels to ensure that the same number of care events were generated at each of the 10 different staffing levels of 1–10 nurses. On average, a total of 160 care events were generated in a 24-hour simulation day (**Exhibit F.18**). The majority of these events were medication passes (mean=106), followed by resident assessments (mean=41). Wound care, catheter/device care, and collecting lab specimens accounted for just a few events each day. With an average of 160 care events per simulation day, 10 percent delayed or omitted care would correspond to 16 events.

Exhibit F.18: Simulated Number of Care Events per Replication in Simul8

Care Type	Acuity 25th			Acuity 50th			Acuity 75th		
	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
All	**158.8**	**12.5**	**0.1**	**160.1**	**12.5**	**0.1**	**162.0**	**12.4**	**0.1**
Medication pass	106.3	10.4	0.1	105.9	10.4	0.1	105.5	10.4	0.1
Resident assessment	40.7	6.4	0.2	40.7	6.4	0.2	40.7	6.4	0.2
Wound care	5.1	1.7	0.3	5.9	1.8	0.3	7.2	2.0	0.3
Catheter/device care	5.0	2.9	0.6	5.7	3.1	0.5	6.8	3.4	0.5
Collecting lab specimens	2.3	1.2	0.5	2.3	1.2	0.5	2.3	1.2	0.5

Abbreviations: SD=standard deviation. CV=coefficient of variation, which is equal to the ratio of the standard deviation to the mean.

Because the number of residents in the High CDC & WC acuity class was higher in the 50th and 75th percentile, the average number of CDC & WC care events was also higher in those two acuity mixes (**Exhibit F.18**). This table shows that the coefficient of variation for wound care and catheter/device care was higher than for medication passes and resident assessments (CV >.2), but as shown in the top row, the total number of care tasks was consistent overall (CV =.1).

F.2.5 ProModel Results

Abt's ProModel simulation showed a drop in levels of delayed or omitted care from about 12 percent to 1 percent at between three and four licensed nurses (1.03–1.37 HPRD), suggesting, like Simul8, that an ideal staffing ratio would fall within that range.

Smoothing Function Predictions

The simulations tested staffing levels only in an increment of one licensed nurse per 8-hour shift in a 24-hour simulation day. To predict delayed and omitted care at more granular levels of staffing, the team fit a smoothing function to the data and predicted outcomes at 0.1 increments of staffing level per 8-hour shift. Plots of results for delayed care, omitted care, and delayed care summed with omitted care can be seen in **Exhibits F.19–F.21**. (See also **Exhibit F.22** for a table of the numeric predictions used to generate these plots.) **Exhibit F.21** shows that delayed and omitted care falls below a frequency of 10 percent at between 3.0 and 3.4 licensed nurses, or 1.03 and 1.17 HPRD. See **Exhibit F.23** for regression coefficients from these models. (Additional details of the regression process can be found in Section F.2.3, "Pooled Results.")

Exhibit F.19: Predicted Delayed Care Across Staffing Levels Based on a Second-degree Binomial Model of the ProModel Simulation Results

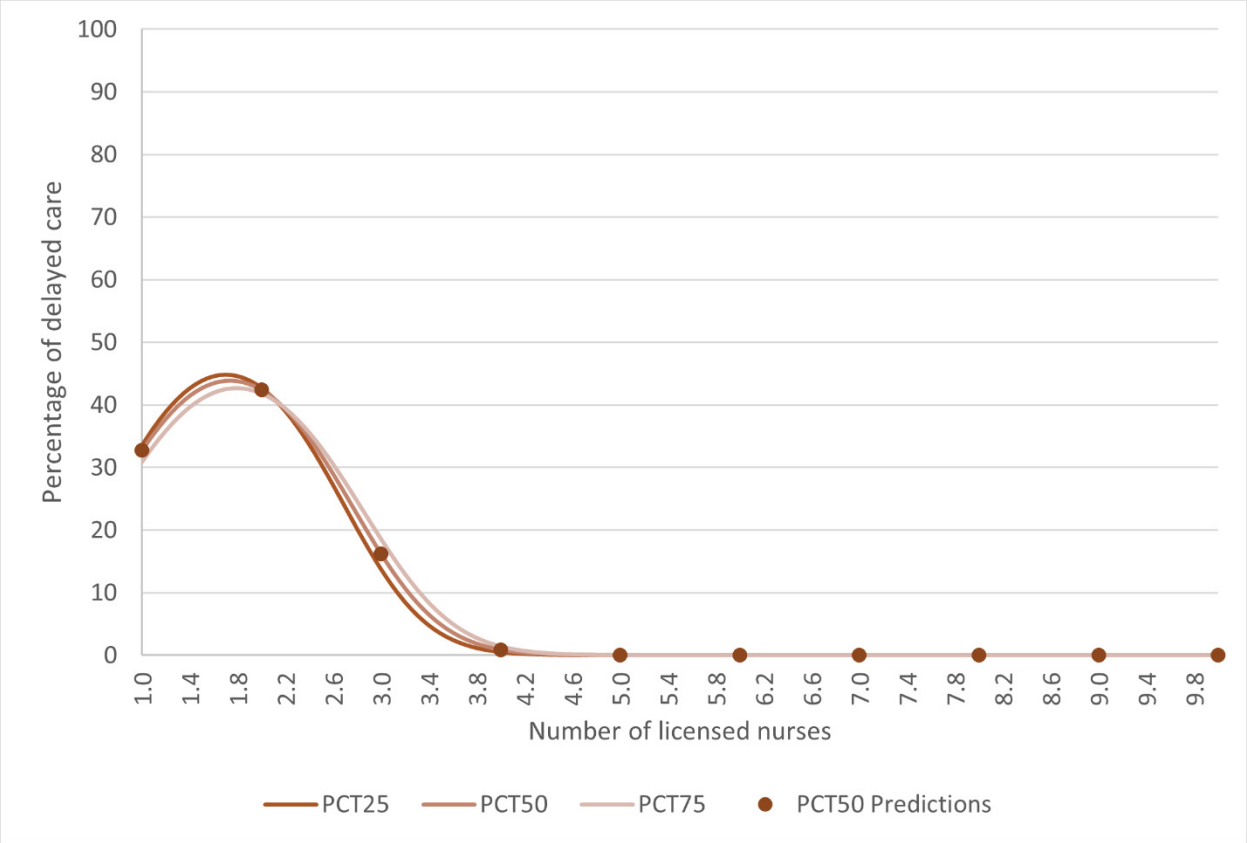


Exhibit F.20: Predicted Omitted Care Across Staffing Levels Based on a Second-degree Binomial Model of the ProModel Simulation Results

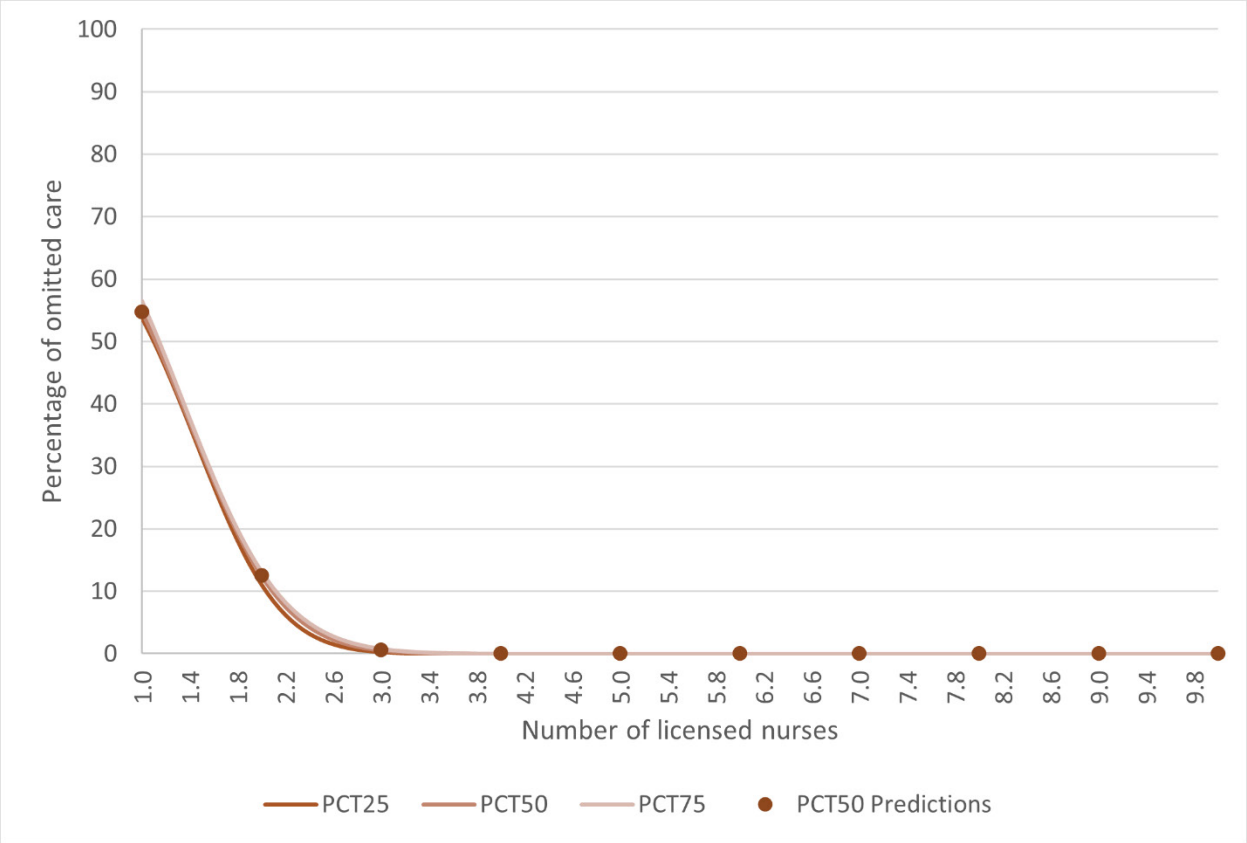


Exhibit F.21: Predicted Delayed and Omitted Care Across Staffing Levels for Each Acuity Mix Percentile Based on a Second-degree Binomial Model of the ProModel Simulation Results

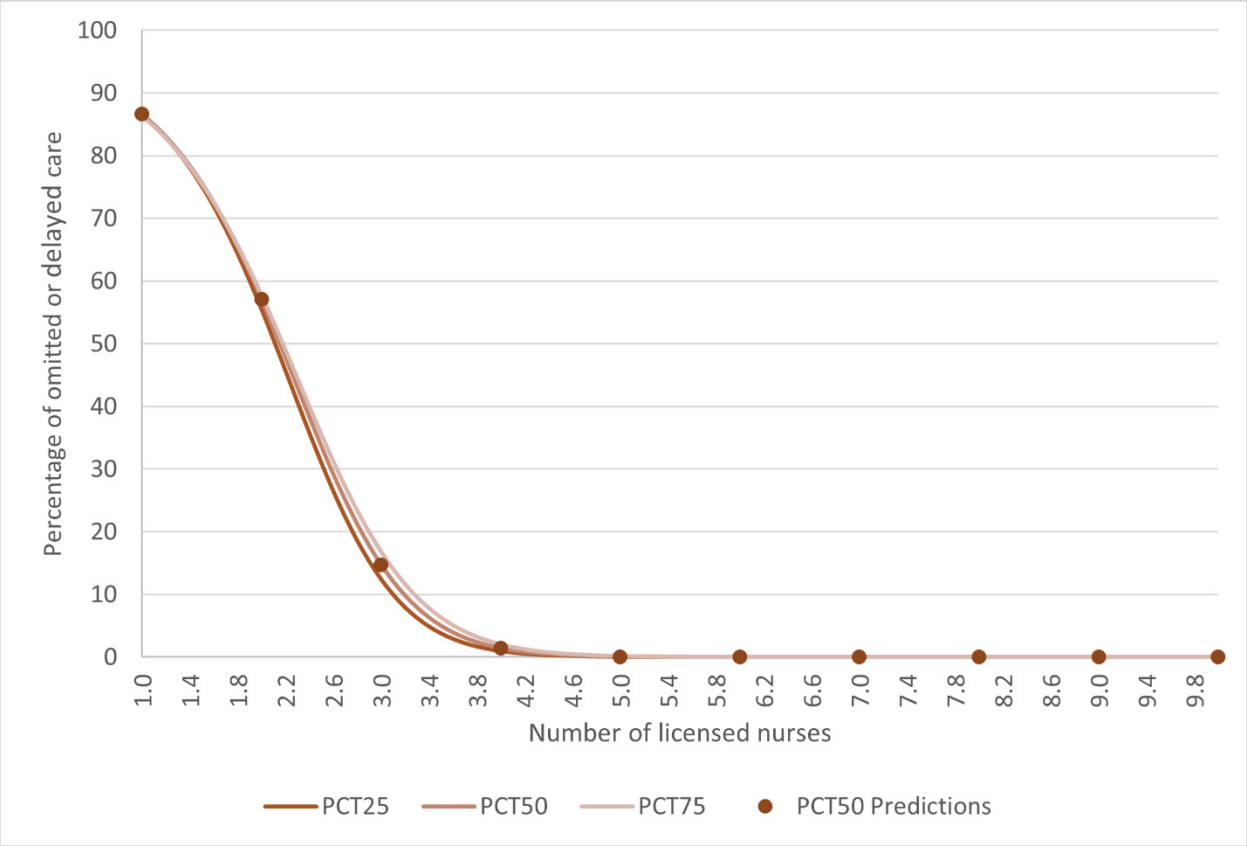


Exhibit F.22: Predicted Delayed and Omitted Care Percentages for Different Staffing Levels Based on a Second-degree Binomial Model Fitted to the ProModel Simulation Results

LN	HPRD	Delayed			Omitted			Omitted/Delayed		
		Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th
1.0	0.34	33.49	32.70	30.82	53.78	54.71	56.55	86.55	86.66	86.39
1.1	0.38	36.36	35.41	33.46	49.94	50.62	52.09	84.83	84.98	84.71
1.2	0.41	38.87	37.80	35.82	45.72	46.26	47.41	82.86	83.07	82.80
1.3	0.45	40.96	39.83	37.88	41.19	41.68	42.58	80.62	80.89	80.66
1.4	0.48	42.62	41.47	39.59	36.45	36.98	37.70	78.06	78.44	78.25
1.5	0.51	43.82	42.70	40.94	31.62	32.28	32.90	75.17	75.68	75.56
1.6	0.55	44.55	43.50	41.90	26.86	27.68	28.26	71.93	72.60	72.58
1.7	0.58	44.80	43.88	42.47	22.31	23.32	23.91	68.33	69.19	69.30
1.8	0.62	44.57	43.83	42.64	18.11	19.29	19.91	64.37	65.45	65.73
1.9	0.65	43.87	43.34	42.41	14.36	15.66	16.33	60.08	61.41	61.89
2.0	0.69	42.69	42.43	41.79	11.12	12.49	13.20	55.50	57.09	57.80
2.1	0.72	41.05	41.10	40.78	8.43	9.79	10.52	50.68	52.54	53.50
2.2	0.75	38.97	39.36	39.39	6.25	7.54	8.27	45.72	47.84	49.05
2.3	0.79	36.48	37.23	37.63	4.53	5.72	6.42	40.72	43.07	44.53

LN	HPRD	Delayed			Omitted			Omitted/Delayed		
		Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th
2.4	0.82	33.63	34.76	35.53	3.23	4.27	4.93	35.78	38.32	40.00
2.5	0.86	30.48	31.98	33.13	2.25	3.14	3.74	31.01	33.68	35.56
2.6	0.89	27.12	28.96	30.46	1.55	2.28	2.81	26.50	29.23	31.26
2.7	0.93	23.65	25.78	27.59	1.04	1.63	2.09	22.35	25.07	27.19
2.8	0.96	20.18	22.53	24.59	0.69	1.15	1.54	18.60	21.25	23.40
2.9	0.99	16.84	19.31	21.55	0.45	0.81	1.12	15.29	17.80	19.94
3.0	1.03	13.72	16.21	18.54	0.29	0.56	0.81	12.41	14.75	16.82
3.1	1.06	10.92	13.32	15.65	0.18	0.38	0.58	9.97	12.09	14.05
3.2	1.10	8.47	10.71	12.95	0.11	0.26	0.41	7.92	9.82	11.64
3.3	1.13	6.42	8.42	10.51	0.07	0.17	0.29	6.24	7.91	9.56
3.4	1.17	4.75	6.48	8.35	0.04	0.11	0.20	4.87	6.31	7.80
3.5	1.20	3.43	4.88	6.51	0.02	0.07	0.14	3.76	5.00	6.31
3.6	1.23	2.43	3.60	4.97	0.01	0.05	0.10	2.89	3.93	5.07
3.7	1.27	1.68	2.60	3.72	0.01	0.03	0.07	2.20	3.07	4.06
3.8	1.30	1.13	1.84	2.74	0.00	0.02	0.05	1.67	2.38	3.22
3.9	1.34	0.75	1.28	1.97	0.00	0.01	0.03	1.25	1.84	2.55
4.0	1.37	0.49	0.87	1.40	0.00	0.01	0.02	0.94	1.41	2.00
4.1	1.41	0.31	0.58	0.97	0.00	0.00	0.01	0.69	1.07	1.56
4.2	1.44	0.19	0.38	0.67	0.00	0.00	0.01	0.51	0.81	1.22
4.3	1.47	0.12	0.25	0.45	0.00	0.00	0.01	0.38	0.61	0.94
4.4	1.51	0.07	0.16	0.30	0.00	0.00	0.00	0.27	0.46	0.73
4.5	1.54	0.04	0.10	0.19	0.00	0.00	0.00	0.20	0.35	0.56
4.6	1.58	0.02	0.06	0.12	0.00	0.00	0.00	0.14	0.26	0.43
4.7	1.61	0.01	0.04	0.08	0.00	0.00	0.00	0.10	0.19	0.33
4.8	1.65	0.01	0.02	0.05	0.00	0.00	0.00	0.07	0.14	0.25
4.9	1.68	0.00	0.01	0.03	0.00	0.00	0.00	0.05	0.10	0.19
5.0	1.71	0.00	0.01	0.02	0.00	0.00	0.00	0.04	0.07	0.14

Abbreviations: HPRD = hours per 24-hour resident day. LN=number of licensed nurses.

Exhibit F.23: Regression Coefficients from Binomial Regression Models Predicting Delayed and Omitted Care for Different Staffing Levels Based on the ProModel Simulation Results

		Acuity 25th	Acuity 50th	Acuity 75th
		Estimate	Estimate	Estimate
Delayed	b0	-3.01	-2.89	-2.91
	b1	3.30	3.05	2.92
	b2	-0.97	-0.88	-0.81
Omitted	b0	0.84	1.22	1.63
	b1	0.08	-0.48	-0.98
	b2	-0.77	-0.55	-0.39
Delayed/omitted	b0	2.97	3.00	3.00
	b1	-0.84	-0.91	-0.96
	b2	-0.27	-0.23	-0.19

Simulation Results

Delays were defined as care that began within two hours after the care window ended, except wound care, which was counted as omitted if it began anytime after the care window. The percentage of delayed care increased from one to two licensed nurses (0.34 to 0.69 HPRD; **Exhibit F.24**), due largely to a corresponding decrease in omitted care: that is, many care instances that had been omitted with only one nurse were completed but delayed when a second nurse was added. From two to five nurses (0.69 to 1.71 HPRD), the percentage of delayed care decreased, falling below 10 percent at between three and four licensed nurses (1.03–1.37 HPRD) at all three acuity levels. No care was delayed with six or more nurses (2.06+ HPRD).

Omitted care was defined as care that began more than two hours after the care window ended, except wound care, which was counted as omitted if it began anytime after the care window. The percentage of omitted care decreased from one to four licensed nurses (0.34 to 1.37 HPRD; **Exhibit F.24**), with no care being omitted when five or more nurses were present (1.71+ HPRD).

When omitted care is summed with delayed care, the percentage of omitted or delayed care is highest with one licensed nurse (0.34 HPRD) and decreases with each additional nurse, falling below 3 percent for four nurses (1.37 HPRD).

Exhibit F.24: Delayed and Omitted Care in Abt's ProModel Simulation Results

	Delayed			Omitted			Delayed/Omitted		
	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th	Acuity 25th	Acuity 50th	Acuity 75th
1 licensed nurse (0.34 HPRD)	32.76%	31.44%	29.47%	53.78%	54.71%	56.53%	86.54%	86.15%	86.00%
2 licensed nurses (0.69 HPRD)	44.43%	46.07%	45.71%	11.12%	12.49%	13.25%	55.54%	58.56%	58.96%
3 licensed nurses (1.03 HPRD)	11.99%	12.86%	14.90%	0.29%	0.56%	0.76%	12.29%	13.42%	15.66%
4 licensed nurses (1.37 HPRD)	1.06%	1.70%	2.33%	0.00%	0.01%	0.04%	1.06%	1.71%	2.37%
5 licensed nurses (1.71 HPRD)	0.01%	0.15%	0.16%	0.00%	0.00%	0.00%	0.01%	0.15%	0.16%
6–10 licensed nurses (2.06+ HPRD)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Abbreviations: HPRD = hours per 24-hour resident day.

Descriptives

Abt's ProModel team performed simulations across all 30 scenarios; however, because of some runtime issues with the ProModel software, the number of simulation replications completed varied from 3,996 to 6,993 across scenarios (**Exhibit F.25**). Each run of the ProModel simulation used the same series of random number seeds across scenarios to ensure consistency across scenarios in the number of care events generated. However, the final numbers of care events vary somewhat across scenarios because the number of simulation replications varied across scenarios.

Exhibit F.25: Number of ProModel Simulation Replications Performed for Each Scenario

	Acuity 25th	Acuity 50th	Acuity 75th
1 licensed nurse	3,996	6,993	5,994
2 licensed nurses	4,995	6,993	5,994
3 licensed nurses	4,995	6,993	5,994
4 licensed nurses	4,995	6,993	5,994
5 licensed nurses	5,994	6,993	5,994
6 licensed nurses	3,996	5,994	3,996
7 licensed nurses	3,996	5,994	3,996
8 licensed nurses	3,996	5,994	3,996
9 licensed nurses	3,996	5,994	3,996
10 licensed nurses	3,996	5,994	3,996

The numbers of care instances per simulation replication are presented in **Exhibit F.26**, broken down by care type. On average, a total of 160.6 (standard deviation=14.1) care events were generated in a 24-hour simulated day at the 25th percentile of acuity mix, a total of 162.2 (standard deviation=14.1) were generated at the 50th percentile, and a total of 164.4 (standard deviation=13.9) were generated at the 75th percentile. The majority of these events were medication passes, followed by resident assessments. Wound care and catheter/device care, which a greater proportion of residents needed as acuity mix percentile increased, occurred at somewhat higher frequencies at higher acuity mix percentiles. The least frequent events were collecting lab specimens, catheter/device care, and wound care; these had the highest coefficients of variation.

Exhibit F.26: Simulated Number of Care Events per Replication in Abt's ProModel Results

	Acuity 25th			Acuity 50th			Acuity 75th		
Care Type	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
All	**160.6**	**14.1**	**0.1**	**162.2**	**14.1**	**0.1**	**164.4**	**13.9**	**0.1**
Medication pass	107.7	9.9	0.1	107.7	9.9	0.1	107.7	9.9	0.1
Resident assessment	41.1	6.3	0.2	41.1	6.3	0.2	41.1	6.3	0.2
Wound care	5.0	1.6	0.3	5.8	1.7	0.3	7.0	2.0	0.3
Catheter/device care	4.8	2.3	0.5	5.6	2.6	0.5	6.6	2.9	0.4
Collecting lab specimens	2.4	1.3	0.5	2.3	1.3	0.6	2.3	1.3	0.6

Abbreviations: SD=standard deviation. CV=coefficient of variation, which is equal to the ratio of the standard deviation to the mean.

F.2.6 MOSIMTEC (ProModel)

MOSIMTEC performed simulations for only the 50th percentile acuity mix (scenarios 11–20), with 200 replications for each scenario. The numbers of care instances per simulation broken down by care type are presented in **Exhibit F.27**.

Exhibit F.27: Simulated Number of Care Events per Replication in MOSIMTEC's ProModel

Care Type	Acuity 50th		
	Mean	SD	CV
All	**196.51**	**12.85**	**0.1**
Medication pass	6.30	0.98	0.2
Resident assessment	0.88	7.02	8.0
Wound care	67.53	4.30	0.1
Catheter/device care	0.39	3.86	9.9
Collecting lab specimens	116.90	5.15	0.0

Abbreviations: SD=standard deviation. CV=coefficient of variation, which is equal to the ratio of the standard deviation to the mean.

Delays were defined as care that began within two hours after the care window ended, except wound care, which was counted as omitted if it began anytime after the care window. The percentage of delayed care increased from one to two licensed nurses (0.34 to 0.69 HPRD; **Exhibit F.28**), due largely to a corresponding decrease in omitted care: that is, a number of care instances that had been omitted with only one nurse were completed but delayed when a second nurse was added. From two to five nurses (0.69 to 1.71 HPRD), the percentage of delayed care decreased, with a particularly sharp decrease from 17 percent to 4 percent between three and four licensed nurses (1.03–1.37 HPRD). No care was delayed with five or more nurses (2.06+ HPRD).

Omitted care was defined as care that began more than two hours after the care window ended, except wound care, which was counted as omitted if it begun anytime after the care window. The percentage of omitted care decreased from one to three licensed nurses (0.34 to 1.03 HPRD; **Exhibit F.28**), with no care being omitted when four or more nurses were present (1.37+ HPRD).

When omitted care is summed with delayed care, the percentage of omitted or delayed care is highest with one licensed nurse (0.34 HPRD) and decreases with each additional nurse, falling below 5 percent for four nurses (1.37 HPRD).

Exhibit F.28: Delayed and Omitted Care in MOSIMTEC Results, Averaged Across 200 Simulation Replications per Scenario

	Delayed Acuity 50th	Omitted Acuity 50th	Delayed/Omitted Acuity 50th
1 licensed nurse (0.34 HPRD)	15%	49%	64%
2 licensed nurses (0.69 HPRD)	26%	23%	49%
3 licensed nurses (1.03 HPRD)	17%	3%	20%
4 licensed nurses (1.37 HPRD)	4%	0%	4%
5 licensed nurses (1.71 HPRD)	0%	0%	0%
6–10 licensed nurses (2.06+ HPRD)	0%	0%	0%

F.2.7 Abbreviations: HPRD = hours per 24-hour resident day. Limitations

The Staffing Study team's overall approach was discussed with an external expert, Dr. Nan Kong (Purdue University). Dr. Kong noted that the approach is a valid method to estimate a snapshot of the association between nurse staffing levels and quality of care provided. Dr. Kong also validated the limitations, discussed below.

All quantitative work reduces highly complex systems into approachable models, and from those models, researchers can gain insights. Though limitations in any reduction are unavoidable, the quality of insight from models depend on the specific limitations. As the simulations are essentially experiments, one can classify limitations in terms of essential threats to validity common to any experiment (Shadish et al., 2002): construct validity, external validity, and internal validity.

Construct Validity

Construct validity refers to the extent to which the measures obtained and used in the simulation model accurately reflect the major concepts and interventions being tested. In some settings, differentiating between construct validity and internal validity is problematic (e.g., see Reichardt, 2011), but the distinction in a simulation experiment is important. The interplay of construct validity with external and internal validity concerns has implications for what can be inferred from an experiment (Jiménez-Buedo & Russo, 2021).

In the Staffing Study simulations, there are several potential limitations related to construct validity. Some relate to the outcome metrics—delayed and omitted care—and how well they proxy the broader concepts of "quality" and "safety" in nursing home care. Other limitations relate to the extent to which the observational data accurately capture the universe of clinical care needs in nursing homes that are met by licensed nurses.

As in the other analyses presented in this report, the conceptual issue at hand is how many nursing home staff are required to provide care of adequate quality and safety. The Staffing Study simulations use the rate of delayed or omitted care events as a proxy for quality and safety. However, this operationalization ignores many other aspects of high-quality health care, ranging from the biological to the social. Analyses in Section 3.1, Site Visits of the main report incorporate a broader range of quality and safety metrics, but the Staffing Study as a whole, and the simulation models in particular, cannot feasibly capture all dimensions of nursing home quality and safety that could be important to residents, families, and other stakeholders.

In addition, the simulations considered only five clinical care tasks that licensed nurses perform. At the design phase, the Staffing Study relied on expert input to develop a list of six common clinical care tasks, and the observational data collection focused on those direct care tasks exclusively. However, licensed nurses might perform hundreds of other possible clinical care tasks in nursing homes. In this sense, simulated rates of delayed and omitted care could underestimate the time needed to complete all licensed nurse clinical care tasks. Collecting data on all these tasks would have required a much larger-scale and longer-duration effort than was feasible within the accelerated Staffing Study time frame. In practice, even one of the six clinical care tasks that experts initially identified for inclusion was observed too rarely during data collection to develop a reliable duration estimate for inclusion in the simulations (ventilator management). This suggests that an attempt to collect data on other, even more rarely completed tasks would have faced similar challenges if attempted. In addition, ability to incorporate substantially larger numbers of care events in simulation models is limited by current computer processing capabilities. Finally, even for the five included clinical care tasks, the relatively small number of observed events necessitated use of triangular distributions in the simulation models, when a more detailed variance structure based on a larger number of empirical observations would have been preferable.

The logistics and time frame of the observational data collection imposed some additional limitations. The Staffing Study timeline was insufficient to develop a consent procedure to allow collection of personally identifiable information from nursing home residents. This limitation prevented development of estimates of clinical care frequency and duration specific to particular types of residents, such as those with particular health conditions or other characteristics that might influence care needs. For example, residents with severe cognitive impairments require additional nursing resources, such that CMS's Patient-Driven Payment Model explicitly weighs cognitive status when assigning resource utilization groupings (Medicare Learning Network, n.d., slides 26–28). On the other hand, other research has not identified conclusive evidence that one measure of cognitive impairment—resident Brief Interview Mental Status (BIMS) score—is necessarily correlated with care duration requirements; some cognitively impaired individuals can have a cooperative disposition. Future research should consider collection of more-detailed data on resident cognitive impairment and its relation to duration and frequency of needed clinical care, perhaps examining dementia with behavioral disturbance in addition to BIMS score.

External experts consulted during design of the observational data collection advised that either RNs or LPNs might perform the specific clinical care tasks being considered. For this reason, the observations did not differentiate between RN and LPN tasks. Simulation output therefore groups RNs and LPNs into a single aggregate "licensed nurse" category, so cannot support separate estimates of potential delayed or omitted care for these staff types. The observations also necessarily converted direct care tasks into a set of discrete and ordered events, whereas multitasking is common in real-life settings. For example, detailed notes from the observation indicated that some resident assessment activities often co-occurred with other direct care tasks, which the data collection instrument was not perfectly tuned to capture. In addition, observations collected limited information on indirect care tasks (e.g., data on nutrition planning or observation).

External Validity

External validity refers to the extent to which the study's population reflects the population of interest. By intention, observational data collected for the simulation included only high-quality nursing homes, those with a four- or five-star rating on Nursing Home Care Compare at the time they were recruited to participate. This was intended to ensure the simulation model output would reflect adequate time needed for delivering high-quality direct care. This approach mirrors that of other simulation models in the literature built to purpose in a specific setting (e.g., see Günal & Pidd, 2010), including similar work on nursing home staffing levels such as Schnelle (Schnelle, et al. 2016).

However, this design feature suggests that observed duration and frequency of direct care tasks in the Staffing Study observational data, and therefore the simulation estimates of delayed and omitted care building on those observations, might not generalize to lower-quality nursing home settings. For example, licensed nurses who are less efficient than those observed in the Staffing Study could take longer to complete some care tasks; alternatively, in understaffed nursing homes where licensed nurses are stretched thin, they could hurry through direct care tasks. Moreover, if there is a large correlation between quality and population characteristics, such as socio-economic status, results might not reflect licensed nurse staffing resources needed to provide high-quality care for the full range of the population.

Internal Validity

Internal validity refers to the extent to which the study estimates accurately reflect the parameters of interest; in this case the number of staff required to deliver high-quality care. This is different from construct validity, which focuses on the measures, as internal validity is focused on whether the differences in the measures, whatever they are, can be reliably identified as a direct function of the factor of interest. In the case of the Staffing Study simulation, this is a highly reliable assumption, as the simulations altered only the staffing levels and resident acuity mix within each scenario, while holding all other factors constant. The major limitation to internal validity in the Staffing Study context, therefore, is

the assumption that differences in delayed or omitted care by staffing levels are consistent across all possible combinations of input parameters, including more-extreme acuity levels and differing nursing home size.

In particular, though the Staffing Study team took care to maintain key complexities of the nursing home care environment, namely acuity-related probabilities of required care and frequency in addition to required time to perform high-quality care tasks, other important dynamics were not addressed or they varied across the simulation scenarios. These dynamics include variations in nursing home characteristics (ownership type, layout, etc.), resident population (demographic and other characteristics), and specific other care needs. Models assume simulated days that are independent and identically distributed, meaning that each day is independent of any other and the population distribution is stable. Though this is a common assumption in most empirical work, it might not reflect reality in most situations and is thus a limitation shared by this study and many others.

F.2.8 Future Work

Like every study, the Staffing Study simulation models have limitations that prevent them from providing answers to every question of interest in this context. However, these limitations also provide a roadmap for directing future work to build on this base, adding complexity, to gain new understanding of care provisions to inform policy and best practice, as described in the remainder of this section. These avenues can be pursued jointly, or independently, in a variety of priority orders.

Increase Complexity of Simulated Populations

Staffing Study simulations were based on resident populations of 70 individuals at three different acuity mixes. In practice, nursing homes vary in size and feature much more nuanced differences in resident acuity. Future research could explore how size and additional acuity details provide contextual impacts on the relationship between staffing levels and quality.

Collect and Incorporate Detailed Resident and Staff Data

Staffing Study simulations simulate five broad categories of direct care tasks. With detailed resident information and a more complex data collection of staff activities, the complexity of related simulations can scale more closely to actual resident care needs and consider licensed nurse multitasking when providing care. Though this would substantially increase the complexity of the simulations, it would help the findings to more accurately represent real-world nursing home settings.

Increase Complexity of Simulated Temporal Dynamics

Staffing Study simulations represent more than 930 years of independent days. In practice, however, quality from one day influences the care needs of the next. Additionally, with an expanded time frame, and additional data collection, the reality of residents out- and in-migrating to the nursing home can be incorporated. Future research can then explore how quality affects change over time in conjunction with changing resident populations.

Expand Staff Variety and Care Tasks

Staffing Study simulations focus on licensed nurses and the clinical care they provide to residents. Yet nursing homes are staffed by a broader set of professionals, who complete a wider variety of tasks. Future work, with additional data collection, can explore as yet unmodeled dynamics of the broader care ecology of the nursing home, with parameters for the types of care different staff can perform, when those exchanges occur, and the impact of different staff mixes on resident care quality.

Expand Types of Outcome Metrics

Staffing Study simulations count whether requested care was completed, and whether it was completed on time. Health professionals and those who receive care are well aware that "quality" encompasses far more than the timeliness of care. However, if other aspects of quality are to be simulated, detailed work on abstracting those aspects into computer representations must be completed. Just as psychological tests are the result of a complex measurement research agenda to better understand how to measure intelligence or academic achievement, the simulation of broader concepts of quality must incorporate measurement research in how to understand the steps required to simulate the provision of care.

Appendix G. Analysis of State Staffing Requirements Supplemental Materials

List of Exhibits

This appendix provides supplemental materials, including detailed methods and results, for the synthetic control analyses presented in Section 4.2 of the Staffing Study report. These analyses of a recent state-level minimum staffing requirement increase enacted in the state of Massachusetts provide insights on the feasibility and estimated impact of a new state-level minimum staffing requirement implemented since the onset of the COVID-19 public health emergency.

Appendix G.1 provides details on construction of the quality measures used as outcomes in one set of synthetic control models. Appendix G.2 postulates a formal conceptual framework for understanding which nursing homes are likely to be most affected by the new Massachusetts requirement given its penalty structure and staffing level thresholds. Appendix G.3 provides supplemental exhibits with synthetic control model results and sensitivity analyses. Appendix G.4 provides additional detail on the composition of the synthetic control donor states for each model.

G.1 Quality Measure Score and Safety Outcome Construction

Quality Measure Score

The quality measure scores are constructed by assigning point values to individual quality measures and summing these points together. Each quality measure pertains to either long-stay or short-stay residents; the individual long-stay and short-stay measures are summed to produce separate long-stay and short-stay quality measure scores. Measures are scored such that higher point values represent better quality outcomes.

- **Long-stay quality measure score**: outcome includes the following six long-stay measures, which are converted into points and summed together, resulting in a scale ranging from 95 to 850:
  - Hospitalizations for long-stay residents (15–150 points)
  - Emergency department visits for long-stay residents (15–150 points)
  - Long-stay activities of daily living decline (15–150 points)
  - Long-stay antipsychotic meds (15–150 points)
  - Long-stay mobility decline (15–150 points)
  - Long-stay pressure ulcers (20–100 points)
- **Short-stay quality measure score**: outcome includes the following three short-stay measures, which are converted into points, summed together, and scaled by a factor of 850/450 to match the sum of the long-stay quality measure score, resulting in a scale ranging from 85 to 850:
  - Rehospitalizations for short-stay residents (15–150 points)
  - Emergency department visits for short-stay residents (15–150 points)
  - Short-stay functional improvement (15–150 points)
- **Total quality measure score**: sum of the long-stay quality measure score and the short-stay quality measure score, resulting in a scale ranging from 180 to 1,700.

Safety Outcomes

The main approach for specifying safety outcomes is modeled after CMS's Five-Star Quality Rating System. First, for each calendar year, the team creates within-state rankings of nursing homes according to their total scores on the latest health inspection survey by the end of the year. Then the team adjusts these rankings such that the nursing homes with the poorest within-state ranks are assigned values of 100

and all other nursing homes are assigned values between 0-100. Last, nursing homes are assigned star-ratings in the following manner:

- Nursing homes with assigned values of 10 or below received ratings of five stars.
- Nursing homes were deducted a star for every increment of 23.33 that their assigned value is above 10 but below 81 (e.g., an assigned value of 33 is assigned four stars; a value of 34 is assigned three stars).
- Nursing homes with assigned values of 81-100 receive one star.

This resulting variable is referred to as the "5-Star Score." Higher numbers of stars correspond to better health inspection outcomes.

We also specify an alternative safety outcome in which we normalize each nursing home's total score on the latest health inspection survey by dividing its score by the highest health inspection score across nursing homes in a given state-year. This produces a continuous outcome measure between 0 and 1, which is referred to as the "Normalized Score." Lower Normalized Scores represent better health inspection outcomes.

G.2 Conceptual Framework (Extended)

The new Massachusetts minimum staffing requirement contains language suggesting that nursing homes with low nurse staffing levels and high Medicaid resident shares are the most likely to be induced to increase their staffing levels in response to the requirement. The text of the new regulation reads as follows:

> 206.13: Average Staffing Hours Incentive
>
> *(1) Effective October 5, 2020, each nursing facility will be required to submit information on its staffing levels, including information demonstrating the facility's average hours per patient day to EOHHS [Executive Office of Health and Human Services] on at least a bi-weekly basis, in the manner and format requested by EOHHS, via administrative bulletin or other written issuance.*
>
> *(2) Beginning January 1, 2021, a nursing facility that fails to meet an average of at least 3.58 hours per patient day in accordance with 101 CMR 206.12(1), will be subject to a downward adjustment equal to 2% of the facility's standard rate for that calendar quarter. The dollar amount resulting from this adjustment will be considered an overpayment pursuant to 130 CMR 450.235: Overpayments.*

Under this regulation, nursing homes with less than 3.58 HPRD of staffing will receive a quarterly penalty on their Medicaid payments equal to 2 percent of the nursing home's Medicaid per diem rate. This suggests that it makes sense financially for a nursing home to comply with the new regulation only if the penalty for noncompliance is greater than or equal to the additional cost of hiring the required nurse staff to reach 3.58 HPRD. One can express this condition algebraically as follows:

$$w_0 \times \Delta N \leq 0.02 \times m_0 \times x$$

Here, w_0 refers to the average hourly wage of new hires. The exact value will depend on the prevailing wage for each type of nurse staff (registered nurse, licensed practical nurse, nurse aide) and the mix of nurse staffing categories that a nursing home hires. For now, assume that w_0 is fixed at some predetermined number. ΔN refers to the additional daily hours of nurses hired to meet the HPRD requirement, m_0 refers to the nursing home's Medicaid per diem rate, and x refers to the nursing home's Medicaid resident census. The remainder of the analysis assumes that w_0 represents an average of market

wages and is out of the control of any individual nursing home, and that x is similarly fixed from the nursing home's perspective.

This expression suggests two things. First, if the nursing home has no Medicaid residents ($x = 0$), then there is no financial penalty and $\Delta N = 0$. Second, a nursing home is indifferent towards coming into compliance at the point where the additional wage cost that would be required to do so ($w_0 \times \Delta N$) is exactly equal to the financial penalty from not doing so ($0.02 \times m_0 \times x$). This point of indifference is expressed below, where ΔN^* represents the additional daily hours of nurse staffing that would make the equation hold:

$$w_0 \times \Delta N^* = 0.02 \times m_0 \times x \qquad (1)$$

However, the amount of new hiring needed to come into compliance depends on the nursing home's current HPRD deficit (i.e., the difference between 3.58 HPRD and the nursing home's current HPRD). Equations refer to this HPRD deficit as $\Delta HPRD$, which is defined below, where y refers to the non-Medicaid resident census:

$$\Delta HPRD = \frac{\Delta N}{(x+y)} \qquad (2)$$

Solving for ΔN^* in equation (1) and plugging in for ΔN in equation (2) yields the following expression:

$$\Delta HPRD^* = \left(\frac{0.02 \times m_0}{w_0}\right)\left(\frac{x}{(x+y)}\right) \qquad (3)$$

Here $\Delta HPRD^*$ represents the largest deficit in HPRD that would make financial sense for a nursing home to make up. This deficit is increasing in the Medicaid per diem and decreasing in the average wage rate. Perhaps more importantly, $\Delta HPRD^*$ is linearly proportional to the Medicaid share of a nursing home's resident census, $\frac{x}{(x+y)}$.

This suggests several illustrative case studies.

Case 1: The nursing home has *no* Medicaid residents ($x = 0$)

In this case, the nursing home has no incentive to increase HPRD because it faces no penalty for noncompliance.

Case 2: The nursing home has *only* Medicaid residents ($y = 0$)

In this case, $\Delta HPRD^*$ is equal to a constant, $\frac{0.02 \times m_0}{w_0}$. Notably, this constant does not depend on the number of Medicaid residents. A nursing home with a deficit lower than this constant will be incentivized to increase nurse staffing HPRD, whereas a nursing home with a deficit higher than this constant will not.

Case 3: The nursing home has both Medicaid and non-Medicaid residents ($y > 0,\ x > 0$)

In this case, $0 < \Delta HPRD^* \leq \frac{0.02 \times m_0}{w_0}$, $\Delta HPRD^*$ is increasing in x, and $\Delta HPRD^*$ is decreasing in y. As the proportion of Medicaid residents approaches 100 percent, $\Delta HPRD^*$ approaches the limit of $\frac{0.02 \times m_0}{w_0}$. However, higher values of y will decrease the change in $HPRD^*$, all else equal.

This basic model produces an important prediction for the empirical analysis:

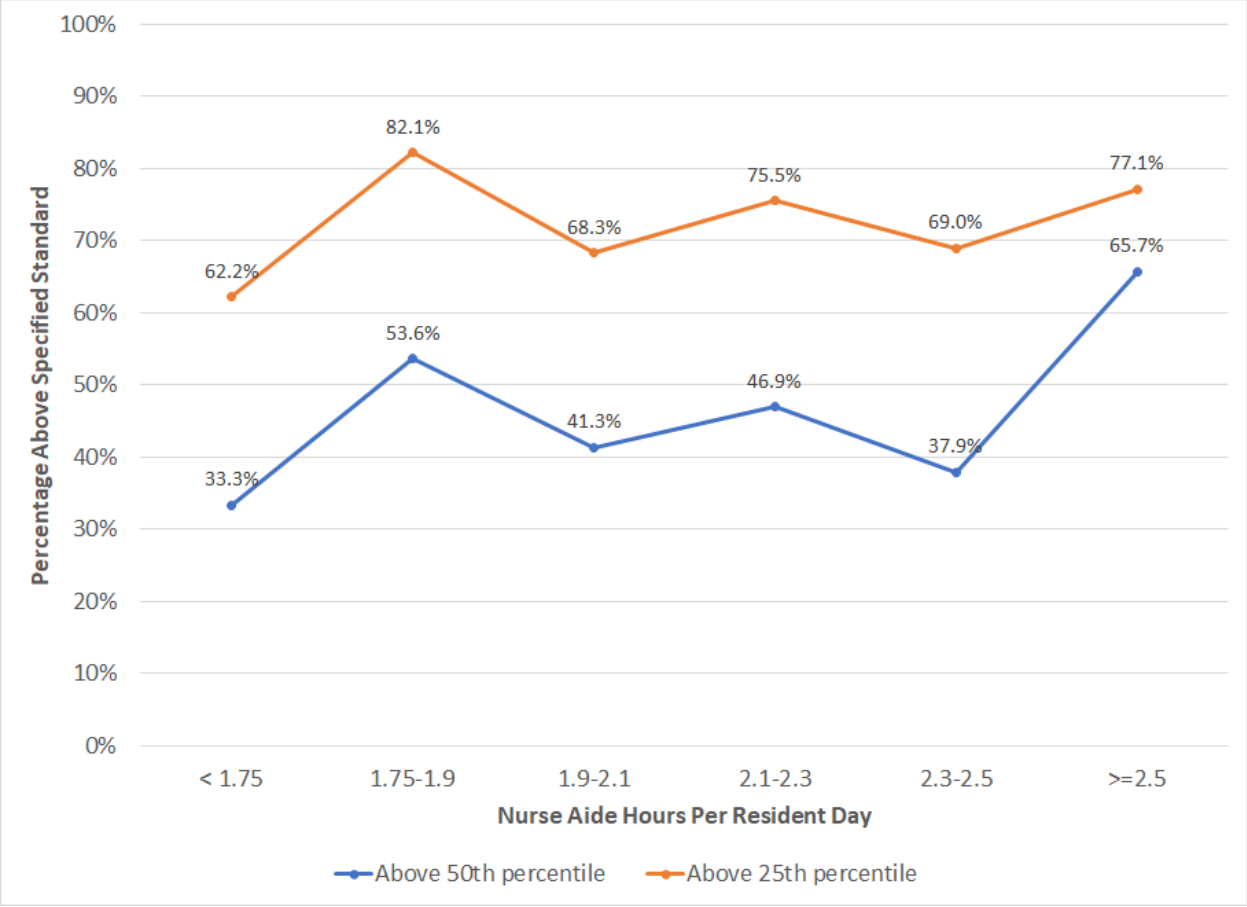
Prediction 1: All else equal, nursing homes with higher shares of Medicaid residents will increase their HPRDs by a greater amount in response to a minimum staffing requirement.

This follows from the fact that $\Delta HPRD^*$ increases with $\frac{x}{x+y}$, and a larger $\Delta HPRD^*$ means that a nursing home is willing to raise HPRD by more to avoid the penalty.

G.3 Supplemental Exhibits

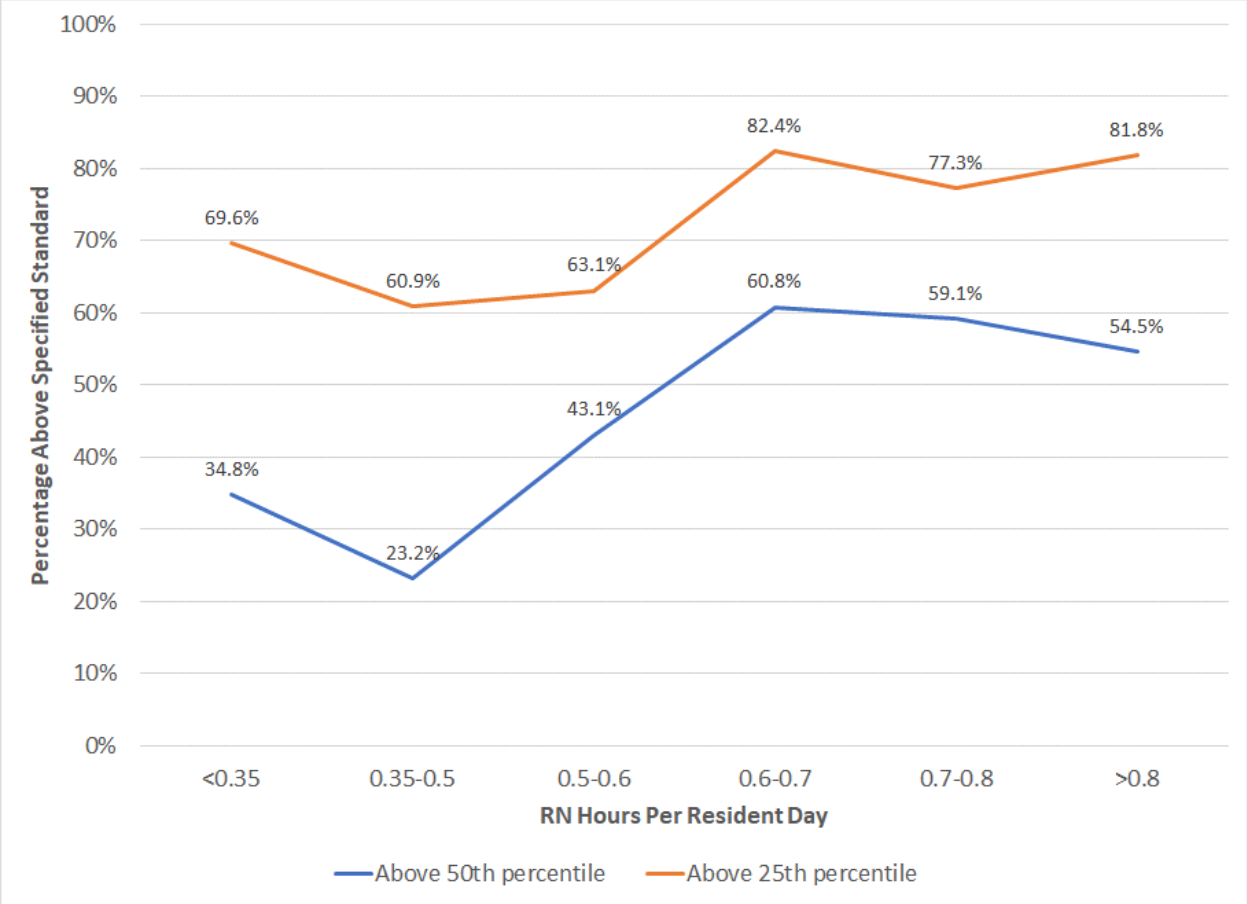
Exhibits G.1-G.4 provide descriptive statistics that examine the relationship between nurse aide and RN staffing levels and nursing home performance in Massachusetts. **Exhibits G.1-G.4** show a general relationship between higher staffing levels and a higher probability of being above the 25th and 50th percentiles in QM score percentiles for both RNs and nurse aides. A similar relationship exists between higher staffing levels and better performance on health inspection surveys. Given that there are only about 350 nursing homes in Massachusetts, staffing levels were collapsed into six categories to produce more stable estimates.

Exhibit G.1: Probability of Exceeding Minimum Acceptable Standards for QM Score, by Nurse Aide Staffing Level for Massachusetts Nursing Homes



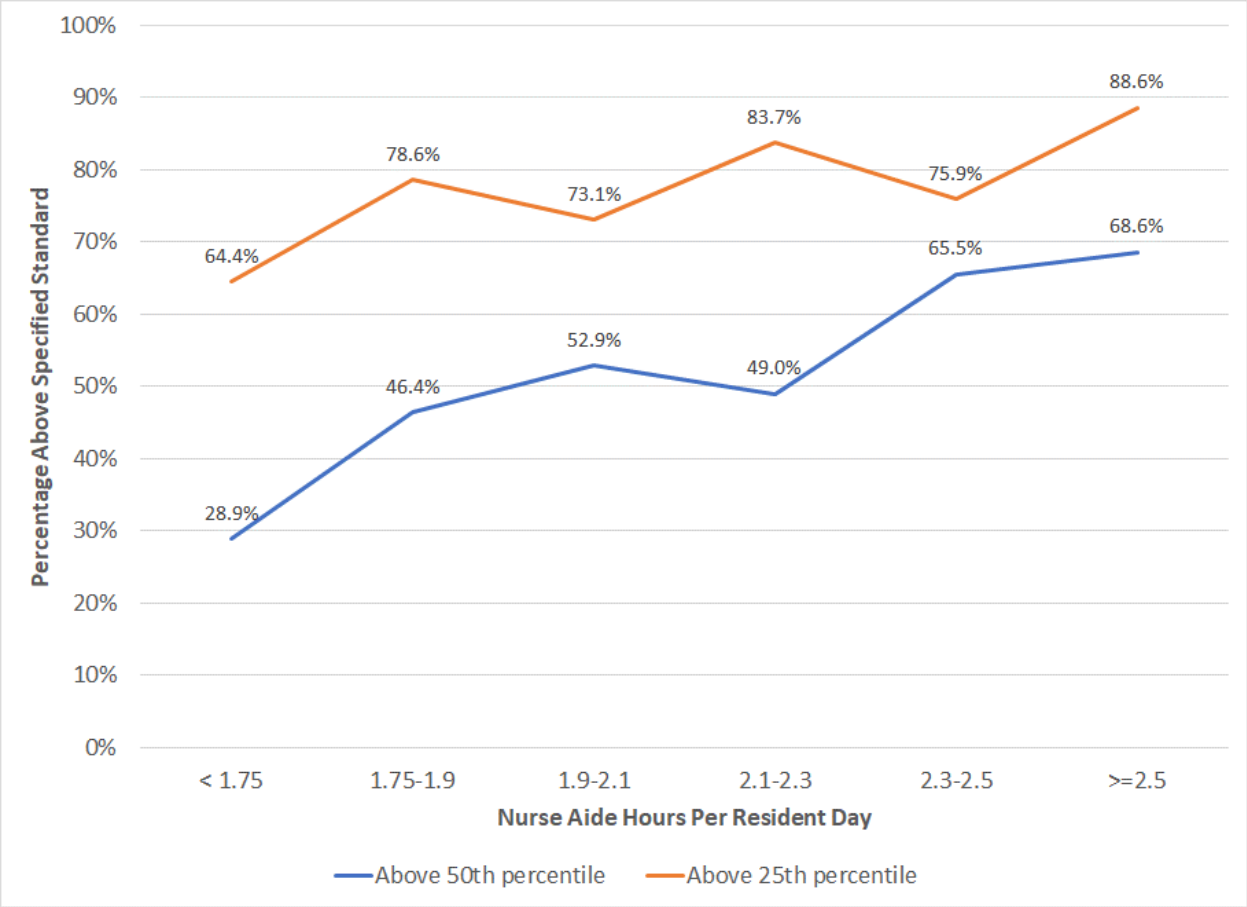
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=318)

Exhibit G.2: Probability of Exceeding Minimum Acceptable Standards for QM Score, by RN Staffing Level for Massachusetts Nursing Homes



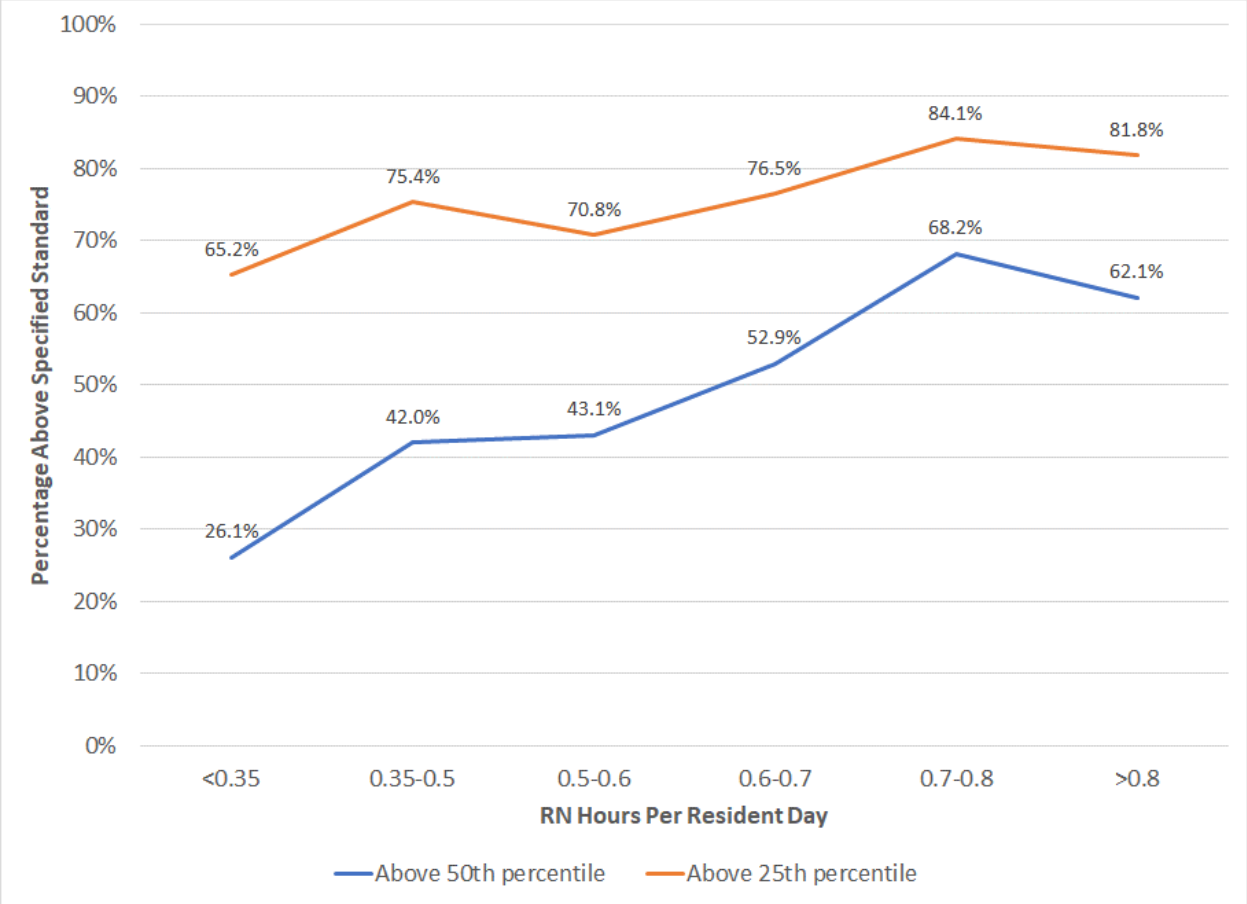
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=318)

Exhibit G.3: Probability of Exceeding Minimum Acceptable Standards for Weighted Health Inspection Survey Score, by Nurse Aide Staffing Level for Massachusetts Nursing Homes



Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=318)

Exhibit G.4: Probability of Exceeding Minimum Acceptable Standards for Weighted Health Inspection Survey Score, by RN Staffing Level for Massachusetts Nursing Homes



Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (*N*=318)

Exhibit G.5 provides a visual representation of the synthetic control estimates for Massachusetts relative to those for placebo states (states *not* implementing a new minimum staffing requirement at the same timepoint as Massachusetts) among nursing homes with high Medicaid share and low prior staffing. It is visually apparent that Massachusetts has an exceptionally close match relative to the synthetic control group in the period prior to the policy change, and a pronounced divergence from placebo states in the period after the policy change. This comparison is a visual representation of the estimates that are ranked to obtain the *p*-value in panel (a) of Exhibit 4.28 in the main report.

Exhibit G.5: Synthetic Control Permutations—Total Nurse Staffing: 2015Q3–2022Q2

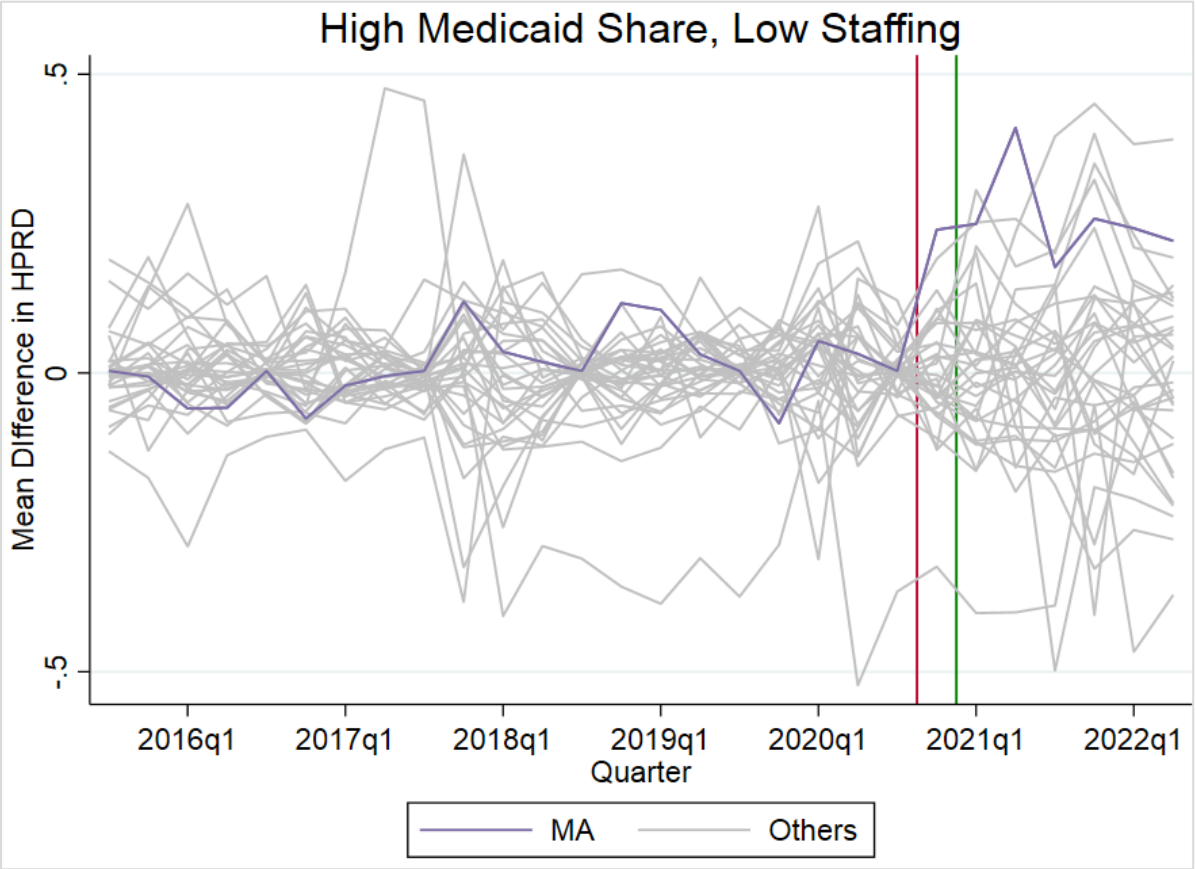
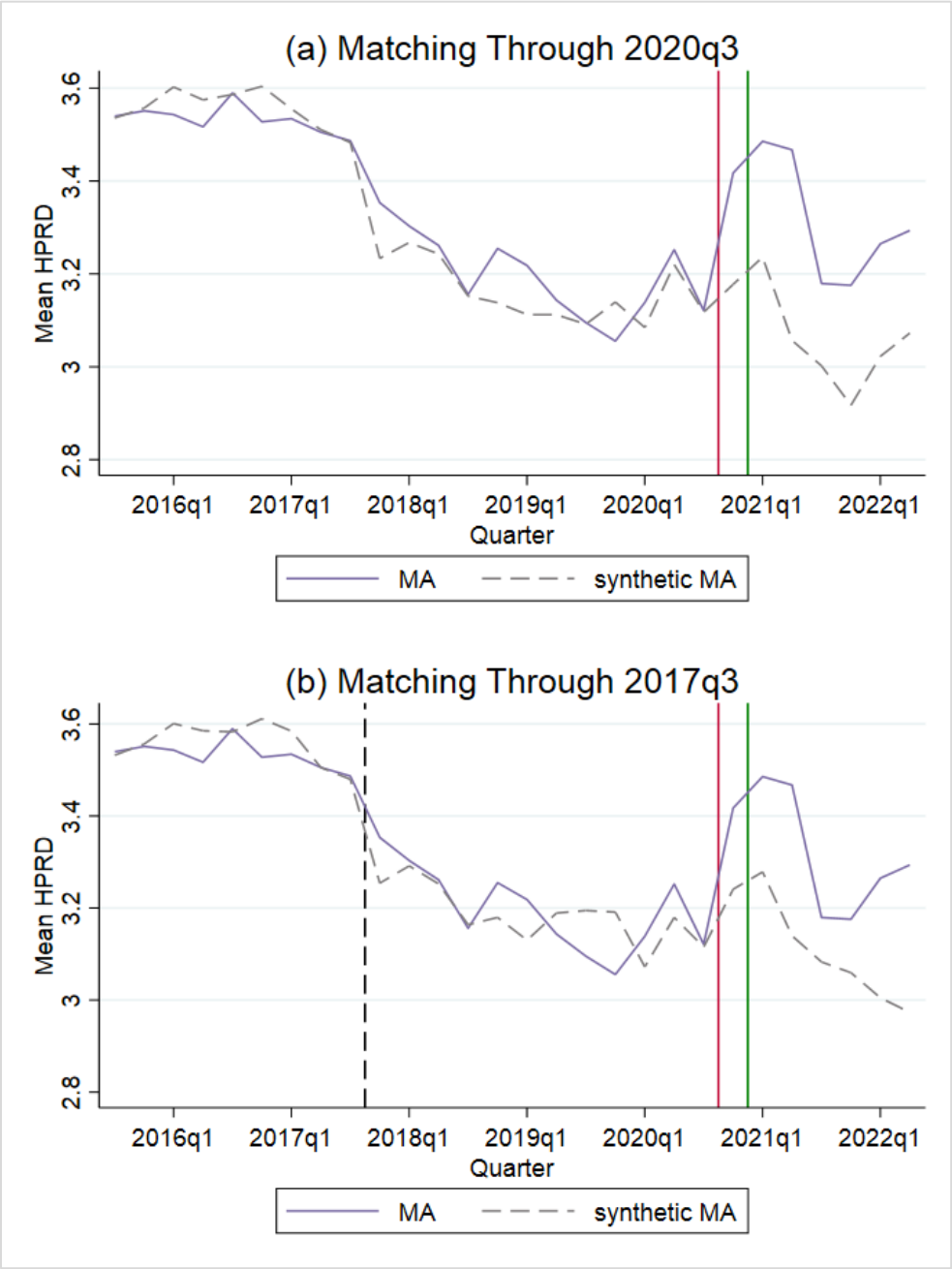


Exhibit G.6 displays a placebo test to verify the validity of comparing Massachusetts with the synthetic Massachusetts that was constructed by matching on Q3 of every year between 2015 and 2020. This figure juxtaposes results from panel (a) of Exhibit 4.28 (derived from a model which matches total HPRD trends on all six pre-policy quarters) in the top panel with results from a comparison model (which matches trends on 2015Q3, 2016Q3, and 2017Q3 only) in the bottom panel. In the bottom panel, the vertical blue dashed line demarcates the point after which matching ends. The purpose of this placebo test is to show that the match between Massachusetts and the placebo states is sufficiently good that, even if the model does not match over the full period prior to policy implementation, the staffing trends for synthetic Massachusetts still follow real Massachusetts through the rest of the pre-implementation period and diverge afterwards.

Indeed, this seems to be the case. Despite not matching on the pre-policy change period between 2017Q4 and 2020Q3, Massachusetts's and synthetic Massachusetts's trends follow each other very closely. Furthermore, the trends still diverge immediately in 2020Q4, when Massachusetts enacted the policy change. These results provide reassurance that synthetic Massachusetts is a good counterfactual for actual Massachusetts.

Exhibit G.6: Synthetic Control Placebo Test—Total Nurse Staffing: 2015Q3–2022Q2



As the Staffing Study team did not have direct data on the quarterly number of individual nurse staff employed by a nursing home at a point in time, the team manually created measures of full-time-equivalent (FTE) nurse staffing. For each model of nurse staff type HPRD, the implied increase in FTEs can be approximated by multiplying the quarterly HPRD means for both Massachusetts and synthetic Massachusetts by the Massachusetts-wide aggregate quarterly average resident census (derived by summing the quarterly average resident censuses across all nursing homes in the analytic sample). This approach assumes that the new staffing requirement did not affect Massachusetts's aggregate resident census (a synthetic control model that found a statistically insignificant impact on resident census). Then the team divided the product by the length of a standard workday (assumed here to be 7.5 hours).

Below, **Exhibit G.7** Panels (a)-(d) display the calculations used to determine the effect of Massachusetts's policy on full-time equivalent (FTE) nurse staffing, rounded to the nearest FTE. The study team then calculated the implied policy impact on FTEs. Note that the FTE increases for RNs, LPN, and nurse aides will not sum to the total nurse staffing increase because they are generated using models with different synthetic control units.

Exhibit G.7: FTE Nurse Staffing Calculations

Panel (a): FTE Total Nurse Staffing Calculation

	Pre-Period Mean	Post-Period Mean
MA	1800.8	1521.9
Synth-MA	1795.4	1404.5

Impact = (1521.9 - 1404.5) – (1801.8 - 1795.4) = 111.0 FTE staff

Panel (b): FTE Nurse Aide Staff Calculation

	Pre-Period Mean	Post-Period Mean
MA	1033.5	857.4
Synth-MA	1029.5	772.3

Impact = (857.4 – 772.3) – (1033.5 – 1029.5) = 81.1 FTE staff

Panel (c): FTE Registered Nurse Staff Calculation

	Pre-Period Mean	Post-Period Mean
MA	318.5	236.7
Synth-MA	317.1	226.0

Impact = (236.7 – 226.0) – (318.5 – 317.1) = 9.3 FTE staff

Panel (d): FTE Licensed Practical Nurse/Licensed Vocational Nurse (LPN) Staff Calculation

	Pre-Period Mean	Post-Period Mean
MA	448.7	427.8
Synth-MA	443.7	392.3

Impact = (427.8 – 392.3) – (448.7– 443.7) = 30.5 FTE staff

Exhibit G.8 disaggregates the total quality measure score into its long-stay and short-stay components and displays the results of synthetic control models estimated for each of them. Although there was no statistically significant effect on total quality measure score, it is possible that Massachusetts's policy change affected only long-stay or only short-stay quality measures. The synthetic control analysis produces estimated treatment effects that are statistically insignificant at conventional levels for both long-stay and short-stay quality measure scores. The estimated average effect of treatment on the treated (ATT) for the long-stay quality measure score is −30.1 and the *p*-value is $p = 12/32 = .375$. Additionally, the estimated ATT for the short-stay quality measure score is −41.9 and the *p*-value is $p = 11/32 = .344$. In combination with the results for total quality measure score, these results confirm there has been no detectable effect of the Massachusetts minimum staffing requirement on nursing home quality of care since implementation.

Exhibit G.8: Synthetic Control Estimates—Long-Stay and Short-Stay Quality Measure Scores: 2018Q4–2020Q3, 2022Q2

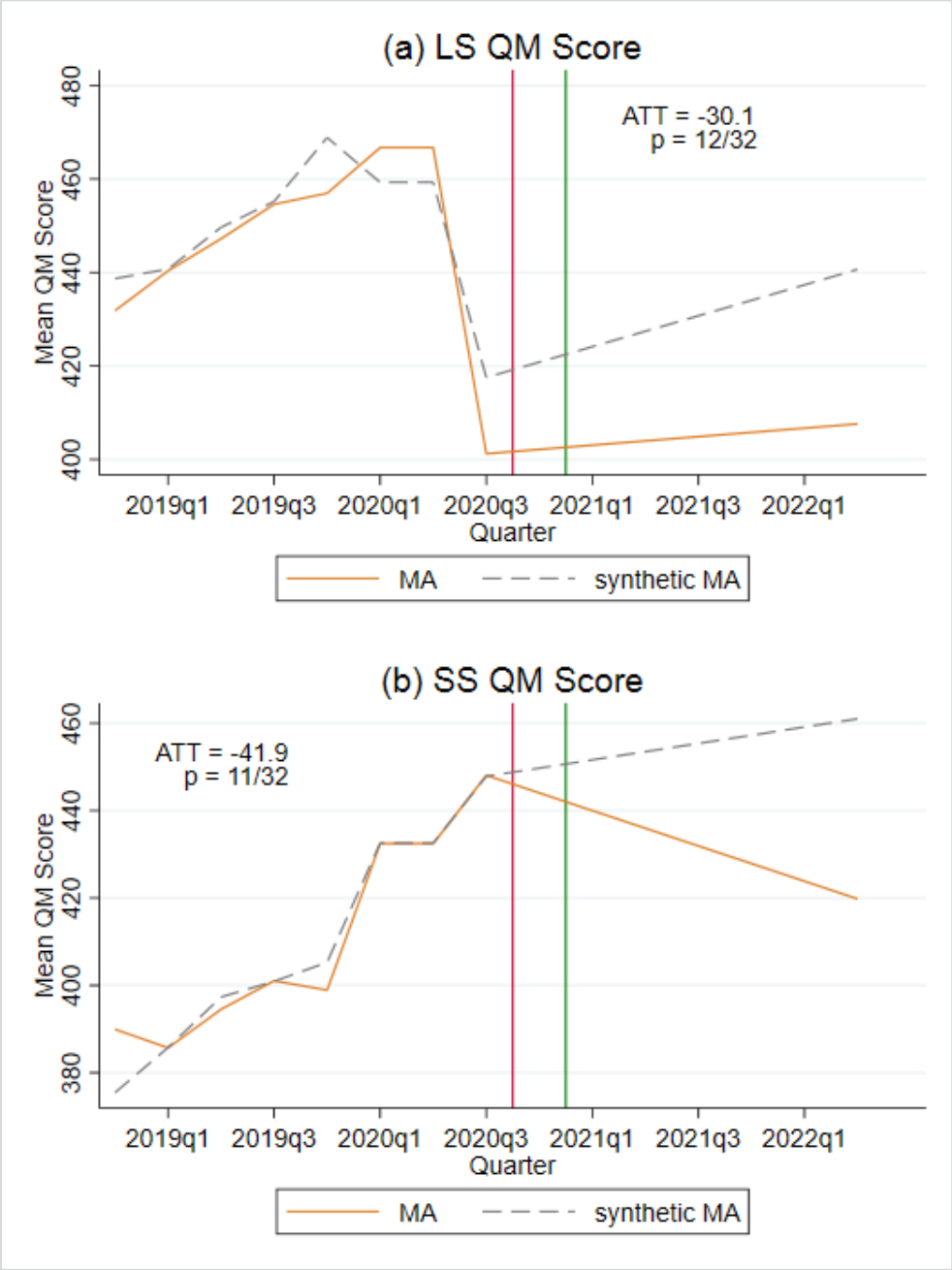
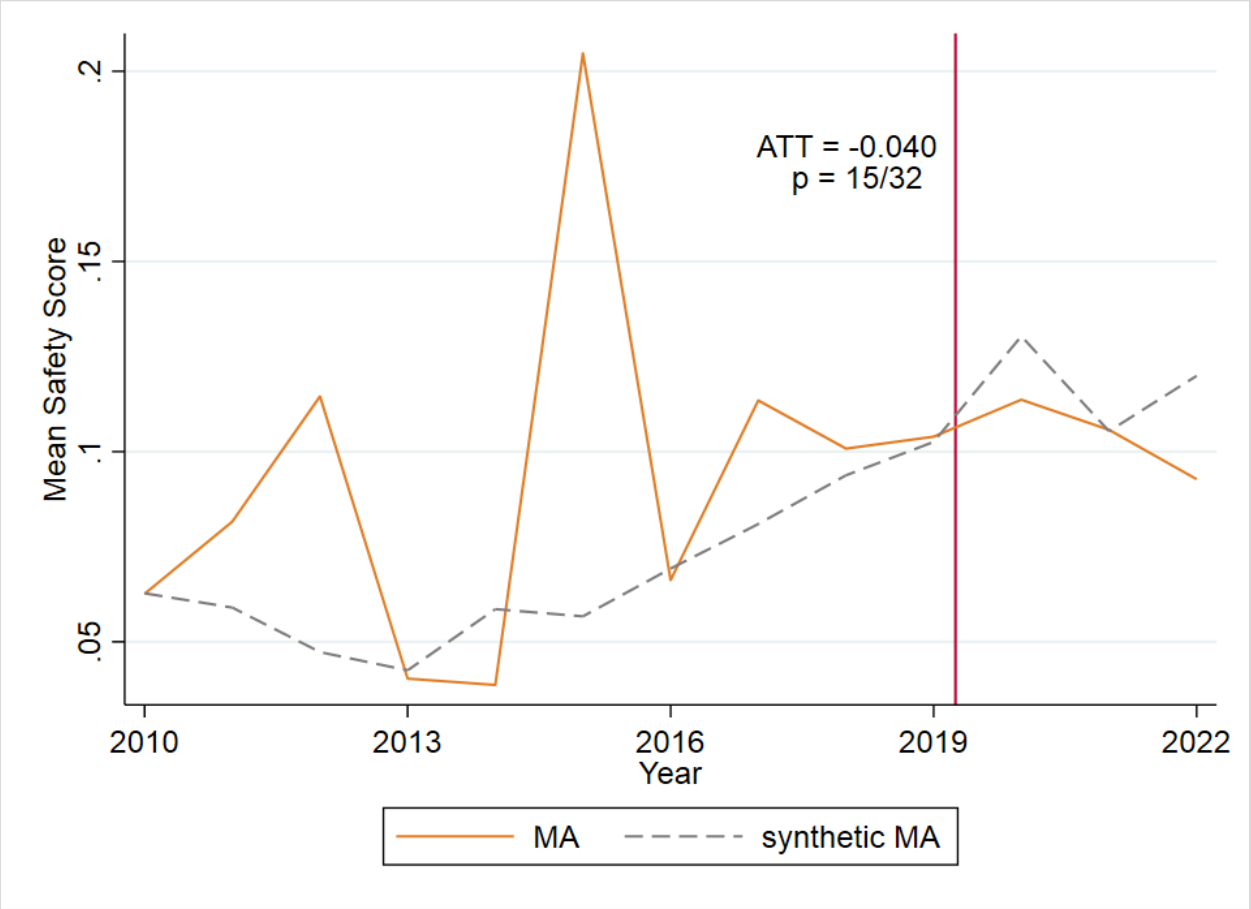


Exhibit G.9 displays the synthetic control and treatment effect estimates for Massachusetts using an alternative safety outcome, the Normalized Score. The ATT is estimated to be −0.040, which ranks as the 15th largest magnitude compared to the placebo effects. This corresponds to a *p*-value of p = .469, which is not statistically significant at the conventional level (α = 0.05).

Exhibit G.9: Synthetic Control Estimates (Massachusetts) – Normalized Safety Score: 2010–2022



G.4 Donor States and Weights for Synthetic Control Models

Exhibit G.10: Donor States and Weights used in Main Report Exhibit 4.28, Panel (a)

State	Weight
CT	0.546
IA	0.032
IL	0.101
MI	0.141
UT	0.052
WI	0.127

Exhibit G.11: Donor States and Weights used in Main Report Exhibit 4.28, Panel (b)

State	Weight
AL	0.006
AR	0.163
AZ	0.003
CA	0.004
CO	0.007
CT	0.392
FL	0.004
GA	0.007
IA	0.009
IL	0.003
IN	0.005
KS	0.012
KY	0.020
MD	0.008
MI	0.006
MN	0.004
MO	0..004
MS	0.007
MT	0.005
NC	0.007
ND	0.003
NE	0.007
NH	0.008
NJ	0.009
NM	0.108
NV	0.006
NY	0.008
OH	0.005
OK	0.007
PA	0.011
RI	0.005
SC	0.006
SD	0.007
TN	0.006
TX	0.005
UT	0.004
VA	0.005
WA	0.009
WI	0.007
WV	0.083
WY	0.006

Exhibit G.12: Donor States and Weights used in Main Report Exhibit 4.28, Panel (c)

State	Weight
AZ	0.020
HI	0.096
ID	0.073
IN	0.118
RI	0.315
TX	0.379

Exhibit G.13: Donor States and Weights used in Main Report Exhibit 4.28, Panel (d)

State	Weight
IN	0.309
LA	0.029
NJ	0.262
NM	0.115
TX	0.208
WY	0.077

Exhibit G.14: Donor States and Weights used in Main Report Exhibit 4.29, Panel (b)

State	Weight
IA	0.161
IN	0.403
LA	0.101
MD	0.118
TN	0.217

Exhibit G.15: Donor States and Weights used in Main Report Exhibit 4.29, Panel (c)

State	Weight
CT	0.475
LA	0.420
NM	0.105

Exhibit G.16: Donor States and Weights used in Main Report Exhibit 4.29, Panel (d)

State	Weight
AL	0.011
AZ	0.011
CA	0.003
CO	0.005
CT	0.013
GA	0.009
IA	0.013
IL	0.298
IN	0.008
KS	0.005
KY	0.006
LA	0.004
MD	0.005
MI	0.237
MO	0.007
MS	0.003
NC	0.006
NJ	0.014
NM	0.006
NY	0.007
OH	0.010
OK	0.004
PA	0.006
SC	0.006
TN	0.009
TX	0.020
UT	0.072
VA	0.008
WI	0.171
WV	0.007

Exhibit G.17: Donor States and Weights used in Main Report Exhibit 4.30

State	Weight
AL	0.002
AZ	0.189
CA	0.001
CO	0.002
CT	0.001
GA	0.004
IA	0.002
IL	0.005
IN	0.002
KS	0.175
KY	0.004
LA	0.007
MD	0.004
MI	0.003
MN	0.002
MO	0.004
MS	0.200
NC	0.002
NM	0.006
NY	0.001
OH	0.003
OK	0.359
PA	0.003
SC	0.003
TN	0.002
TX	0.003
UT	0.001
VA	0.004
WI	0.002
WV	0.004

Exhibit G.18: Donor States and Weights used in Main Report Exhibit 4.31

State	Weight
GA	0.036
NM	0.062
NY	0.593
TX	0.309

Exhibit G.19: Donor States and Weights used in Appendix G Exhibit G.8, Panel (a)

State	Weight
CT	0.181
MD	0.782
NJ	0.036

Exhibit G.20: Donor States and Weights used in Appendix G Exhibit G.8, Panel (b)

State	Weight
KY	0.271
LA	0.462
TN	0.169
WI	0.098

Exhibit G.21: Donor States and Weights used in Appendix G Exhibit G.9

State	Weight
LA	0.057
MN	0.138
NJ	0.723
UT	0.082

Appendix H. Cost and Savings Analyses Supplemental Materials

List of Exhibits

Appendix H presents cost estimates for increasing staffing levels to meet potential minimum staffing requirements for a three-requirement structure of RN hours per resident day (HPRD), licensed nurse (RN/LPN) HPRD, and total nurse HPRD (Appendix H.1). This appendix also includes estimated minimum quantifiable Medicare savings from potential minimum staffing requirements due to decreased emergency department visits and hospitalizations and increased community discharges (Appendix H.2).

H.1 Cost Tables

Exhibit H.1a: Estimated Additional Annual Salary Costs for Increasing Nurse Staffing Levels to Meet Potential Minimum Staffing Requirements—by Selected Facility Characteristics (Low Option)

	Estimated Additional Weighted Annual Salary Costs			Number of Nursing Homes	
	Low Facilities	All Facilities	Total Additional Annual Salary Costs	Low Facilities	All Facilities
Staffing Rating					
1 star	$499,253	$460,338	$595,879,101	1,548	1,773
2 stars	$321,696	$252,649	$655,857,207	2,700	3,405
3 stars	$162,380	$65,555	$219,031,023	1,628	3,959
4 stars	$84,838	$7,794	$21,322,953	339	3,262
5 stars	$35,179	$192	$586,201	16	2,106
% Medicaid Residents					
Lowest	$314,589	$79,378	$155,333,963	779	3,674
Second	$254,273	$105,711	$298,967,539	1,499	3,671
Third	$278,179	$146,399	$420,793,625	1,895	3,671
Highest	$389,088	$238,192	$636,661,725	2,133	3,672
Total Profit Margin					
Lowest	$301,459	$118,571	$239,086,810	1,048	2,902
Second	$293,409	$134,115	$275,366,426	1,229	2,902
Third	$340,016	$170,268	$329,960,504	1,371	2,903
Highest	$352,443	$201,217	$423,483,823	1,561	2,902
Bed Size					
<50 beds	$87,432	$19,262	$30,065,671	341	1,674
50–99 beds	$158,660	$66,267	$345,778,193	2,269	5,608
100–199 beds	$269,326	$134,940	$846,842,439	3,281	6,555
>199 beds	$786,296	$376,409	$289,070,549	415	851
Ownership					
For-profit	$322,205	$174,414	$1,328,047,886	5,291	10,418
Government	$203,154	$59,948	$45,748,753	274	888
Non-profit	$312,037	$77,074	$137,960,215	741	3,382

	Estimated Additional Weighted Annual Salary Costs			Number of Nursing Homes	
	Low Facilities	All Facilities	Total Additional Annual Salary Costs	Low Facilities	All Facilities
Certification					
Dually participating	$313,137	$147,830	$1,459,308,928	6,150	13,857
Medicaid	$589,695	$302,319	$48,690,908	121	263
Medicare	$111,929	$7,238	$3,757,018	35	568
Hospital Affiliation					
Freestanding nursing homes	$315,969	$148,645	$1,493,429,982	6,216	14,171
Hospital-based nursing homes	$340,436	$77,594	$18,326,871	90	517
Urban/Rural					
Rural	$176,109	$88,831	$289,350,193	1,858	4,031
Urban	$360,078	$163,235	$1,222,406,660	4,448	10,657
National	**$316,261**	**$146,915**	**$1,511,756,853**	**6,306**	**14,688**

Notes: *N*=14,688. Low facilities: nursing homes not meeting at least one of the three staffing minimum requirements (registered nurses, licensed nurses, or total nurse staff). All facilities: all nursing homes in the study sample, regardless of meeting staffing minimum requirements. Information about staffing ratings and other facility characteristics was based on an October 2021 refresh of Nursing Home Care Compare. For each nursing home, its total profit margin was calculated as total profits divided by total revenues based on its FY2021 skilled nursing facility Medicare cost report. For % Medicaid residents and total profit margin, nursing homes were grouped into four groups with roughly equal size based on quartiles. Within each stratified group, nursing homes with missing values in the corresponding facility characteristic (e.g., staffing ratings, total profit margins) were excluded in calculating the weighted salary costs. See the methods section of the cost analyses in the main report (Section 4.4.1) for more details about assumptions and methodology for the analyses.

Exhibit H.1b: Estimated Additional Annual Salary Costs for Increasing Nurse Staffing Levels to Meet Potential Minimum Staffing Requirements—by Selected Facility Characteristics (Medium Option)

	Estimated Additional Weighted Annual Salary Costs		Total Additional Annual Salary Costs	Number of Nursing Homes	
	Low Facilities	All Facilities		Low Facilities	All Facilities
Staffing Rating					
1 star	$641,639	$612,746	$795,675,686	1,624	1,773
2 stars	$445,242	$403,899	$1,050,835,842	3,121	3,405
3 stars	$215,192	$131,692	$433,294,000	2,438	3,959
4 stars	$112,349	$22,495	$61,075,348	719	3,262
5 stars	$57,382	$686	$1,790,479	32	2,106
% Medicaid Residents					
Lowest	$367,286	$127,135	$256,623,114	1,096	3,674
Second	$323,189	$177,007	$497,466,513	1,981	3,671
Third	$357,495	$236,194	$676,235,900	2,394	3,671
Highest	$480,111	$350,107	$941,398,371	2,564	3,672
Total Profit Margin					
Lowest	$360,432	$186,438	$378,977,030	1,385	2,902
Second	$373,441	$218,341	$446,944,819	1,591	2,902
Third	$418,082	$266,764	$525,115,377	1,757	2,903
Highest	$440,660	$300,112	$638,043,603	1,896	2,902
Bed Size					
<50 beds	$100,905	$31,236	$48,270,569	478	1,674
50–99 beds	$193,965	$104,832	$547,939,774	2,956	5,608
100–199 beds	$340,858	$212,918	$1,335,924,189	4,085	6,555
>199 beds	$970,626	$575,481	$439,589,367	516	851
Ownership					
For-profit	$401,346	$268,317	$2,056,236,996	6,613	10,418
Government	$264,954	$105,914	$76,490,539	375	888
Non-profit	$371,731	$129,992	$238,996,363	1,047	3,382
Certification					
Dually participating	$389,194	$231,819	$2,303,810,558	7,852	13,857
Medicaid	$650,817	$379,360	$62,016,497	142	263
Medicare	$157,021	$12,037	$5,896,843	41	568

	Estimated Additional Weighted Annual Salary Costs			Number of Nursing Homes	
	Low Facilities	All Facilities	Total Additional Annual Salary Costs	Low Facilities	All Facilities
Hospital Affiliation					
Freestanding nursing homes	$391,395	$231,834	$2,342,404,319	7,909	14,171
Hospital-based nursing homes	$418,395	$126,016	$29,319,579	126	517
Urban/Rural					
Rural	$224,163	$140,889	$460,466,244	2,361	4,031
Urban	$443,373	$254,085	$1,911,257,654	5,674	10,657
National	**$391,734**	**$229,256**	**$2,371,723,898**	**8,035**	**14,688**

Notes: *N*=14,688. Low facilities: nursing homes not meeting at least one of the three staffing minimum requirements (registered nurses, licensed nurses, or total nurse staff). All facilities: all nursing homes in the study sample, regardless of meeting staffing minimum requirements. Information about staffing ratings and other facility characteristics was based on an October 2021 refresh of Nursing Home Care Compare. For each nursing home, its total profit margin was calculated as total profits divided by total revenues based on its FY2021 skilled nursing facility Medicare cost report. For % Medicaid residents and total profit margin, nursing homes were grouped into four groups with roughly equal size based on quartiles. Within each stratified group, nursing homes with missing values in the corresponding facility characteristic (e.g., staffing ratings, total profit margins) were excluded in calculating the weighted salary costs. See the methods section of the cost analyses in the main report (Section 4.4.1) for more details about assumptions and methodology for the analyses.

Exhibit H.1c: Estimated Additional Annual Salary Costs for Increasing Nurse Staffing Levels to Meet Potential Minimum Staffing Requirements—by Selected Facility Characteristics (Higher Option)

	Estimated Additional Weighted Annual Salary Costs			Number of Nursing Homes	
	Low Facilities	All Facilities	Total Additional Annual Salary Costs	Low Facilities	All Facilities
Staffing Rating					
1 star	$811,181	$788,364	$1,028,030,879	1,669	1,773
2 stars	$621,173	$597,072	$1,555,742,864	3,288	3,405
3 stars	$295,340	$241,307	$787,044,608	3,233	3,959
4 stars	$150,108	$58,415	$155,462,947	1,317	3,262
5 stars	$60,084	$2,290	$5,159,773	89	2,106
% Medicaid Residents					
Lowest	$435,332	$199,495	$413,437,278	1,458	3,674
Second	$407,600	$279,272	$787,172,447	2,480	3,671
Third	$459,808	$360,061	$1,031,991,515	2,844	3,671
Highest	$601,486	$496,163	$1,341,731,516	2,927	3,672
Total Profit Margin					
Lowest	$430,931	$284,260	$584,299,986	1,779	2,902
Second	$473,961	$335,270	$689,775,040	1,943	2,902
Third	$529,662	$398,962	$797,528,729	2,092	2,903
Highest	$555,058	$432,661	$925,923,652	2,177	2,902
Bed Size					
<50 beds	$124,370	$48,663	$74,716,631	605	1,674
50–99 beds	$240,857	$159,941	$838,171,936	3,643	5,608
100–199 beds	$433,335	$321,541	$2,017,817,094	4,852	6,555
>199 beds	$1,195,240	$842,947	$643,627,097	609	851
Ownership					
For-profit	$504,614	$395,169	$3,052,088,475	7,799	10,418
Government	$360,078	$182,209	$124,263,813	465	888
Non-profit	$436,976	$208,903	$397,980,470	1,445	3,382
Certification					
Dually participating	$486,701	$347,939	$3,487,066,691	9,488	13,857
Medicaid	$736,927	$471,290	$78,175,341	162	263
Medicare	$168,231	$19,374	$9,090,726	59	568

	Estimated Additional Weighted Annual Salary Costs			Number of Nursing Homes	
	Low Facilities	All Facilities	Total Additional Annual Salary Costs	Low Facilities	All Facilities
Hospital Affiliation					
Freestanding nursing homes	$488,023	$346,702	$3,529,814,653	9,553	14,171
Hospital-based nursing homes	$518,605	$192,084	$44,518,104	156	517
Urban/Rural					
Rural	$288,622	$213,520	$699,313,577	2,815	4,031
Urban	$548,470	$379,298	$2,875,019,180	6,894	10,657
National	**$488,416**	**$342,935**	**$3,574,332,757**	**9,709**	**14,688**

Notes: *N*=14,688. Low facilities: nursing homes not meeting at least one of the three staffing minimum requirements (registered nurses, licensed nurses, or total nurse staff). All facilities: all nursing homes in the study sample, regardless of meeting staffing minimum requirements. Information about staffing ratings and other facility characteristics was based on an October 2021 refresh of Nursing Home Care Compare. For each nursing home, its total profit margin was calculated as total profits divided by total revenues based on its FY2021 skilled nursing facility Medicare cost report. For % Medicaid residents and total profit margin, nursing homes were grouped into four groups with roughly equal size based on quartiles. Within each stratified group, nursing homes with missing values in the corresponding facility characteristic (e.g., staffing ratings, total profit margins) were excluded in calculating the weighted salary costs. See the methods section of the cost analyses in the main report (Section 4.4.1) for more details about assumptions and methodology for the analyses.

Exhibit H.1d: Estimated Additional Annual Salary Costs for Increasing Nurse Staffing Levels to Meet Potential Minimum Staffing Requirements—by Selected Facility Characteristics (Highest Option)

	Estimated Additional Weighted Annual Salary Costs			Number of Nursing Homes	
	Low Facilities	All Facilities	Total Additional Annual Salary Costs	Low Facilities	All Facilities
Staffing Rating					
1 star	$1,016,680	$1,001,984	$1,312,079,488	1,708	1,773
2 stars	$861,752	$847,158	$2,204,206,443	3,348	3,405
3 stars	$439,691	$410,779	$1,329,473,717	3,693	3,959
4 stars	$217,517	$141,071	$361,296,400	2,111	3,262
5 stars	$90,622	$9,239	$17,645,784	224	2,106
% Medicaid Residents					
Lowest	$526,585	$310,814	$660,174,135	1,900	3,674
Second	$534,742	$431,085	$1,218,812,205	2,926	3,671
Third	$612,508	$533,369	$1,527,904,846	3,172	3,671
Highest	$768,722	$692,784	$1,879,612,270	3,218	3,672
Total Profit Margin					
Lowest	$546,012	$429,004	$887,368,203	2,124	2,902
Second	$618,185	$502,361	$1,040,324,772	2,261	2,902
Third	$681,269	$582,466	$1,179,052,366	2,396	2,903
Highest	$716,912	$615,356	$1,320,840,025	2,410	2,902
Bed Size					
<50 Beds	$153,930	$74,619	$114,061,727	752	1,674
50–99 Beds	$310,750	$239,244	$1,257,302,554	4,251	5,608
100–199 Beds	$565,455	$475,282	$2,985,201,814	5,511	6,555
>199 Beds	$1,493,464	$1,221,406	$929,937,361	702	851
Ownership					
For-profit	$651,680	$570,682	$4,440,476,741	8,794	10,418
Government	$493,277	$306,934	$197,287,673	560	888
Non-profit	$543,188	$331,451	$648,739,042	1,862	3,382
Certification					
Dually participating	$626,810	$512,812	$5,172,725,016	10,936	13,857
Medicaid	$828,624	$585,463	$98,769,715	184	263
Medicare	$172,897	$33,442	$15,008,724	96	568

	Estimated Additional Weighted Annual Salary Costs			Number of Nursing Homes	
	Low Facilities	All Facilities	Total Additional Annual Salary Costs	Low Facilities	All Facilities
Hospital Affiliation					
Freestanding nursing homes	$627,088	$509,556	$5,218,682,366	11,019	14,171
Hospital-based nursing homes	$606,551	$290,455	$67,821,089	197	517
Urban/Rural					
Rural	$376,273	$316,037	$1,036,349,199	3,233	4,031
Urban	$701,205	$557,094	$4,250,154,257	7,983	10,657
National	**$626,790**	**$504,219**	**$5,286,503,456**	**11,216**	**14,688**

Notes: *N*=14,688. Low facilities: nursing homes not meeting at least one of the three staffing minimum requirements (registered nurses, licensed nurses, or total nurse staff). All facilities: all nursing homes in the study sample, regardless of meeting staffing minimum requirements. Information about staffing ratings and other facility characteristics was based on an October 2021 refresh of Nursing Home Care Compare. For each nursing home, its total profit margin was calculated as total profits divided by total revenues based on its FY2021 skilled nursing facility Medicare cost report. For % Medicaid residents and total profit margin, nursing homes were grouped into four groups with roughly equal size based on quartiles. Within each stratified group, nursing homes with missing values in the corresponding facility characteristic (e.g., staffing ratings, total profit margins) were excluded in calculating the weighted salary costs. See the methods section of the cost analyses in the main report (Section 4.4.1) for more details about assumptions and methodology for the analyses.

H.2 Savings Tables

Exhibit H.2a: Regression Coefficients, Percentage of Short-Stay Residents Who Were Re-Hospitalized After a Nursing Home Admission, by Staff Type Decile

Variable	Regression Coefficients				Adjusted Mean Outcome		
	Coefficient	95% Confidence Interval (CI)—Lower	95% CI—Upper	*p*-Value (vs. ref)*	Mean	95% CI—Lower	95% CI—Upper
Case-Mix Adjusted RN Staffing							
<3rd decile (<0.38 HPRD)	Reference				22.95	22.68	23.21
3rd decile (0.38 – <0.45 HPRD)	-0.202	-0.656	0.252	0.3832	22.58	22.21	22.94
4th decile (0.45 – <0.52 HPRD)	-0.376	-0.834	0.082	0.1078	22.41	22.04	22.78
5th decile (0.52 – <0.60 HPRD)	-0.809	-1.264	-0.355	0.0005	21.89	21.53	22.26
6th decile (0.60 – <0.70 HPRD)	-0.873	-1.328	-0.417	0.0002	21.76	21.4	22.12
7th decile (0.70 – <0.82 HPRD)	-0.705	-1.168	-0.242	0.0028	21.78	21.42	22.15
8th decile (0.82 – <1.00 HPRD)	-0.795	-1.277	-0.312	0.0012	21.51	21.14	21.89
9th decile (1.00 – <1.28 HPRD)	-0.820	-1.347	-0.293	0.0023	21.13	20.73	21.53
10th decile (1.28 HPRD or higher)	-0.934	-1.529	-0.339	0.0021	20.65	20.24	21.06
Case-Mix Adjusted Nurse Aide Staffing							
<3rd decile (<1.76 HPRD)	Reference				22.35	22.09	22.61
3rd decile (1.76 – <1.89 HPRD)	-0.486	-0.925	-0.046	0.0302	21.83	21.48	22.18
4th decile (1.89 – <2.01 HPRD)	-0.217	-0.668	0.234	0.3458	22.09	21.72	22.45
5th decile (2.01 – <2.13 HPRD)	0.126	-0.334	0.587	0.5914	22.38	22.01	22.76
6th decile (2.13 – <2.28 HPRD)	-0.449	-0.901	0.003	0.0517	21.73	21.37	22.1
7th decile (2.28 – <2.44 HPRD)	0.058	-0.405	0.520	0.8064	22.29	21.92	22.66
8th decile (2.44 – <2.62 HPRD)	0.011	-0.462	0.484	0.9632	22.3	21.92	22.68
9th decile (2.62 – <2.93 HPRD)	-0.501	-0.984	-0.018	0.0420	21.59	21.21	21.98
10th decile (2.93 HPRD or higher)	-1.050	-1.604	-0.495	0.0002	20.68	20.23	21.13
Case-Mix Adjusted LPN Staffing							
<3rd decile (<0.62 HPRD)	Reference				20.8	20.53	21.08
3rd decile (0.62 – <0.71 HPRD)	0.340	-0.136	0.816	0.1613	21.43	21.04	21.81
4th decile (0.71 – <0.80 HPRD)	0.318	-0.143	0.778	0.1761	21.45	21.09	21.82
5th decile (0.80 – <0.87 HPRD)	0.927	0.454	1.400	0.0001	22.11	21.74	22.49
6th decile (0.87 – <0.95 HPRD)	1.013	0.541	1.485	<.0001	22.21	21.84	22.58

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% Confidence Interval (CI)—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
7th decile (0.95 – <1.04 HPRD)	1.223	0.757	1.689	<.0001	22.52	22.17	22.88
8th decile (1.04 – <1.14 HPRD)	1.287	0.804	1.769	<.0001	22.53	22.16	22.91
9th decile (1.14 – <1.30 HPRD)	1.586	1.103	2.069	<.0001	22.84	22.46	23.21
10th decile (1.30 HPRD or higher)	1.907	1.407	2.407	<.0001	22.93	22.54	23.31
Ownership							
For-profit	Reference				22.39	22.25	22.53
Non-profit	-0.748	-1.082	-0.413	<.0001	21.11	20.85	21.36
Government	-1.370	-1.970	-0.770	<.0001	20.14	19.56	20.71
Special Focus Facility Status							
Neither Special Focus Facility (SFF) nor candidate	Reference				21.92	21.79	22.04
SFF candidate	0.886	0.159	1.612	0.0169	23.14	22.42	23.85
SFF	0.546	-1.068	2.161	0.5071	22.99	21.38	24.60
% Medicaid Residents (Quartiles)							
Lowest	Reference				21.87	21.63	22.10
Second	-0.132	-0.485	0.220	0.4617	21.85	21.62	22.08
Third	-0.148	-0.513	0.216	0.4255	22.00	21.77	22.23
Highest	-0.045	-0.441	0.351	0.8247	22.11	21.84	22.38
Hospital-Based vs. Freestanding							
Free standing	Reference				22.02	21.89	22.14
Hospital-based	-0.496	-1.326	0.334	0.2416	20.33	19.54	21.11
Continuing Care Retirement Community (CCRC) Status							
Not part of CCRC	Reference				22.00	21.87	22.13
Part of CCRC	-0.223	-0.647	0.201	0.3018	21.57	21.23	21.92
Urban vs. Rural							
Urban	Reference				22.52	22.38	22.66
Rural	-1.749	-2.042	-1.456	<.0001	20.47	20.22	20.73
Number of Certified Beds (per 1-bed increment)	-0.002	-0.004	0.000	0.0546			

* Overall facility average for short-stay rehospitalizations is 22.0%.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,424).

Exhibit H.2b: Regression Coefficients, Percentage of Short-Stay Residents Who Have Had an Outpatient Emergency Department Visit, by Total Nurse Staffing Decile

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% CI—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
Case-Mix Adjusted RN Staffing							
<3rd Decile (<0.38 HPRD)	Reference				11.77	11.56	11.98
3rd Decile (0.38 – <0.45 HPRD)	-0.361	-0.728	0.006	0.0540	11.41	11.12	11.71
4th Decile (0.45 – <0.52 HPRD)	-0.388	-0.759	-0.018	0.0400	11.35	11.05	11.65
5th Decile (0.52 – <0.60 HPRD)	-0.370	-0.738	-0.003	0.0483	11.38	11.09	11.68
6th Decile (0.60 – <0.70 HPRD)	-0.532	-0.900	-0.163	0.0047	11.23	10.94	11.53
7th Decile (0.70 – <0.82 HPRD)	-0.564	-0.939	-0.190	0.0032	11.14	10.85	11.44
8th Decile (0.82 – <1.00 HPRD)	-0.894	-1.284	-0.503	<.0001	10.73	10.43	11.04
9th Decile (1.00 – <1.28 HPRD)	-0.342	-0.768	0.084	0.1155	11.24	10.92	11.57
10th Decile (1.28 HPRD or higher)	-0.504	-0.985	-0.022	0.0403	10.74	10.4	11.07
Case-Mix Adjusted Nurse Aide Staffing							
<3rd decile (<1.76 HPRD)	Reference				11.37	11.16	11.58
3rd decile (1.76 – <1.89 HPRD)	-0.146	-0.501	0.209	0.4207	11.16	10.87	11.44
4th decile (1.89 – < 2.01 HPRD)	0.109	-0.256	0.473	0.5587	11.42	11.12	11.71
5th Decile (2.01 – <2.13 HPRD)	0.333	-0.039	0.706	0.0794	11.65	11.34	11.95
6th Decile (2.13 – <2.28 HPRD)	0.240	-0.126	0.606	0.1988	11.56	11.27	11.86
7th Decile (2.28 – <2.44 HPRD)	-0.026	-0.400	0.347	0.8898	11.16	10.86	11.46
8th Decile (2.44 – <2.62 HPRD)	-0.221	-0.604	0.161	0.2572	11.01	10.7	11.32
9th Decile (2.62 – <2.93 HPRD)	-0.215	-0.606	0.175	0.2800	11.06	10.75	11.37
10th Decile (2.93 HPRD or higher)	-0.250	-0.698	0.199	0.2750	11.01	10.65	11.38
Case-Mix Adjusted LPN/LVN Staffing							
<3rd Decile (<0.62 HPRD)	Reference				11.34	11.12	11.57
3rd Decile (0.62 – <0.71 HPRD)	-0.041	-0.426	0.344	0.8353	11.34	11.03	11.65
4th Decile (0.71 – <0.80 HPRD)	-0.203	-0.576	0.169	0.2850	11.14	10.85	11.44
5th Decile (0.80 – <0.87 HPRD)	0.142	-0.241	0.525	0.4670	11.42	11.11	11.72
6th Decile (0.87 – <0.95 HPRD)	-0.287	-0.668	0.095	0.1412	10.96	10.66	11.26
7th Decile (0.95 – <1.04 HPRD)	0.100	-0.277	0.477	0.6032	11.33	11.03	11.62
8th Decile (1.04 – <1.14 HPRD)	0.184	-0.207	0.574	0.3567	11.34	11.03	11.65

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% CI—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
9th Decile (1.14 – <1.30 HPRD)	0.459	0.068	0.849	0.0214	11.55	11.25	11.85
10th Decile (1.30 HPRD or higher)	0.211	-0.194	0.615	0.3075	11.01	10.7	11.32
Ownership							
For-profit	Reference				11.48	11.37	11.59
Non-profit	-0.459	-0.729	-0.188	0.0009	10.6	10.39	10.81
Government	-0.281	-0.766	0.204	0.2567	11.44	10.97	11.9
Special Focus Facility (SFF) Status							
Neither SFF nor candidate	Reference				11.25	11.15	11.35
SFF candidate	0.911	0.324	1.499	0.0024	12.09	11.51	12.66
SFF	0.262	-1.044	1.567	0.6945	11.48	10.18	12.78
% Medicaid Residents (Quartiles)							
Lowest	Reference				10.33	10.14	10.52
Second	0.746	0.461	1.031	<.0001	11.45	11.26	11.64
Third	0.835	0.540	1.130	<.0001	11.58	11.4	11.77
Highest	0.972	0.652	1.293	<.0001	11.72	11.5	11.93
Hospital-Based vs. Freestanding							
Freestanding	Reference				11.32	11.22	11.42
Hospital-based	-1.673	-2.345	-1.002	<.0001	10.18	9.54	10.82
Continuing Care Retirement Community (CCRC) Status							
Not part of CCRC	Reference				11.41	11.3	11.51
Part of CCRC	-0.439	-0.782	-0.096	0.0121	10.17	9.89	10.45
Urban vs. Rural							
Urban	Reference				10.45	10.34	10.56
Rural	2.758	2.521	2.995	<.0001	13.46	13.25	13.66
Number of Certified Beds (per 1-bed increment)	-0.010	-0.011	-0.008	<.0001			

* Overall facility average for short-stay emergency department visits is 11.1%.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,424).

Exhibit H.2c: Regression Coefficients, Number of Hospitalizations per 1,000 Long-Stay Resident-Days, by Staff Type Decile

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% CI—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
Case-Mix Adjusted RN Staffing							
<3rd decile (<0.38 HPRD)	Reference				1.67	1.64	1.69
3rd decile (0.38 – <0.45 HPRD)	-0.065	-0.111	-0.020	0.0048	1.59	1.55	1.63
4th decile (0.45 – <0.52 HPRD)	-0.110	-0.155	-0.064	<.0001	1.55	1.51	1.59
5th decile (0.52 – <0.60 HPRD)	-0.157	-0.203	-0.112	<.0001	1.49	1.45	1.53
6th decile (0.60– <0.70 HPRD)	-0.161	-0.206	-0.115	<.0001	1.49	1.45	1.52
7th decile (0.70 – <0.82 HPRD)	-0.158	-0.205	-0.112	<.0001	1.48	1.44	1.51
8th decile (0.82 – <1.00 HPRD)	-0.253	-0.301	-0.204	<.0001	1.37	1.33	1.4
9th decile (1.00 – <1.28 HPRD)	-0.263	-0.315	-0.210	<.0001	1.34	1.3	1.38
10th decile (1.28 HPRD or higher)	-0.341	-0.402	-0.281	<.0001	1.23	1.19	1.27
Case-Mix Adjusted Nurse Aide Staffing							
<3rd decile (<1.76 HPRD)					1.47	1.44	1.5
3rd decile (1.76 – <1.89 HPRD)	0.016	-0.030	0.062	0.4964	1.46	1.43	1.5
4th decile (1.89 – <2.01 HPRD)	-0.007	-0.054	0.039	0.7613	1.43	1.4	1.47
5th decile (2.01 – <2.13 HPRD)	0.072	0.024	0.119	0.0029	1.49	1.46	1.53
6th decile (2.13 – <2.28 HPRD)	0.118	0.072	0.165	<.0001	1.52	1.48	1.56
7th decile (2.28 – <2.44 HPRD)	0.132	0.085	0.179	<.0001	1.52	1.48	1.56
8th decile (2.44 – <2.62 HPRD)	0.149	0.101	0.197	<.0001	1.53	1.5	1.57
9th decile (2.62 – <2.93 HPRD)	0.153	0.105	0.202	<.0001	1.51	1.47	1.55
10th decile (2.93 HPRD or higher)	0.171	0.117	0.224	<.0001	1.44	1.4	1.48
Case-Mix Adjusted LPN Staffing							
<3rd decile (<0.62 HPRD)					1.38	1.35	1.4
3rd decile (0.62 – <0.71 HPRD)	0.026	-0.021	0.073	0.2802	1.46	1.43	1.5
4th decile (0.71 – <0.80 HPRD)	-0.026	-0.071	0.020	0.2726	1.42	1.38	1.46
5th decile (0.80 – <0.87 HPRD)	0.021	-0.027	0.068	0.3901	1.48	1.44	1.52
6th decile (0.87 – <0.95 HPRD)	0.010	-0.038	0.057	0.6866	1.48	1.44	1.52
7th decile (0.95 – <1.04 HPRD)	0.045	-0.002	0.091	0.0607	1.53	1.49	1.57
8th decile (1.04 – <1.14 HPRD)	0.061	0.012	0.110	0.0154	1.55	1.51	1.59
9th decile (1.14 – <1.30 HPRD)	0.099	0.051	0.148	<.0001	1.6	1.56	1.63
10th decile (1.30 HPRD or higher)	0.134	0.082	0.185	<.0001	1.59	1.55	1.64

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% CI—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
Ownership							
For-profit					1.54	1.52	1.55
Non-profit	-0.054	-0.088	-0.020	0.0017	1.35	1.32	1.38
Government	-0.050	-0.102	0.002	0.0601	1.4	1.35	1.44
Special Focus Facility (SFF) Status							
Neither SFF nor candidate					1.48	1.47	1.49
SFF candidate	0.041	-0.029	0.112	0.2484	1.59	1.52	1.66
SFF	0.160	0.005	0.315	0.0431	1.75	1.59	1.9
% Medicaid Residents (Quartiles)							
Lowest					1.35	1.32	1.38
Second	0.067	0.031	0.104	0.0003	1.46	1.44	1.48
Third	0.122	0.085	0.160	<.0001	1.54	1.52	1.57
Highest	0.155	0.117	0.194	<.0001	1.59	1.56	1.61
Hospital-Based vs. Freestanding							
Freestanding					1.5	1.48	1.51
Hospital-based	-0.193	-0.273	-0.113	<.0001	1.2	1.12	1.28
Continuing Care Retirement Community (CCRC) Status							
Not part of CCRC					1.51	1.49	1.52
Part of CCRC	-0.102	-0.147	-0.056	<.0001	1.31	1.27	1.35
Urban vs. Rural							
Urban					1.52	1.51	1.53
Rural	-0.120	-0.148	-0.092	<.0001	1.39	1.37	1.42
Number of Certified Beds (per 1-bed increment)	0.000	0.000	0.000	0.2096			

*Overall facility average for long-stay hospitalizations is 1.49 per 1,000 resident-days.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,424).

Exhibit H.2d: Regression Coefficients, Number of Outpatient Emergency Department Visits per 1,000 Long-Stay Resident-Days, by Staff Type Decile

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% CI—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
Case-Mix Adjusted RN Staffing							
<3rd decile (<0.38 HPRD)	Reference				1.01	0.99	1.03
3rd decile (0.38 – <0.45 HPRD)	-0.058	-0.095	-0.022	0.0016	0.96	0.93	0.99
4th decile (0.45 – <0.52 HPRD)	-0.069	-0.105	-0.032	0.0002	0.94	0.91	0.97
5th decile (0.52 – <0.60 HPRD)	-0.106	-0.143	-0.070	<.0001	0.9	0.88	0.93
6th decile (0.60 – <0.70 HPRD)	-0.153	-0.190	-0.117	<.0001	0.86	0.83	0.89
7th decile (0.70 – <0.82 HPRD)	-0.142	-0.179	-0.105	<.0001	0.86	0.83	0.89
8th decile (0.82 – <1.00 HPRD)	-0.167	-0.205	-0.128	<.0001	0.83	0.8	0.86
9th decile (1.00 – <1.28 HPRD)	-0.189	-0.231	-0.147	<.0001	0.81	0.78	0.84
10th decile (1.28 HPRD or higher)	-0.268	-0.317	-0.220	<.0001	0.71	0.67	0.74
Case-Mix Adjusted Nurse Aide Staffing							
<3rd decile (<1.76 HPRD)	Reference				0.9	0.88	0.93
3rd decile (1.76 – <1.89 HPRD)	0.011	-0.026	0.047	0.5609	0.89	0.86	0.92
4th decile (1.89 – <2.01 HPRD)	0.022	-0.015	0.059	0.2404	0.9	0.87	0.93
5th decile (2.01 – <2.13 HPRD)	0.052	0.015	0.090	0.0062	0.93	0.9	0.96
6th decile (2.13 – <2.28 HPRD)	0.054	0.017	0.091	0.0042	0.92	0.89	0.95
7th decile (2.28 – <2.44 HPRD)	0.031	-0.007	0.068	0.1096	0.87	0.84	0.9
8th decile (2.44 – <2.62 HPRD)	0.006	-0.033	0.044	0.7768	0.84	0.81	0.87
9th decile (2.62 – <2.93 HPRD)	0.022	-0.017	0.060	0.2734	0.86	0.83	0.89
10th decile (2.93 HPRD or higher)	0.066	0.023	0.108	0.0026	0.88	0.84	0.91
Case-Mix Adjusted LPN Staffing							
<3rd decile (<0.62 HPRD)	Reference				0.89	0.87	0.91
3rd decile (0.62 – <0.71 HPRD)	-0.025	-0.063	0.012	0.1864	0.89	0.86	0.92
4th decile (0.71 – <0.80 HPRD)	-0.036	-0.073	0.000	0.0510	0.88	0.85	0.91
5th decile (0.80 – <0.87 HPRD)	-0.013	-0.051	0.024	0.4905	0.89	0.86	0.92
6th decile (0.87 – <0.95 HPRD)	-0.044	-0.082	-0.007	0.0212	0.86	0.83	0.89
7th decile (0.95 – <1.04 HPRD)	-0.005	-0.042	0.032	0.8034	0.9	0.87	0.93
8th decile (1.04 – <1.14 HPRD)	0.011	-0.028	0.050	0.5698	0.91	0.88	0.95

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% CI—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
9th decile (1.14 – <1.30 HPRD)	0.022	-0.017	0.060	0.2722	0.92	0.89	0.95
10th decile (1.30 HPRD or higher)	0.007	-0.034	0.047	0.7490	0.86	0.83	0.89
Ownership							
For-profit	Reference				0.93	0.92	0.94
Non-profit	-0.085	-0.112	-0.058	<.0001	0.75	0.73	0.77
Government	-0.027	-0.068	0.015	0.2065	0.96	0.92	0.99
Special Focus Facility (SFF) Status							
Neither SFF nor candidate	Reference				0.88	0.87	0.89
SFF candidate	0.143	0.087	0.199	<.0001	1.04	0.99	1.1
SFF	0.258	0.135	0.382	<.0001	1.16	1.04	1.29
% Medicaid Residents (Quartiles)							
Lowest	Reference				0.71	0.69	0.73
Second	0.105	0.076	0.134	<.0001	0.9	0.88	0.92
Third	0.147	0.117	0.176	<.0001	0.96	0.94	0.98
Highest	0.161	0.130	0.192	<.0001	0.99	0.97	1
Hospital-Based vs. Freestanding							
Freestanding	Reference				0.89	0.88	0.9
Hospital-based	-0.023	-0.087	0.041	0.4850	0.89	0.82	0.95
Continuing Care Retirement Community (CCRC) Status							
Not part of CCRC	Reference				0.92	0.91	0.93
Part of CCRC	-0.060	-0.097	-0.024	0.0010	0.67	0.64	0.7
Urban vs. Rural							
Urban	Reference				0.76	0.75	0.77
Rural	0.435	0.412	0.457	<.0001	1.23	1.21	1.25
Number of Certified Beds (per 1-bed increment)	-0.001	-0.001	-0.001	<.0001			

*Overall facility average for long-stay emergency department visits is 0.90 per 1,000 resident-days.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,424).

Exhibit H.2e: Regression Coefficients, Rate of Successful Return to Home or Community from a Skilled Nursing Facility

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% CI—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
Case-Mix Adjusted RN Staffing							
<3rd decile (<0.38 HPRD)	Reference				49.18	48.82	49.54
3rd decile (0.38 – <0.45 HPRD)	0.741	0.149	1.334	0.0140	50.19	49.72	50.67
4th decile (0.45 – <0.52 HPRD)	1.851	1.250	2.452	<.0001	51.32	50.84	51.8
5th decile (0.52 – <0.60 HPRD)	2.349	1.758	2.940	<.0001	51.93	51.46	52.4
6th decile (0.60 – <0.70 HPRD)	3.218	2.633	3.803	<.0001	52.98	52.52	53.43
7th decile (0.70 – <0.82 HPRD)	3.633	3.041	4.225	<.0001	53.4	52.95	53.85
8th decile (0.82 – <1.00 HPRD)	5.100	4.485	5.715	<.0001	55.06	54.59	55.53
9th decile (1.00 – <1.28 HPRD)	5.989	5.323	6.656	<.0001	56.08	55.59	56.57
10th decile (1.28 HPRD or higher)	8.156	7.412	8.900	<.0001	59.02	58.53	59.52
Case-Mix Adjusted Nurse Aide Staffing							
<3rd decile (<1.76 HPRD)	Reference				51.52	51.18	51.86
3rd decile (1.76 – <1.89 HPRD)	-0.019	-0.581	0.543	0.9470	52.17	51.72	52.62
4th decile (1.89 – <2.01 HPRD)	-0.147	-0.724	0.430	0.6170	52.35	51.88	52.81
5th decile (2.01 – <2.13 HPRD)	-0.522	-1.109	0.066	0.0820	52.4	51.93	52.88
6th decile (2.13 – <2.28 HPRD)	-0.192	-0.770	0.387	0.5160	53.31	52.84	53.77
7th decile (2.28 – <2.44 HPRD)	-1.199	-1.784	-0.615	<.0001	52.92	52.46	53.38
8th decile (2.44 – <2.62 HPRD)	-1.146	-1.747	-0.544	<.0001	53.35	52.87	53.82
9th decile (2.62 – <2.93 HPRD)	-1.369	-1.985	-0.752	<.0001	53.53	53.05	54.02
10th decile (2.93 HPRD or higher)	-1.205	-1.904	-0.506	0.0010	55.43	54.87	55.99
Case-Mix Adjusted LPN Staffing							
<3rd decile (<0.62 HPRD)	Reference				52.58	52.23	52.94
3rd decile (0.62 – <0.71 HPRD)	1.122	0.503	1.740	<.0001	52.18	51.68	52.68
4th decile (0.71 – <0.80 HPRD)	1.292	0.702	1.881	<.0001	52.27	51.81	52.73
5th decile (0.80 – <0.87 HPRD)	1.407	0.800	2.014	<.0001	52.2	51.72	52.68
6th decile (0.87 – <0.95 HPRD)	2.009	1.405	2.613	<.0001	52.6	52.13	53.07
7th decile (0.95 – <1.04 HPRD)	2.391	1.795	2.987	<.0001	52.81	52.35	53.26
8th decile (1.04 – <1.14 HPRD)	2.161	1.546	2.776	<.0001	52.62	52.14	53.1
9th decile (1.14 – <1.30 HPRD)	2.727	2.115	3.340	<.0001	53.2	52.73	53.66
10th decile (1.30 HPRD or higher)	3.738	3.105	4.371	<.0001	55.41	54.93	55.89

Variable	Regression Coefficients			*p*-Value (vs. ref)*	Adjusted Mean Outcome		
	Coefficient	95% CI—Lower	95% CI—Upper		Mean	95% CI—Lower	95% CI—Upper
Ownership							
For-profit	Reference				51.95	51.77	52.13
Non-profit	-0.021	-0.435	0.394	0.9220	55.44	55.12	55.75
Government	-0.008	-0.799	0.783	0.9840	53.65	52.89	54.41
Special Focus Facility (SFF) Status							
Neither SFF nor candidate	Reference				53.02	52.86	53.18
SFF candidate	-2.782	-3.733	-1.831	<.0001	48.1	47.16	49.03
SFF	-2.200	-4.280	-0.120	0.0380	48.23	46.16	50.3
% Medicaid Residents (Quartiles)							
Lowest	Reference				57.59	57.31	57.88
Second	-2.029	-2.463	-1.595	<.0001	53.67	53.39	53.96
Third	-3.892	-4.347	-3.436	<.0001	51.19	50.9	51.48
Highest	-5.847	-6.367	-5.327	<.0001	49.05	48.67	49.42
Hospital-Based vs. Freestanding							
Freestanding	Reference				52.66	52.5	52.82
Hospital-based	2.482	1.492	3.472	<.0001	57.88	56.95	58.82
Continuing Care Retirement Community (CCRC) Status							
Not part of CCRC	Reference				52.39	52.22	52.56
Part of CCRC	-0.106	-0.623	0.412	0.6890	56.72	56.3	57.14
Urban vs. Rural							
Urban	Reference				53.27	53.1	53.45
Rural	-1.542	-1.923	-1.162	<.0001	51.74	51.41	52.07
Number of Certified Beds (per 1-bed increment)							

*Overall facility average for long-stay emergency department visits is 0.90 per 1,000 resident-days.
Source: Abt Associates analysis of Payroll Based Journal system and Nursing Home Care Compare data (N=14,424).

Exhibit H.2f: Predicted Medicare Savings by RN Staffing Decile

	0.38–<0.45 (3rd Decile)	0.45–<0.52 (4th Decile)	0.52–<0.60 (5th Decile)	0.60–<0.70 (6th Decile)	0.70–<0.82 (7th Decile)	0.82–<1.00 (8th Decile)	1.00–<1.28 (9th Decile)	1.28 or higher (10th Decile)
Long-Stay Hospitalizations	$63,377,699	$111,480,255	$195,814,421	$204,955,553	$226,794,143	$504,165,256	$570,424,665	$896,868,001
Long-Stay Emergency Department Visits	$5,749,505	$8,650,577	$16,716,282	$30,060,959	$30,621,766	$42,089,268	$58,342,546	$100,995,977
Short-Stay Hospitalizations	$3,906,203	$6,450,057	$17,272,596	$20,788,673	$20,127,962	$30,543,865	$47,534,616	$70,463,105
Short-Stay Emergency Department Visits	$1,876,692	$2,515,074	$2,096,225	$4,413,239	$6,384,997	$14,392,999	$4,958,034	$16,570,059
Successful Return to Home or Community	$21,764,011	$58,544,604	$86,360,192	$149,362,549	$181,182,521	$332,922,893	$442,328,415	$794,985,717
Total	**$96,674,109**	**$187,640,568**	**$318,259,715**	**$409,580,973**	**$465,111,388**	**$924,114,281**	**$1,123,588,276**	**$1,879,882,859**