The Effects of Nursing Home Staffing on the Quality of Nursing Home Care: Evidence from Employee Absences

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Abstract

Nursing homes provide critical long-term and post-acute care to older adults, yet persistently low care quality remains a pressing policy issue in this industry. Direct care staffing—provided by certified nursing assistants (CNAs), licensed practical nurses (LPNs), and registered nurses (RNs)—is a key determinant of quality, but there is limited consensus on optimal staffing levels and skill mix. Using daily employee-level nursing home staffing data, this study leverages day-to-day staffing shock caused by employee absences to causally estimate the effects of staffing levels and skill mix on patient outcomes. We find that, on average, nursing homes are only able to replace 82% of lost staff hours when an employee is absent with wide variation around this mean. Instrumenting for potentially endogenous staffing levels with our absence instrument, we find that a 25% increase in the weekly staff-to-resident ratio results in a 15.3% reduction in the share of residents hospitalized and a 15.1% reduction in the share of patients who die in that week, as well as an 11% and 13% reduction in days spent in the hospital and overall spending on inpatient care. Quality effects were largest from increases in CNA staffing levels, consistent with this staff type providing the preponderance of daily hands-on patient care. These findings can directly inform ongoing debates about minimum federal staffing standards recently implemented by the Biden administration and currently being reviewed by the Trump administration.

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Introduction

Nursing homes form the backbone of the long-term and post-acute care systems in the United States. Every day, roughly 15,000 US nursing homes, also known as skilled nursing facilities (SNFs), care for about 1.2 million individuals who are recovering from a recent hospitalization or have physical and/or cognitive disabilities that prohibit them from residing in the community (KFF, 2024). Despite the critical role of these facilities, nursing homes have been plagued by persistently low care quality for over 40 years (Institute of Medicine, 1986; National Academies of Sciences & Medicine, 2022).

Numerous reforms and policy initiatives have been implemented to improve nursing home quality, with mixed success. Federal initiatives, such as the Nursing Home Reform Act of 1987, sought to improve care by mandating comprehensive assessments, ensuring residents' rights, and imposing quality standards (Zhang & Grabowski, 2004). In 2002, the Centers for Medicare and Medicaid Services (CMS) launched Nursing Home Compare, a web-based quality reporting platform aimed at improving transparency and incentivizing quality improvements (Tamara Konetzka, Yan, & Werner, 2021). And numerous state initiatives have sought to improve nursing home quality through a mix of financial incentives, regulations, and penalties for quality deficiencies (National Academies of Sciences & Medicine, 2022). Despite these efforts, poor nursing home quality continues to be a pressing policy issue with many observers arguing these issues were only worsened by the Covid-19 pandemic (McGarry & Grabowski, 2021).

A commonality among the various quality initiative that have been tried is an acknowledgement that direct care staffing provided by certified nursing assistants (CNAs), licensed practical nurses (LPNs), and registered nurses (RNs) is one of the most important determinants of care quality. Nursing home care is low-tech, but high-touch. Patients require

high levels hands-on care to support their rehabilitation or assist with mobility and activities of daily living, like dressing, eating, bathing, and toileting. Approximately half of all nursing home patients have dementia which requires close supervision to ensure safety (Dana B. Mukamel, Debra Saliba, Heather Ladd, & R. Tamara Konetzka, 2023), and most patients have complex clinical needs due to multiple chronic conditions and high levels of disability. As CMS noted in a 2019 memo "…staffing has the greatest impact on the quality of care nursing homes deliver" (Centers for Medicare and Medicaid Services, 2019).

Despite consensus on the importance of direct care staff, there is little agreement on what constitutes adequate staffing levels and the skill mix needed to promote high quality care. Prior to 2024, there was no uniform minimum staffing requirement. Rather CMS required only that nursing homes have "sufficient" staff to ensure patient safety and well-being and that an RN or LPN was on site at all times. At the state level, many states implemented their own minimum staffing standards, but these vary widely both in their total staffing minimum and their requirement around specific nurse types. A 2001 studied commissioned by CMS used time-motion study technique and expert input to conclude that a minimum of 4.1 hours per resident day (HPRD) were needed to prevent patient harm (Medicare & Services, 2001), yet very few nursing homes meet this recommendation (Geng, Stevenson, & Grabowski, 2019).

The uncertainty around optimal staffing patterns were brought to the fore in 2023 and 2024 when the Biden administration proposed, and eventually finalized, national minimum staffing standard for nursing homes. Final rule creation was contentious. Industry groups argued that the standards were too high and not able to be tailored to the needs of individual facilities and their patient mix. Patient advocates, on the other hand, argued the standards were too low, falling well short of the 4.1 HPRD recommended minimum. Researchers, meanwhile, pointed

out that the details of the policy (3.48 total HRPD, 0.55 HPRD from RNs with at least 1 RN onsite 24 hours a day, and 2.45 HPRD from CNAs) might disincentivize facilities from using LPNs (Grabowski & Bowblis, 2023).

The purpose of this paper is to provide causal evidence on the impact of nursing home direct care staffing levels and skill mix on patient health outcomes. Using detailed employee-level data, this study exploits exogenous shocks to staffing levels and composition—such as unanticipated staff absences—to isolate the effects of staffing variations on care quality. By leveraging quasi-experimental methods, this paper aims to inform ongoing policy debates by providing robust empirical evidence on the relationship between staffing and patient outcomes.

We find that, on average, nursing homes are only able to replace 82% of lost staff hours when an employee is absent, and that replacement rates are lower for LPN and RN absences. Instrumenting for potentially endogenous staffing levels with our absence instrument, we find that a 25% increase in the weekly staff-to-resident ratio results in a 15.3% reduction in the share of residents hospitalized and a 15.1% reduction in the share of patients who die in that week, as well as an 11% and 13% reduction in days spent in the hospital and overall spending on inpatient care. Quality effects were largest from increases in CNA staffing levels, consistent with this staff type providing the preponderance of daily hand-on patient care.

The remainder of this paper is organized as follows. Section 2 provides details on the dataset used for this study. Section 3 describes the empirical approach, section 4 presents our main results, and section 5 discusses the results and policy implications.

1. Data

The key data source for this study is the 2017-2021 CMS Payroll-Based Journal (PBJ) database which records hours worked for nearly all CMS-certified nursing homes at the

employee-day level. Collection of these data began in the fourth quarter of 2016 when CMS implemented a new system to objectively track nursing home staffing levels on a daily basis (Centers for Medicare and Medicaid Services, 2023). In addition to hours worked by nursing home employees, it contains information on staff type (i.e., RN, LPN, CNA) and payment type (i.e., facility employee or contract worker).

Records in the PBJ are identified through employee IDs that are unique to employees within facilities. As a result, we are able to track employee tenure within a given facility, as well as whether they are a full- or part-time worker. In total, PBJ captures more than 500 million employee shifts during our study window.

To measure nursing home quality, we use 100% samples of the Medicare Provider Analysis and Review (MedPAR) file, Medicare enrollment data, and the Minimum Dataset (MDS). MedPAR contains health insurance claims-based information for all inpatient hospitalizations and skilled nursing facility stays covered by traditional Medicare (TM), including the primary diagnosis, admission and discharge dates, and Medicare spending. Medicare enrollment data (also known as the Master Beneficiary Summary file) contains beneficiary demographic information, chronic disease diagnoses, and dates of death. The MDS contains information from resident assessments that are required to be performed by all CMS certified nursing homes for all residents at regularly scheduled intervals. Critically, these data sources contain information on nursing home entry and discharge dates for all residents, which we use to identify the population of nursing home patients at a given point in time for a facilities active during 2017-2019. We exclude years where the facility closed, quarters where the facility reported no occupancy or occupancy below 30 residents, and dates when hours were not reported to the PBJ database.

2. Empirical Strategy

In our naïve specification, we estimate the relationship between staffing levels in week t in facility f and patient outcomes. Equation 1 summarizes this approach.

$$Y_{f,t} = S_{f,t} + \theta_t + \gamma_f * \varphi_t + \varepsilon_{f,t} \quad (1)$$

Analyses are conducted at the facility-week level and $Y_{f,t}$ represents the quality outcomes of interest. We focus on patient outcomes that can be objectively measured in claims data and are the primary measures of nursing home quality, including: the share of nursing home residents hospitalized (as identified via a hospital admission on the same date as a nursing home discharge in the MDS) during the given week, 2) the share of nursing home patients who die during the given week, either in the nursing home or after being hospitalized, and 3) total inpatient (i.e., Medicare and out-of-pocket spending on acute care hospital stays and subsequent skilled care in a SNF) during the given week. $S_{f,t}$ represent our variables measuring staffing. Initially we examine total direct care staffing levels by summing the hours of care provided by CNAs, LPNs, and RNs within a facility week. We determine a staffing ratio (i.e., staff hours per nursing home resident) by dividing total hours by the average weekly patient census in facility f during 2017-2019. The weekly census was weighted by each resident's days in the SNF for the given week to create an hours per resident day (HPRD) measure. We use the average census to calculate the staffing ratio to avoid confounding from facilities endogenously admitting or discharging residents in response to changes in staff available or staff hours (e.g., nursing homes could limit new admissions on days when they are short staffed). In a sensitivity analyses, we use mean staffing levels rather than hours per resident as the endogenous variable.

θ_t represents week fixed effects, $\gamma_f * \varphi_t$ is a facility-by-quarter quarter fixed effect, and $\varepsilon_{f,t}$ is a robust standard error clustered at the level of the nursing home.

In additional analyses, we examine staff types separately by including terms for CNA, LPN, and RN staffing ratios in the same model.

Instrumental Variables

Observed staffing levels are likely endogenous to facilities' patient census and case-mix. For example, we expect that nursing homes may increase staffing when patient census is high, or the care needs of their caseload require additional staff attention. Similarly, when facilities are short staffed, they may respond by limited new admissions or only accepting new patients who have relatively low care needs. These relationships will bias the estimates obtained from Equation 1. In response, we instrument for observed staffing levels using staff absences.

Nursing home staffing has previously been identified as having a high degree of day-to-day variability (Geng et al., 2019; Dana B Mukamel, Debra Saliba, Heather Ladd, & R Tamara Konetzka, 2023), and staff absences—due to vacations, family care needs, staff illnesses, and transportation issues, etc.—are likely a key drive of this volatility. Furthermore, the nursing home industry is marked by persistent excess demand for labor (McGarry & Grabowski, 2021), meaning that facilities may not be able to fully replace lost staff hours, even when absences are planned.

We leverage plausibly exogenous variation in staff absences, and the facility's ability to replace missing staff hours, to instrument for observed staffing ratios, which is our endogenous variable. We are able to determine absences because we can track individual employees over time in a given facility in the PBJ data. Using the PBJ data, we calculate the usual hours contributed by employees in facility *f* who were absent during part of or the entirety of week *t.* To do so, we first identify absences —defined as no work hours for employee *e* at facility *f* over a consecutive time period that lasts at least 7 days but is no longer than 30 days—that occur in

part or fully in week t for each employee e that has ever been employed at facility *f*. Limiting absences to durations between 7 and 30 days ensures that we exclude employees that are absent for weekends or short-term reasons as well as those who permanently leave the facility's employment. Then, for each day of the absence t for employee e, we determine the number of lost hours as their average daily usual hours worked over the 2 weeks prior to the start of the absence (total hours divided by 14 days). We then aggregate this measure of lost hours for each absent employee and day of absence in facility *f* from the daily level to the weekly level. As with our endogenous variables, our instrument is normalized by the weighted average weekly census for the facility.

We use absences to instrument for actual staffing levels, defined as total staff hours normalized by weighted average weekly census for the facility to estimate the effects of staffing on patient outcomes using two-stage least squares regressions. Equations 2 and 3 summarize our approach. All specifications include calendar week and facility-by-quarter fixed effects to isolate identifying variation that is not due to holidays or facility-specific seasonal changes in staffing.

$$S_{f,t} = Z_{f,t} + \theta_t + \gamma_f * \varphi_t + \varepsilon_{f,t} \quad (2)$$

$$Y_{f,t} = \widehat{S_{f,t}} + \theta_t + \gamma_f * \varphi_t + \varepsilon_{f,t} \quad (3)$$

The key identifying assumption is that the hours usually provided by absent nursing home staff are orthogonal to patient outcomes during the week the staff is absent. By measuring hours usually provided during the two weeks prior to the absence start and patient outcomes during the week of the absence, this assumption is likely to be satisfied. Furthermore, note that the first stage measures what share of an absent hour per resident is replaced by the facility. A smaller first stage indicates smaller replacement rate, i.e., the facility is not as easily able to replace missing staff hours with other staff. Nursing homes care for a variety of residents with

different needs. For instance, nursing homes may have long-term residents affected by Alzheimer's disease or related dementias whose care needs differ greatly from those of residents in nursing homes rehabilitating from acute conditions such as hip fractures or replacement. We assess whether staffing ratios affect nursing home quality for different types of residents by examining how our IV results differ for short-stay residents (those in the nursing home for less than 30 days) vs. long-stay residents (those in the nursing home for 30 days or longer). Long-stay residents typically live in the nursing home and tend to require around-the-clock long term care, whereas short-stay residents typically reside in the nursing home for rehabilitative reasons.

3. Results

After excluding facilities with missing or low-quality staffing data in PBJ, our final sample included 14,663 nursing homes, or roughly 93% of all CMS certified facilities in operation during our study window, and 2,073,833 facility weeks. Table 1 presents summary statistics of the outcomes, endogenous staffing variables, and instruments for our study sample.

Table 1- Sample Description

	Mean	SD	25th Percentile	Median	75th Percentile
Outcomes					
% readmitted	0.21	0.24	0.00	0.16	0.33
% died	0.12	0.18	0.00	0.00	0.20
Hospital days	8.09	12.09	0.00	4.00	11.00
Hospital spending	12,475.29	20,281.12	0.00	4,904.00	17,030.00
Endogenous variables					
Nurse hours per res-day	3.74	0.73	3.26	3.65	4.13
CNAs	2.27	0.52	1.93	2.21	2.56
LPNs	0.86	0.32	0.66	0.86	1.06
RNs	0.60	0.32	0.37	0.54	0.76
Instruments					
Usual hours of absent nurses, per res-day	0.25	0.15	0.14	0.23	0.33
CNAs	0.14	0.11	0.07	0.12	0.20
LPNs	0.06	0.06	0.01	0.05	0.09
RNs	0.05	0.05	0.01	0.03	0.07

Figure 1 shows the distribution of weekly absences (measured as the usual number of hours worked by absent staff, which includes both nurses and nursing assistant, and the usual number of HPRD). Nearly all facility-weeks had some level of staff absences, consistent with earlier research about the volatility of nursing home staffing. The median value of absent HPRD was 0.23, or roughly 6% of the mean staffing level in our sample. About 20% of facility weeks in our sample had absences amounting to 10% or more of average usual hours worked. In Appendix Figures 1-3, we present this distribution of absences by specific staff type, demonstrating that CNA absences are by far the most common. Our data suggest that nurse absences are most common in December and January, likely due to holidays, and during summer months (June-August), likely due to summer holidays. This further suggests that nurse absences are likely to be orthogonal to patient outcomes.

Figure 1- Distribution of Nursing Home Staff Absences

(a) Total hours, nurses



Unit of observation: facility-week.
Includes dates in 2017-2019. Winsorized at 99th percentile.
Sample facility-dates only.

(b) Total hours, nurses, by resident-days



Unit of observation: facility-week.
Includes dates in 2017-2019. Winsorized at 99th percentile.
Sample facility-dates only.

Effect of Absences on Staffing

Figure 2 graphically presents the first stage relationship between absences and actual staff-to-resident ratios for all nurse types (Panel A) and CNAs, LPNs, and RNs (Panels B-D) using binned scatter plots at the facility week level. All panels show a clear inverse relationship between absences and staff HPRD, consistent with the notion that nursing homes are unable to replace all hours lost due to workers who are sick, on vacation, or taking other forms of paid/unpaid time off. Appendix Figures 4-7 show the same relationship when using staff hours as the endogenous variable.

These findings are further confirmed by first stage regression results (Table 2 for staff HPRD, Table 3 for staff hours). Focusing on staff hours for ease of interpretation, when facilities lose 1 hour of total labor, overall staffing levels decline by 0.18 hours (about 11 minutes). Put differently, facilities can replace about 82% of hours lost to absences on average. Columns 2-4 of Tables 2 and 3 show the effects by staff type.

One hour of absent CNA labor resulted in a reduction of 0.18 actual CNA hours and a 0.01 increase in LPN hours, suggesting that facilities compensate, in part, for absent CNAs with more labor from LPNs. A missing hour of LPN labor resulted in 0.03 increase in CNA hours, a 0.26 decrease in actual LPN hours, and a 0.04 increase in RN hours. Absent LPNs appear to be more difficult to replace than CNAs and require the use of both lower *and* higher skilled nurses. Finally, RNs appear to be the most difficult to replace when absent—an hour of missing RN labor resulted in 0.40 fewer RN hours that were minimally offset by a 0.04 increase in LPN hours.

Figure 2- First Stage Relationship between Staff Hours Per Resident and Usual Hours per Resident Worked by Absent Staff

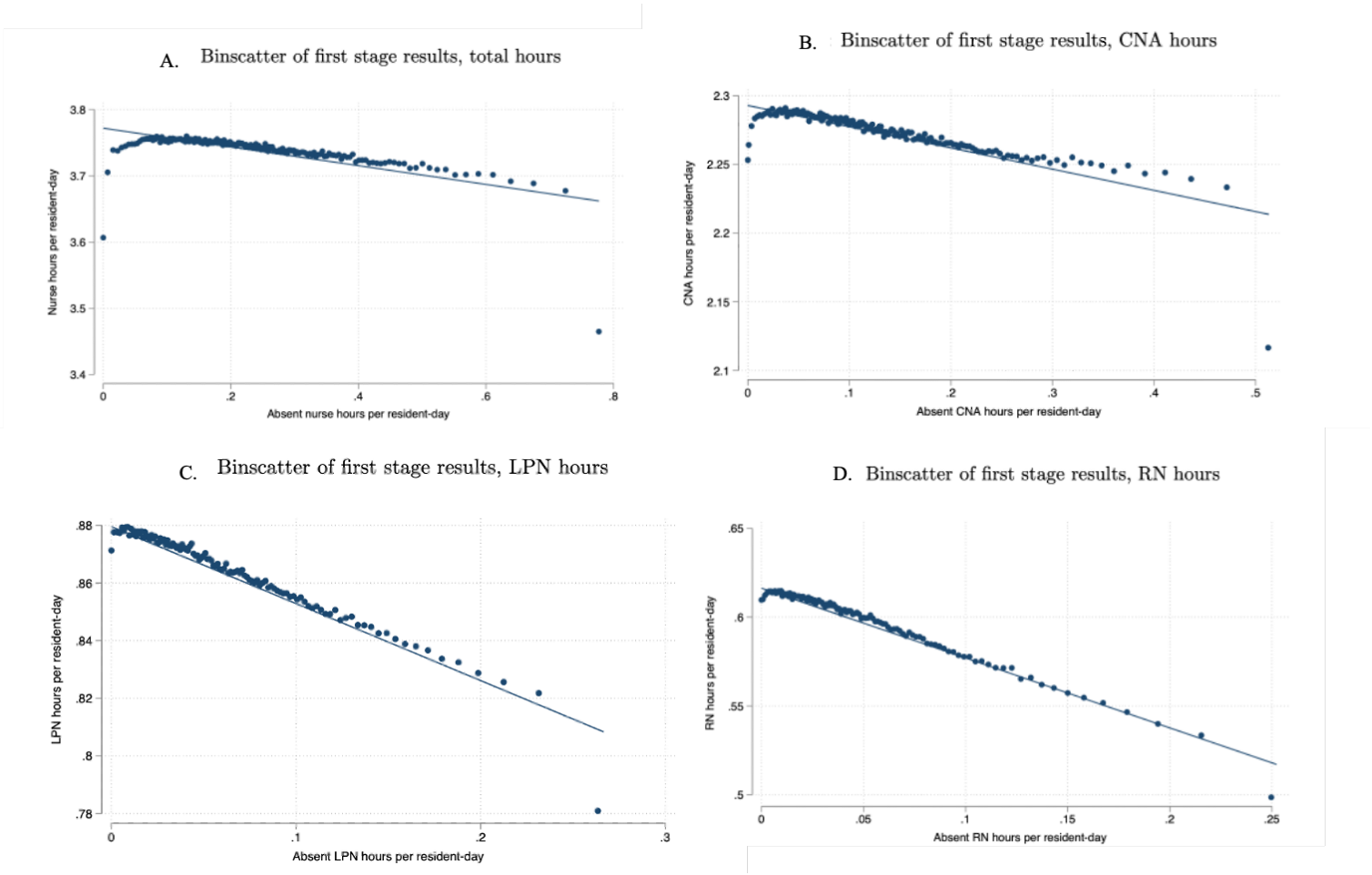


Figure Notes- Unit of observation is facility-weeks. Includes dates in 2017-2019. Endogenous variables and instruments Winsorized at the 99th percentile. Binned scatter plots after adjustment for calendar week and facility-by-quarter fixed effects.

Table 2- First Stage Regression Results, Hours per Resident Day

	(1) Nurse hours per res-day b/se	(2) CNA hours per res-day b/se	(3) LPN hours per res-day b/se	(4) RN hours per res-day b/se
Usual hrs of absent nurses (per res-day)	-0.141329***			
	(0.007655)			
Usual hrs of absent CNAs (per res-day)		-0.154471***	0.019255***	0.007858***
		(0.006354)	(0.002523)	(0.002071)
Usual hrs of absent LPNs (per res-day)		0.040042***	-0.267096***	0.056275***
		(0.007795)	(0.004413)	(0.003042)
Usual hrs of absent RNs (per res-day)		-0.001837	0.084320***	-0.393301***
		(0.009104)	(0.004072)	(0.004729)
Facility FE	No	No	No	No
Week FE	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No
Facility x quarter FE	Yes	Yes	Yes	Yes
N facilities	14,664	14,664	14,664	14,664
N observations	2,073,923	2,073,923	2,073,923	2,073,923
Dep. var mean in control	3.7362	2.2708	0.8632	0.5981
coef rel to mean	-0.0378			
CNA coef rel to mean		-0.0680	0.0223	0.0131
LPN coef rel to mean		0.0176	-0.3094	0.0941
RN coef rel to mean		-0.0008	0.0977	-0.6576

Table 3- First Stage Regression Results, Hours

	(1) Nurse hours b/se	(2) CNA hours b/se	(3) LPN hours b/se	(4) RN hours b/se
Usual hrs of absent nurses	-0.178424***			
	(0.010332)			
Usual hrs of absent CNAs		-0.180271***	0.011062***	0.000437
		(0.008682)	(0.003235)	(0.002466)
Usual hrs of absent LPNs		0.027381***	-0.256650***	0.043466***
		(0.009758)	(0.005422)	(0.003416)
Usual hrs of absent RNs		-0.005168	0.084677***	-0.403430***
		(0.011759)	(0.005034)	(0.005661)
Facility FE	No	No	No	No
Week FE	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No
Facility x quarter FE	Yes	Yes	Yes	Yes
N facilities	14,664	14,664	14,664	14,664
N observations	2,073,923	2,073,923	2,073,923	2,073,923
Dep. var mean in control	2398.6557	1457.3206	562.5552	377.0648
coef rel to mean	-0.0001			
CNA coef rel to mean		-0.0001	0.0000	0.0000
LPN coef rel to mean		0.0000	-0.0005	0.0001
RN coef rel to mean		-0.0000	0.0002	-0.0011

Effect of Staffing on Quality

We begin by presenting the reduced form relationship between staff absences and our primary quality outcomes—hospitalizations and mortality. Figure 3 shows the relationship using HPRD, while Appendix Figures 8 and 9 use hours. After adjustment for facility-by-quarter and calendar week fixed effects, there was a clear positive relationship between staff absences and the share of residents hospitalized and the share of residents who died.

Figure 3. Reduced Form Relationship between Staff Absences and Quality Outcomes

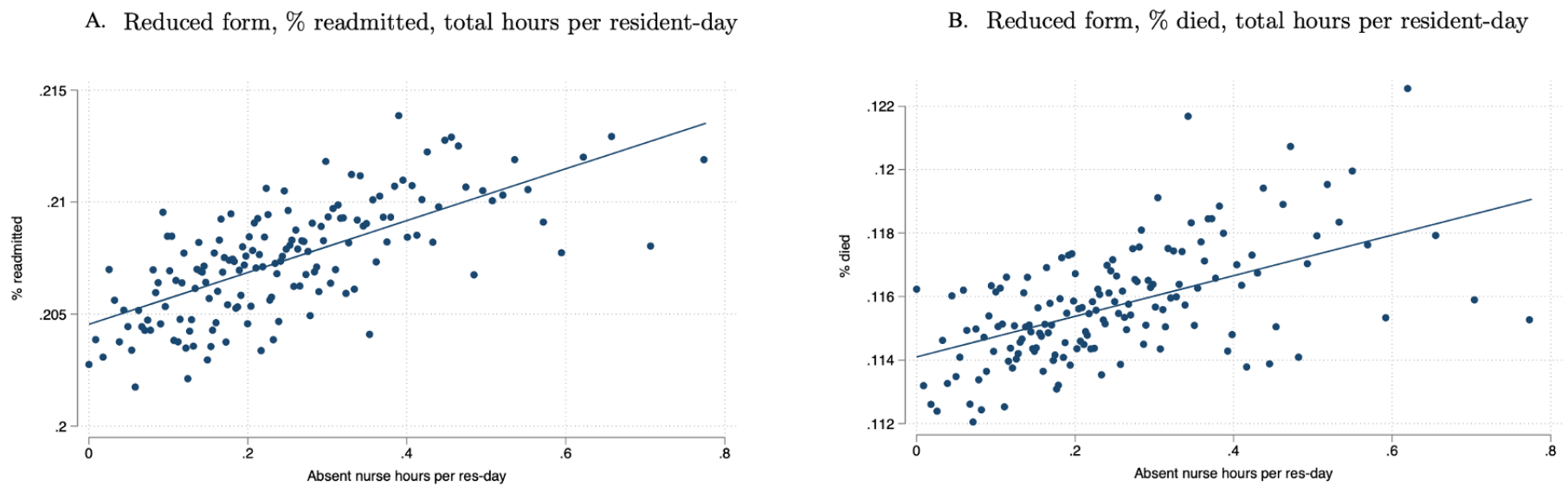


Figure Notes- Unit of observation is facility-weeks. Includes dates in 2017-2019. Endogenous variables and instruments Winsorized at the 99th percentile. Binned scatter plots after adjustment for calendar week and facility-by-quarter fixed effects.

The IV results are presented in Table 4. We separately estimate a regression model of the effect of total staff hours per resident-day, presented in the first row of Table 4, and a separate regression model of the effect of staff hours by nurse type, presented in rows 2-4 of Table 4. A one-unit increase in total staff hours per resident day (roughly a 27% increase relative to the mean staffing ratio) resulted in a 0.032 percentage point decline in the weekly share of patients hospitalized, which equates to a 15.3% decline relative to the outcome mean (Column 1). These effects were concentrated in staffing increases among CNAs and LPNs. The same increase in total staffing levels reduced the share of patients who died by 0.018 pp decline in the weekly share of patients who died, equating to a reduction of 15.1% relative to the mean (Column 2). Mortality effects were driven almost entirely by increases in CNA staffing.

The absence of significant quality effects from increases in RN staffing is inconsistent with prior studies that have found RNs are the key driver of quality (Chen & Grabowski, 2015; Lin, 2014). This discrepancy may be related to the fact that prior studies generally identified effects from point in time policy changes that created persistent shifts in nursing home staffing patterns. Additionally, outcomes in these studies were generally measured over longer time horizons. In contrast, our study focuses on short-term shocks to staffing levels and their near-term effects on quality. Because CNAs provide the preponderance of hands-on day-to-day care for nursing home residents, it is likely that CNA absences could result in immediate patient harms, whereas RN absences may only be detrimental if they are long enough to affect the clinical direction and oversight of residents' care plans.

Columns 3 and 4 display findings for our other quality outcomes, demonstrating that the benefits of increased staffing result in meaningful reductions in the total number of days nursing home patients spend in the hospital and total spending on inpatient (hospital and SNF) spending.

Table 4- Effects of Increased Staffing on Nursing Home Quality, 2SLS

	(1) % Readmitted to Hospital	(2) % Died	(3) Hospital Days	(4) Hospital Spending (in $)
Staff hours (per res-day)	-0.032***	-0.018***	-0.890***	-1,740***
	(0.005)	(0.004)	(0.210)	(370)
	[-15.310%]	[-15.170%]	[-10.77%]	[-13.37%]
CNA hours (per res-day)	-0.037***	-0.021***	-1.010***	-1,670***
	(0.006)	(0.005)	(0.290)	(500)
	[-17.890%]	[-11.570%]	[-12.21%]	[-12.83%]
LPN hours (per res-day)	-0.026***	-0.009	-0.590	-1,550*
	(0.009)	(0.007)	(0.420)	(710)
	[-12.480%]	[-15.170%]	[-7.12%]	[-11.92%]
RN hours (per res-day)	-0.009	-0.007	-0.490	-1,250*
	(0.008)	(0.007)	(0.370)	(679)
	[-4.550%]	[-5.920%]	[-5.92%]	[-9.59%]
Week fixed effects	Yes	Yes	Yes	Yes
Facility x quarter fixed effects	Yes	Yes	Yes	Yes
N facilities	14,663	14,663	14,663	14,663
N observations	2,073,833	2,073,833	2,073,833	2,073,833
Dep. var mean	0.208	0.116	8.290	13,040

A 1-unit increase in the overall staffing ratio resulted in a 0.89 reduction in total hospital days, a nearly 11% decline relative to the sample mean, and a $1,740 reduction in total inpatient spending, a 13% reduction. Consistent with our findings for the other quality outcomes, quality improvements in total hospital use were driven by increases in CNA staffing. Spending reductions were related to increases in all 3 staff types.

Appendix Tables 1 and 2 show that staff hours reduce hospitalizations for both short-stay and long-stay residents, but the relative impact of an additional staff hour per resident day on hospitalizations is much bigger for long-stay residents. Furthermore, the overall effect of staffing levels on mortality appears to be entirely driven by decreases in mortality among long-stay residents. Although the results by staff type are imprecise for short-stay residents, Appendix Table 1 shows that short-term staffing hours for LPNs and RNs impact readmission and mortality outcomes for long-stay residents. The concentration of results among long-stayers aligns with the high levels of frailty in this population, as well as their staff-intensive personal care needs.

In ongoing analyses, we examine how these staffing effects vary by several staff dimensions, including worker experience (i.e., are there differential returns to additional staff hours from more vs. less experienced nurses), full- vs. part-time status, and employee vs. contract worker status. Additionally, we examine how the effects of staffing vary by patients' characteristics, including being a short-stay, rehabilitative patients vs. being a long-stay resident with primarily person care needs, having dementia, and having high vs. low levels of physical impairment. Our ongoing work will also expand the set of quality outcomes we examine to include those derived from nursing home assessment data (the MDS). These measures will include the development of pressure ulcers, falls, declines in functional independence, and the use of physical and chemical restraints.

4. Discussion

Our paper provides some of the first plausibly causal evidence on the short-run effects of day-to-day variation in nursing home staffing on the quality of care. Our findings align with previous work that increase in overall staffing result in improvements in care quality (Chen & Grabowski, 2015; Foster & Lee, 2015; Hackmann, 2019; Lin, 2014). Notably, our findings diverge from much of this earlier work in two ways. First, we find that our quality effects are determined primarily by lower-skilled (CNA) staffing levels. Second, our estimated effects on hospitalizations and mortality are relatively large compared to earlier studies.

Further work is needed to understand these differences, but they are consistent with the fact that our identifying variation comes from temporary and, likely unexpected, losses of staffing. If nursing homes operate with limited "slack" in their typical staffing levels, unexpected losses of staff hours due to absences may drop facility staffing levels below a minimum threshold needed to ensure patient safety. Because CNAs are the primary staff type delivering hands-on care and direct monitoring of patients, it is reasonable that losses of this staff type may be particularly detrimental to residents. In contrast, absences of RNs may have limited impact on residents in the short-run because their responsibilities are primarily to develop and oversee the implementation of patient plans of care. As such, persistently low levels of RN staffing may have significant long-run harms on patients that our current empirical specifications are not well-suited to detect.

Our findings broadly support recent policy efforts to implement federal minimum staffing standards (Centers for Medicare and Medicaid Services, 2024). However, the lack of clear short-term quality effects from daily variation in registered nurse staffing levels suggest that the relatively high standards imposed by the current rule for this staff type—a minimum of 0.55 HPRD from RNs and at least 1 RN onsite 24-hours a day—may not be warranted. Instead, policy

makers may want to consider options that give facilities greater flexibility, such as a minimum daily staffing requirement that does not consider skill mix coupled with a weekly or monthly minimum staffing level for RNs. Such a policy may be particularly attractive given the reported difficulties in hiring RNs in the nursing home sector (AHCA/NCAL, 2024; Brazier et al., 2023).

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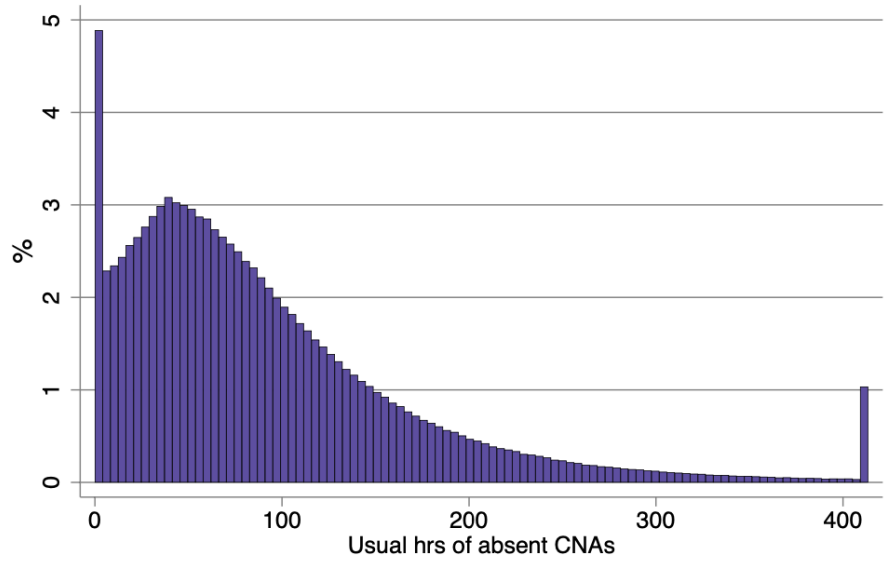
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6. Appendix

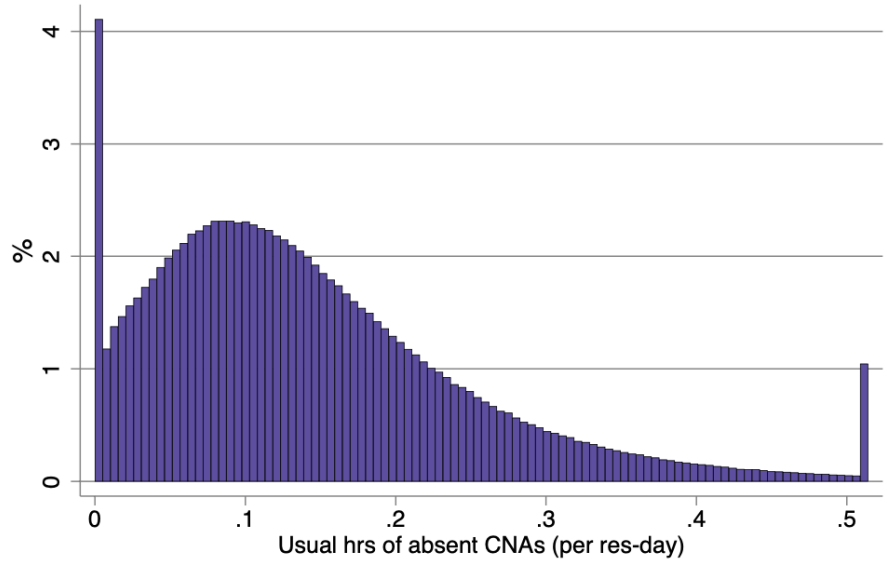
Appendix Figure 1- Distribution of Usual Hours Worked by Absent CNA Staff

(a) Total CNA hours



Unit of observation: facility-week.
Includes dates in 2017-2019. Winsorized at 99th percentile.
Sample facility-dates only.

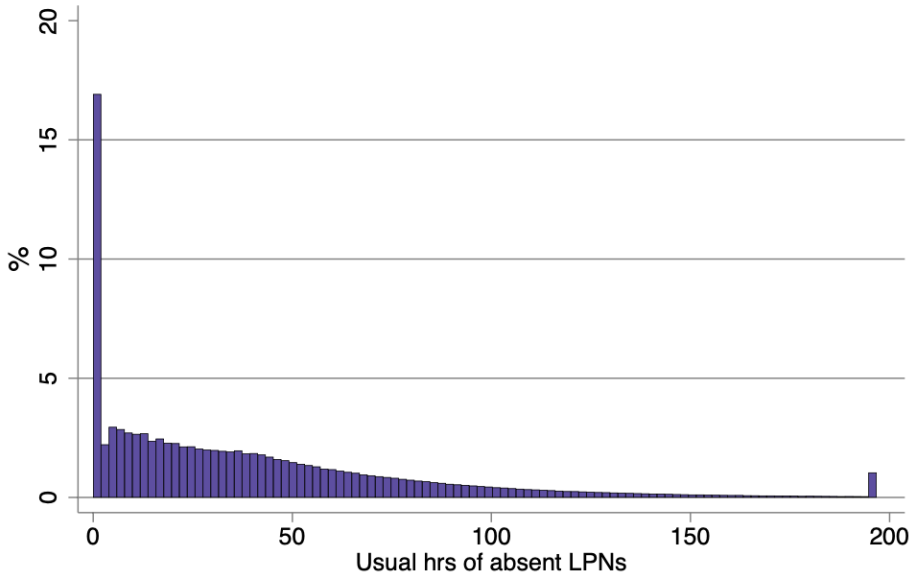
(b) Total CNA hours, by resident-days



Unit of observation: facility-week.
Includes dates in 2017-2019. Winsorized at 99th percentile.
Sample facility-dates only.

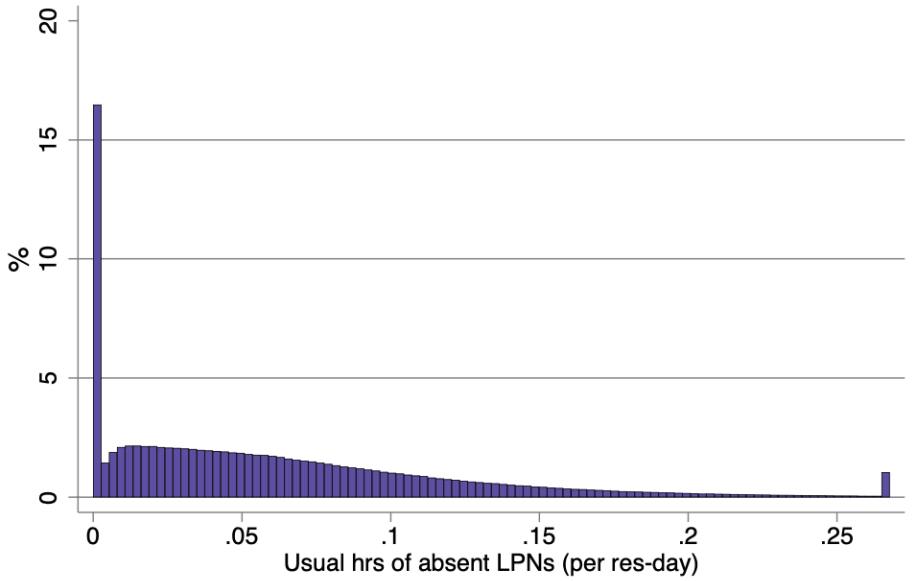
Appendix Figure 2- Distribution of Usual Hours Worked by Absent LPN Staff

(a) Total LPN hours



Unit of observation: facility-week.
Includes dates in 2017-2019. Winsorized at 99th percentile.
Sample facility-dates only.

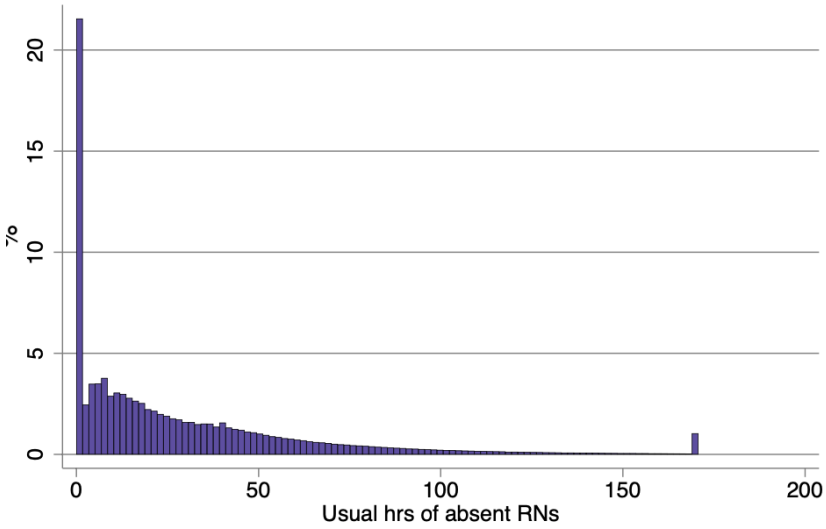
(b) Total LPN hours, by resident-days



Unit of observation: facility-week.
Includes dates in 2017-2019. Winsorized at 99th percentile.
Sample facility-dates only.

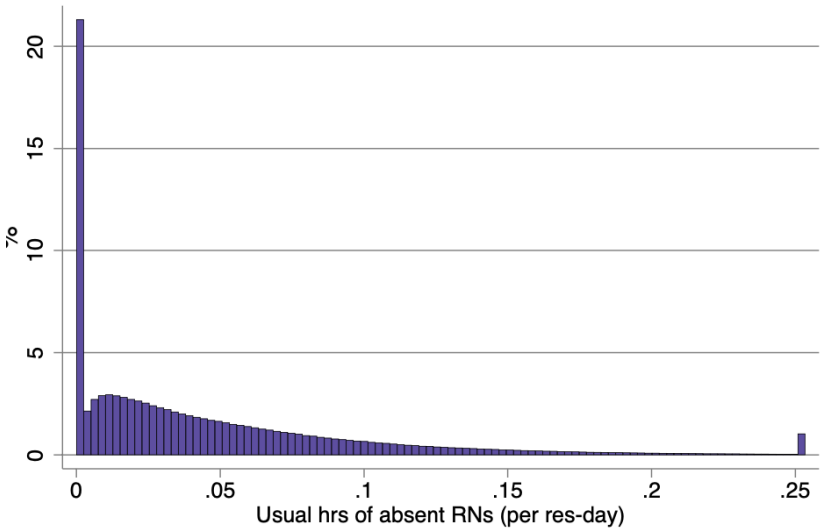
Appendix Figure 3- Distribution of Usual Hours Worked by Absent RN Staff

(a) Total RN hours



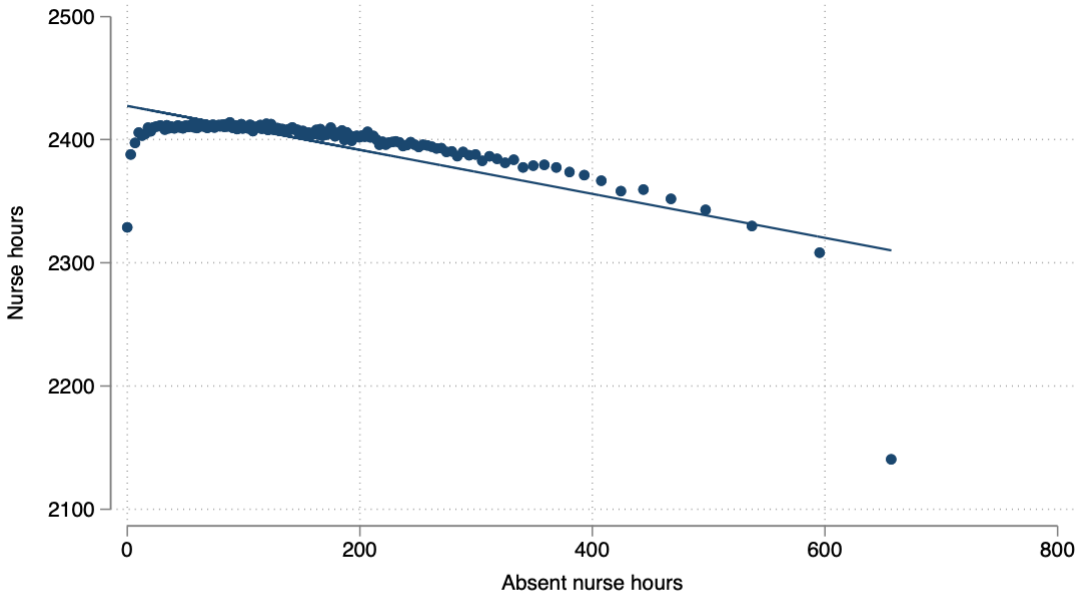
Unit of observation: facility-week.
Includes dates in 2017-2019. Winsorized at 99th percentile.
Sample facility-dates only.

(b) Total RN hours, by resident-days



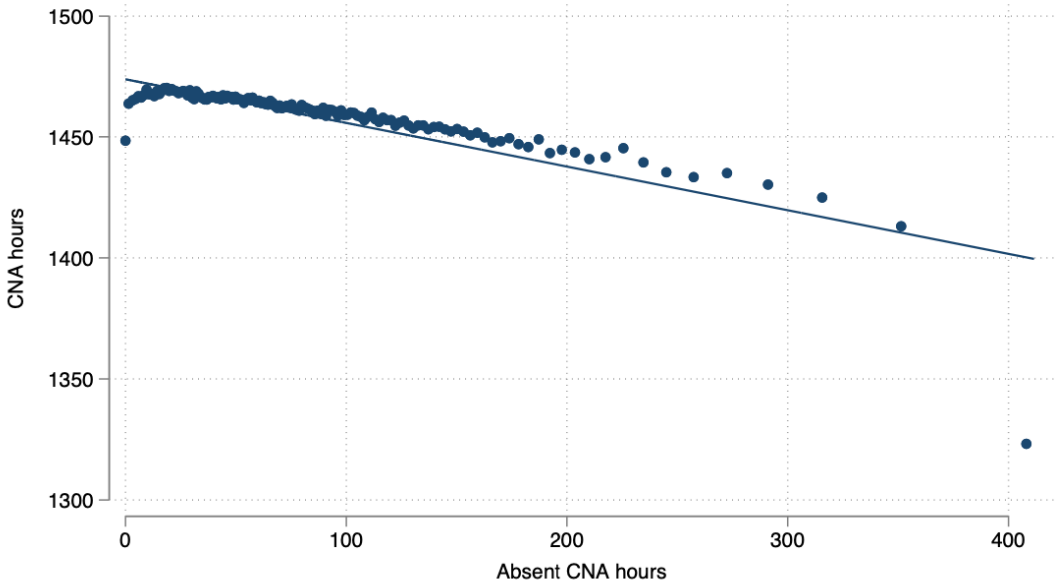
Unit of observation: facility-week.
Includes dates in 2017-2019. Winsorized at 99th percentile.
Sample facility-dates only.

Appendix Figure 4- First Stage Relationship between Total Nurse Hours and Usual Hours Worked by Absent Nurses



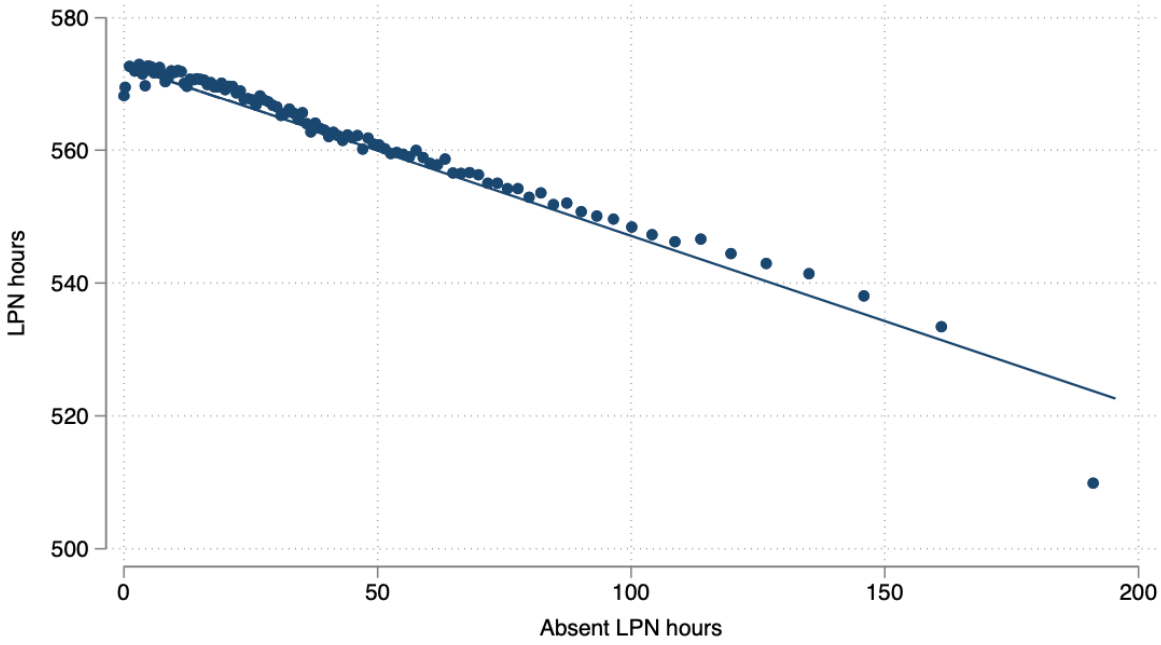
Unit of observation: facility-week.
Includes dates in 2017-2019. Endogenous variables and instruments winsorized at 99th percentile.
Sample facility-weeks only.
Includes FEs for: i.accptid_num#i.quarter i.week.

Appendix Figure 5- First Stage Relationship between CNA Hours and Usual Hours Worked by Absent CNAs



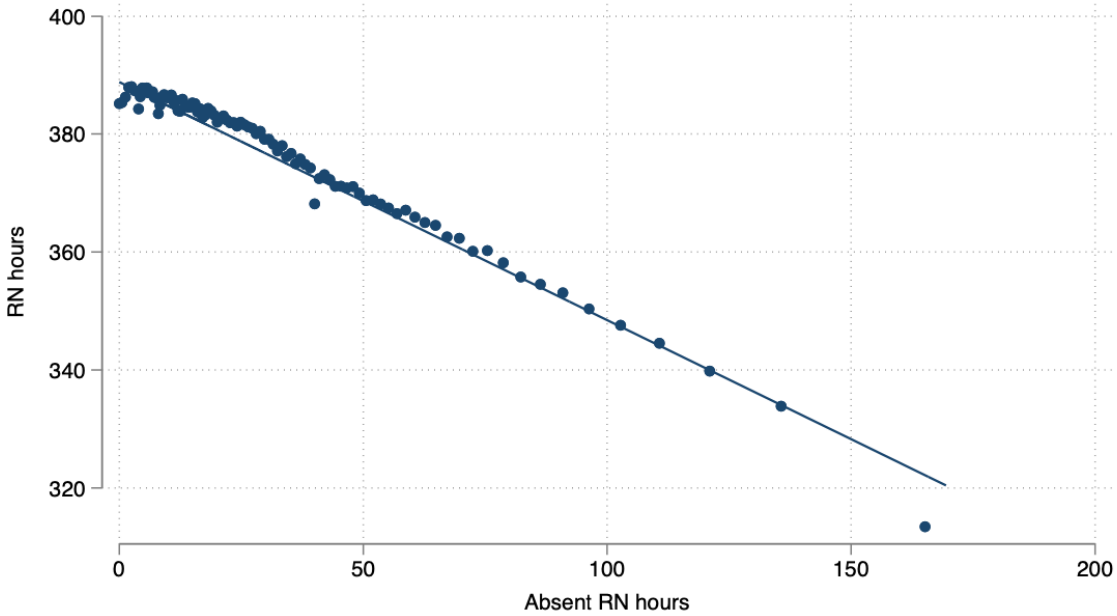
Unit of observation: facility-week.
Includes dates in 2017-2019. Endogenous variables and instruments winsorized at 99th percentile.
Sample facility-weeks only.
Includes FEs for: i.accptid_num#i.quarter i.week.

Appendix Figure 6- First Stage Relationship between LPN Hours and Usual Hours Worked by Absent LPNs



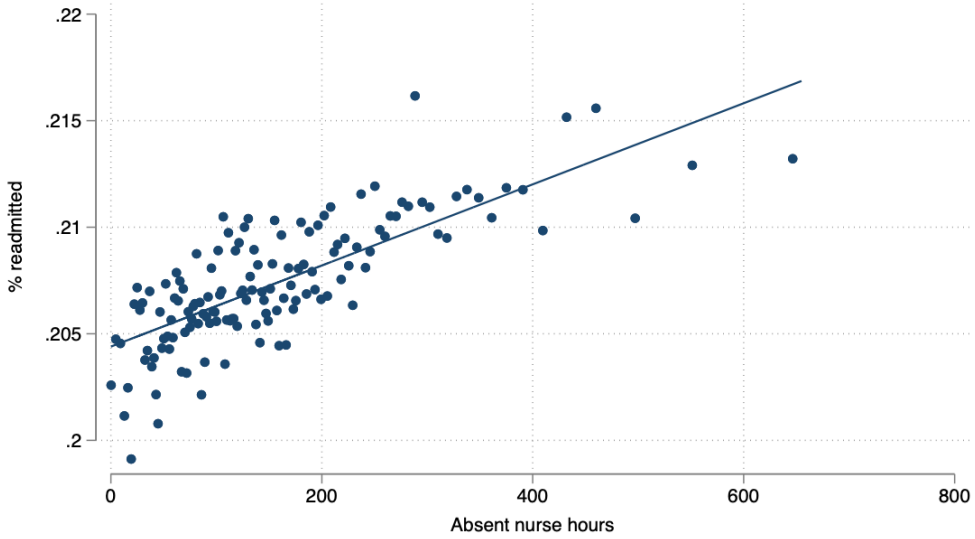
Unit of observation: facility-week.
Includes dates in 2017-2019. Endogenous variables and instruments winsorized at 99th percentile.
Sample facility-weeks only.
Includes FEs for: i.accptid_num#i.quarter i.week.

Appendix Figure 7- First Stage Relationship between RN Hours and Usual Hours Worked by Absent RNs



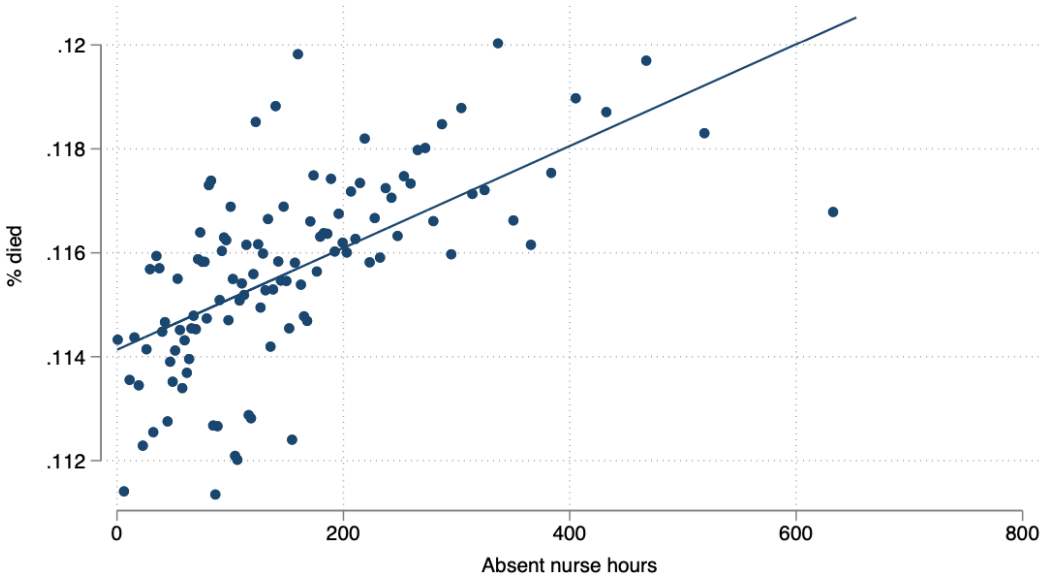
Unit of observation: facility-week.
Includes dates in 2017-2019. Endogenous variables and instruments winsorized at 99th percentile.
Sample facility-weeks only.
Includes FEs for: i.accptid_num#i.quarter i.week.

Appendix Figure 8- Reduced Form Relationship between Staff Absences and Hospitalizations Using Hours as the Endogenous Variable



Unit of observation: facility-week.
Includes dates in 2017-2019. Instruments winsorized at 99th percentile.
Sample facility-dates only.
Includes FEs for: i.accptid_num#i.quarter i.week.

Appendix Figure 9- Reduced Form Relationship between Staff Absences and Mortality Using Hours as the Endogenous Variable



Unit of observation: facility-week.
Includes dates in 2017-2019. Instruments winsorized at 99th percentile.
Sample facility-dates only.
Includes FEs for: i.accptid_num#i.quarter i.week.

Appendix Table 1: Effects of Increased Staffing on Nursing Home Quality on Long-Stay Residents, IV Results

	(1) % readmit b/se	(2) % readmit b/se	(3) % died b/se	(4) % died b/se
Staff hrs (per res-day)	-0.025253***		-0.018196***	
	(0.003721)		(0.003199)	
CNA hrs (per res-day)		-0.030042***		-0.019648***
		(0.005177)		(0.004473)
LPN hrs (per res-day)		-0.017788**		-0.011659*
		(0.007233)		(0.006198)
RN hrs (per res-day)		-0.008039		-0.011050*
		(0.006820)		(0.005943)
Facility FE	No	No	No	No
Week FE	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No
Facility x quarter FE	Yes	Yes	Yes	Yes
N facilities	14,663	14,663	14,663	14,663
N observations	2,073,831	2,073,831	2,073,831	2,073,831
Dep. var mean in control	0.1136	0.1136	0.0754	0.0754
coef rel to mean	-0.2224		-0.2412	
CNA coef rel to mean		-0.2645		-0.2604
LPN coef rel to mean		-0.1566		-0.1545
RN coef rel to mean		-0.0708		-0.1465

Appendix Table 2: Effects of Increased Staffing on Nursing Home Quality on Short-Stay Residents, IV Results

	(1) % readmit b/se	(2) % readmit b/se	(3) % died b/se	(4) % died b/se
Staff hrs (per res-day)	-0.209225**		-0.076835	
	(0.091594)		(0.089359)	
CNA hrs (per res-day)		-0.161405		-0.077114
		(0.127904)		(0.127611)
LPN hrs (per res-day)		-0.271349		-0.084219
		(0.171416)		(0.169444)
RN hrs (per res-day)		-0.170733		-0.063071
		(0.152992)		(0.156486)
Facility FE	No	No	No	No
Week FE	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No
Facility x quarter FE	Yes	Yes	Yes	Yes
N facilities	14,653	14,653	14,653	14,653
N observations	1,966,068	1,966,068	1,966,068	1,966,068
Dep. var mean in control	1.4586	1.4586	0.8606	0.8606
coef rel to mean	-0.1434		-0.0893	
CNA coef rel to mean		-0.1107		-0.0896
LPN coef rel to mean		-0.1860		-0.0979
RN coef rel to mean		-0.1171		-0.0733