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Original Study

Shortages of Staff in Nursing Homes During the COVID-19 Pandemic: What are the Driving Factors?

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A B S T R A C T

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Objectives: During the Coronavirus Disease 2019 (COVID-19) pandemic, US nursing homes (NHs) have been under pressure to maintain staff levels with limited access to personal protection equipment (PPE). This study examines the prevalence and factors associated with shortages of NH staff during the COVID-19 pandemic.

Design: We obtained self-reported information on staff shortages, resident and staff exposure to COVID-19, and PPE availability from a survey conducted by the Centers for Medicare and Medicaid Services in May 2020. Multivariate logistic regressions of staff shortages with state fixed-effects were conducted to examine the effect of COVID-19 factors in NHs.

Setting and Participants: 11,920 free-standing NHs.

Measures: The dependent variables were self-reported shortages of licensed nurse staff, nurse aides, clinical staff, and other ancillary staff. We controlled for NH characteristics from the most recent Nursing Home Compare and Certification and Survey Provider Enhanced Reporting, market characteristics from Area Health Resources File, and state Medicaid reimbursement calculated from Truven data.

Results: Of the 11,920 NHs, 15.9%, 18.4%, 2.5%, and 9.8% reported shortages of licensed nurse staff, nurse aides, clinical staff, and other staff, respectively. Georgia and Minnesota reported the highest rates of shortages in licensed nurse and nurse aides (both >25%). Multivariate regressions suggest that shortages in licensed nurses and nurse aides were more likely in NHs having any resident with COVID-19 (adjusted odds ratio [AOR] = 1.44, 1.60, respectively) and any staff with COVID-19 (AOR = 1.37, 1.34, respectively). Having 1-week supply of PPE was associated with lower probability of staff shortages. NHs with a higher proportion of Medicare residents were less likely to experience shortages.

Conclusions/Implications: Abundant staff shortages were reported by NHs and were mainly driven by COVID-19 factors. In the absence of appropriate staff, NHs may be unable to fulfill the requirement of infection control even under the risk of increased monetary penalties.

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The epicenter of the Coronavirus Disease 2019 (COVID-19) pandemic in the United States has been in long-term care facilities, particular nursing homes (NHs).[1] The first COVID-19 case in an NH was confirmed in a Kirkland, Washington, facility on February 28, 2020.[2] Since then, the Centers for Medicare and Medicaid Services (CMS)

reported 107,389 confirmed cases and 71,278 suspected cases of COVID-19 among residents based on self-reported data by NHs released in June 20, 2020.[3] NH residents are extremely vulnerable to COVID-19 because they are older, functionally impaired, and have multiple comorbidities.[1,4] This frail population thus bore more than

27.5% of all confirmed cases resulting in death.[3] In fact, a *New York Times* analysis claims that NH residents and workers accounted for one-third of COVID-19 death in the United States.[5]

A critical aspect of NH care is staff.[6−10] Before the pandemic, NH staff was the single largest cost to operating an NH.[11] NHs must staff positions to provide direct care to residents but also ancillary services, such as housekeeping and food service. Examples of staffing categories include licensed nurses (ie, registered nurses [RNs] and licensed practical nurses [LPNs]), nurse aides that assist licensed nurses and provide direct care to residents (certified nurse aides [CNAs]), clinical staff (ie, physicians and other advanced practice providers), and other ancillary staff (eg, recreation and food services).[12] Research suggests that NHs with higher staffing levels tend to provide better quality of care,[4,6−10,12−16] but low wages, and less-desirable work environments compared with alternatives have made it difficult for NHs to hire and retain staff.[10,17−19] Reliance on government payment models, such as Medicaid, which reimburses at or below actual costs,[20] further limits NHs' ability to increase wages or offer other benefits to hire and retain staff.

These structural challenges have only become worse for NHs during the coronavirus pandemic.[21,22] NH workforce does not have the luxury of being able to social distance, as their job requires close contact with the residents. At the early stage of the pandemic, NHs lacked the life-saving personal protection equipment (PPE) to prevent the transmission within the facility.[23−25] The shortage put staff at increased risk of contracting the virus, with staff suspected of having contracted COVID-19 required to quarantine for at least 14 days. The net result was existing NH staff were often sidelined. Yet, other factors also created pressure. NHs needed to implement infection control protocols, including isolating residents who were suspected of having the virus.[26] The ban on visitors to NHs also reduced the availability of some informal care provided to residents by visiting relatives. This created a situation in which time and effort needed from NHs staff increased, yet structural factors made it more difficult to address,[8,22,25,27] creating the potential for a staff shortage.[22] CMS acknowledged this shortage by temporarily suspending the competency requirement for providing direct care to residents,[28] but the additional $600 per week federal unemployment benefit hurt the ability of NHs to recruit needed staff.[22]

The coronavirus pandemic has led to an urgent shortage of staff faced by NHs,[22,25] yet which facilities and what factors drove these shortages are not well understood. To mitigate this knowledge gap, we analyzed the first-ever national COVID-19 NH staff data from CMS to examine the staffing shortages in NHs. Understanding the potential predictors of staffing shortages can help policy makers and NH administrators implement effective interventions to combat staff shortages.

Methods

Data Sources

We consolidated several publicly available datasets to create our analytic file. We download the Nursing Home COVID-19 Public File (COVID-19 File) from the Nursing Home Compare (NHCompare) website for COVID-19−related information, including detailed self-reported data on the number of resident and staff COVID-19 cases, supply of PPE, and shortages of staff. As of June 15, 2020, CMS published data of the weeks ending on May 24 and 31, 2020 for each certified NH and conducted the quality check of the data.[3] Of the 15,451 NHs with data on May 31, 2020, 80.1% (12,375) passed the quality check. NHs that did not pass the quality check tended to be smaller, for-profit, and with lower five-star ratings.

The COVID-19 file was merged with other data to obtain NH characteristics, particularly the April 2020 monthly NHCompare archive database and the Certification And Survey Provider Enhanced Reporting (CASPER). The NHCompare archive contains summary information about each NH, including select measures of facility structure, nursing staff levels, and star ratings. This information is updated regularly by CMS and contains the most recent publicly available information regarding facilities. CASPER captures a snapshot of each facility's payer-mix and resident case-mix before the pandemic. CASPER includes data collected as part of initial and annual recertification inspections of all Medicare and Medicaid−certified NHs, with these inspections occurring every 9 to 15 months. Because CASPER is available with a lag, we used the most recent inspection for each facility that occurred from August 2018 through October 2019 (with a median date of March 28, 2019). The 2010 Rural-Urban Commuting Areas Codes (RUCAs) that incorporate information on both population size and commuting time were downloaded to define the rurality of NHs.[29] County market factors were obtained from the 2018−2019 Area Health Resources File.[30] Truven Health Analytics' 2016 report on Medicaid expenditures for NHs was used to estimate state Medicaid reimbursement rates.[15,31]

Study Cohort

The primary analysis included all free-standing NHs with COVID-19 information in the week of May 31, 2020, that could be merged with NHCompare and CASPER data, resulting in 11,920 unique NHs.

Dependent Variables

The dependent variables included whether the NH self-reported a shortage in staff (yes/no) for the following type of staff: licensed nurse staff, nurse aides, clinical staff, and other staff. Licensed nurse staff included RNs and LPNs. Nurse aides included the CNAs, nurse aides, and medication aides/technicians. Clinical staff referred to physician, physician assistant, advanced practice nurse. Finally, other staff included all staff not mentioned in the preceding categories (eg, ancillary services such as housekeeping).

Covariates

Covariates associated with potential shortages included COVID-19 factors, NH and market characteristics, and state policy relating to NHs.[4,9,15,32,33] COVID-19 factors included the cumulative number of residents and staff diagnosed with COVID-19 per 100 beds. We scaled the number of cases to 100 beds to account for differences in facility size. PPE has been shown to be very critical in preventing the transmission of COVID-19. We included 3 binary variables indicating whether a NH had a 1-week supply of N95 masks, eye protection, and gowns.

We used CASPER data to extract NH characteristics that might be associated with staffing shortages: staffing levels (RNs, LPNs, and CNAs measured in hours per resident day [HPRD]), NH structure (ownership, chain status, total beds, occupancy rate, and dementia special care unit), resident case-mix and payer-mix (case-mix acuity index, % Medicaid residents, and % Medicare residents), rurality, and NHCompare Overall Five-star Rating.[4,15,32,34−36] Rurality of NHs was determined from zip codes merged with 2010 RUCAs.[37] NHs were grouped into urban, large rural city/town (micropolitan), and small rural town/ isolated small rural town (rural).[38]

We included the following factors that described the NH market identified as the county in which the NH was located[4]: primary care

physician per 1000 population, concentration of total NH beds measured by the Herfindahl-Hirschman Index (HHI),[39] Medicare Advantage penetration rate (% Medicare Advantage of all Medicare beneficiaries in the county), median household income ($), and % older population (≥65).[4,15,32–34] Medicaid reimbursements were approximated by the ratio of a state's total Medicaid expenditure on NHs derived from Truven reports[31] divided by the total number of Medicaid bed days estimated from the number of NH residents with Medicaid payer reported in CASPER data.[15] Finally, we included state effects to control for unobserved fixed differences across states.

Statistical Analysis

Descriptive analyses were conducted to show staff shortages, COVID-19 factors, NH characteristics, market factors, and state policy. We also compared these factors by whether the NHs had any staff with COVID-19 and tested the statistical significance of differences between NHs with and without any staff with COVID-19 using *t*-tests for continuous variables and χ² tests for binary variables. We then conducted 4 separate multivariate logistic regressions to examine factors associated with shortages of staff with standard errors clustered at county level, as many COVID-19 policies including reporting are county-based. We dichotomized the residents and staff with COVID-19 at 1 to indicate whether the facility had any confirmed COVID-19 for easy interpretation and to avoid potential bias in reported cases. Overall 5-star rating was categorized as 4 or 5 stars versus 1 to 3 stars as an indicator of high rating. Continuous variables (except staffing and Medicaid rates) were standardized at overall means and SDs to reduce variance and simplify the comparison of parameter estimates.[33] The data of COVID-19 File in the week of May 24, 2020, were analyzed as sensitivity analysis and showed similar results (not reported).

Table 1
Nursing Home Characteristics, Market Factors, and State Policy

Variables	All NHs (N = 11,920)	Staff with COVID-19 (n = 4466)	Staff without COVID-19 (n = 7454)	P value*
	Mean (SD) or N (%)	Mean (SD) or N (%)	Mean (SD) or N (%)	
Outcome measures				
Shortage of licensed nurse staff (RN+LPN)	1897 (15.9)	877 (19.6)	1020 (13.7)	<.01
Shortage of nurse aides†	2189 (18.4)	996 (22.3)	1193 (16.0)	<.01
Shortage of clinical staff (MD+NP+PA)	301 (2.5)	161 (3.6)	140 (1.9)	<.01
Shortage of other staff	1170 (9.8)	567 (12.7)	603 (8.1)	<.01
COVID-19 factors				
Total residents with COVID-19 per 100 beds	5.68 (30.24)	13.86 (35.58)	0.79 (25.31)	<.01
Total staff with COVID-19 per 100 beds	3.79 (18.86)	10.13 (29.77)	0.00 (0.00)	<.01
Has 1-week supply of N95 masks	9796 (82.2)	3727 (83.5)	6069 (81.4)	<.01
Has 1-week supply of eye protection	10,705 (89.8)	4088 (91.5)	6617 (88.8)	<.01
Has 1-week supply of gowns	9486 (79.6)	3559 (79.7)	5927 (79.5)	.82
NH characteristics				
Staffing				
RN staffing level (HPRD)	0.66 (0.42)	0.68 (0.42)	0.65 (0.42)	<.01
LPN staffing level (HPRD)	0.86 (0.33)	0.88 (0.32)	0.85 (0.34)	<.01
CNA staffing level (HPRD)	2.29 (0.53)	2.28 (0.54)	2.29 (0.52)	.33
Structure				
Ownership				
For-profit	8561 (71.8)	3190 (71.4)	5371 (72.1)	<.01
Government	647 (5.4)	192 (4.3)	455 (6.1)	
Not-for-profit	2712 (22.8)	1084 (24.3)	1628 (21.8)	
Chain-affiliated	7205 (60.6)	2541 (57.0)	4664 (62.7)	<.01
Number of beds	108.47 (58.65)	129.75 (72.16)	95.73 (44.12)	<.01
Occupancy rate (0–100)	78.91 (16.55)	81.61 (15.00)	77.30 (17.22)	<.01
Dementia special care unit	1688 (14.2)	694 (15.6)	994 (13.4)	<.01
Resident and payer mix				
Case-mix acuity index	10.42 (1.35)	10.56 (1.32)	10.34 (1.36)	<.01
% Medicaid paid (0–100)	59.44 (23.45)	58.75 (24.49)	59.84 (22.80)	.01
% Medicare paid (0–100)	13.11 (12.88)	13.85 (12.99)	12.66 (12.79)	<.01
Rurality				
Urban	7871 (66.3)	3698 (83.1)	4173 (56.2)	<.01
Micropolitan	1703 (14.3)	384 (8.6)	1319 (17.8)	
Rural	2300 (19.4)	368 (8.3)	1932 (26.0)	
Overall 5-star Rating ≥4	5519 (46.3)	2105 (47.1)	3414 (45.8)	.16
Market factors at county level				
Primary care physician per 1000 population	0.60 (1.21)	0.93 (1.49)	0.40 (0.96)	<.01
Competitive market (HHI < 0.15)	8872 (74.4)	3803 (85.2)	5069 (68.0)	<.01
% Medicare Advantage penetration (0–100)	31.63 (13.75)	32.67 (13.13)	31.00 (14.08)	<.01
Median household income ($)	58,206.04 (15,797.69)	63,264.92 (17,467.63)	55,139.06 (13,820.35)	<.01
% Older population (≥65) (0–100)	16.90 (4.02)	15.95 (3.43)	17.47 (4.24)	<.01
State policy				
Medicaid reimbursement rates	179.74 (52.43)	185.89 (57.38)	176.06 (48.87)	<.01

HHI, Herfindahl-Hirschman Index; MD, physician; NP, Nurse Practitioner; PA, Physician Assistant.
Micropolitan, large rural city/town; Rural, small rural town/ isolated small rural town.
Data sources included the COVID-19 Nursing Home Dataset for COVID-19–related information, Nursing Home Compare Data (April 2020) for nursing home characteristics, CASPER (2018–2019) for nursing home characteristics, and Area Health Resources File (2018–2019) for market factors.
*P values measure whether nursing homes of staff with versus without COVID-19 had the same characteristics using *t*-tests for continuous variables, and χ² tests for binary variables.
†Nurse aides included the certified nursing assistant, nurse aide, medication aide, and medication technician.

All statistical analyses were performed in SAS 9.4 (SAS Institute Inc., Cary, NC) and Stata 16.0 (StataCorp LLC, College Station, TX).

Results

Descriptive results by whether NHs had any staff with COVID-19 are presented in Table 1. Of the 11,920 NH sample, 15.9%, 18.4%, 2.5%, and 9.8% reported shortages of licensed nursing staff, nurse aides, clinical staff, and other staff, respectively. On average, 5.7 (SD 30.2) residents and 3.8 (SD 18.9) staff per 100 beds were confirmed with COVID-19; 82.2%, 89.8%, and 79.6% NHs had a 1-week supply of N95 masks, eye protection, and gowns, respectively. Most NHs were for-profit (71.8%), chain-affiliated (60.6%), with most residents paid by Medicaid (59.4%), and located in urban areas (66.3%). Approximately one-half (46.3%) of NHs had overall 5-star rating ≥4. The average % Medicare Advantage penetration was 31.6% and state on average reimbursed NHs $179.7 per resident day. Table 1 also suggests that almost all predictors were significantly different in NHs having any staff with versus without COVID-19, except for 1-week supply of gowns, CNA staffing level, and overall 5-star rating (all P ≤ .01). NHs having any staff with COVID-19 were more likely to experience shortages of licensed nurse, nurse aides, clinical staff, and other staff.

Figure 1 presents the geographic variation of staff shortages in licensed nurse and nurse aides. NHs in east and midwest states had a greater percentage of reported shortages, with the following states reporting the highest rate of shortages in licensed nurse and nurse aides (both >25%): District of Columbia, Georgia, Minnesota, and Rhode Island. Figure 2 suggests that number of residents and staff with COVID-19 were highly correlated and also varied by states. Connecticut, District of Columbia, Massachusetts, and New Jersey reported more than 20 residents and 10 staff per 100 NH beds. Together, Figure 1 and 2 imply that states with higher number of residents and staff with COVID-19 were more likely to report shortages in licensed nurse and nurse aides.

Multivariate logistic regression results are shown in Table 2. NHs having any resident with COVID-19 were more likely to experience shortages of nursing staff, nursing aides, clinical staff, and other staff (adjusted odds ratio [AOR] = 1.60, 1.44, 2.10, and 1.71, respectively; all P < .01). Similarly, NHs with any staff with COVID-19 were more likely to report all shortages of all types of staff (AOR ranges 1.34–1.43; all P < .01). Having a 1-week supply of eye protection and gowns was associated with lower probability of staffing shortages.

Previous staffing levels were not associated with staffing shortages during the pandemic (at the 5% level), except that NHs with higher RN staffing level were less likely to report shortages in licensed nurse staff. Most NH structure factors were not significantly associated with staff shortages, except for occupancy rates. NHs with higher occupancy rates were less likely to have shortage in licensed nurse staff, nurse aides, and other staff. NHs with more Medicare residents were less likely to have shortages in licensed nurse staff, nurse aides, and other staff. No differences in staff shortages were found among NHs located in urban, micropolitan, or rural areas. NHs with ≥4 overall ratings were less likely to report shortages in licensed nurse staff, nurse aides, and other staff (AOR = 0.79, 0.83, 0.85, respectively; all P < .01). Most market factors in the model were not associated with staffing shortages, except market competition for shortage in other staff and % Medicare Advantage penetration for shortage in licensed nurse staff. Finally, Medicaid reimbursement rates were not associated with any shortage in staff.

Discussion

Using publicly available staff data, we found that 16% to 18% of NHs reported shortages in licensed nurse staff and nurse aides during the coronavirus pandemic. These reported shortages were not evenly distributed across states, with 1 of 4 facilities in states like Georgia and Minnesota reporting shortages in licensed nurses or aides. Those numbers are concerning, as licensed nurse and nurse aides are the essential workers who provide most of the direct care to residents. Adequate staffing levels are required to provide high-quality care to residents.[7,12] A recent article reported that higher RN staffing levels before the pandemic was associated with fewer COVID-19 cases in a sample of Connecticut NHs.[35]

A major finding of our study is that staff shortages were associated with COVID-19—related factors. NHs having any resident or staff with COVID-19 were significantly more likely to experience shortages of all types of staff, with resident cases of the virus having a stronger effect on licensed nurse staff and clinical staff than nurse aides. This might be because COVID-19 residents require clinical care usually at the level of RNs or physician. Even in May 2020, 20% of NHs did not have a 1-week supply of gowns, calling for help from federal and state governments.[24,25] NHs with a 1-week supply of eye protection and gowns were less likely to report staff shortages, reinforcing the importance of PPE on staff security. Importantly, available supply of N95 masks, which are required only for closer procedure care, were not related to shortages.

Findings support the expectation that NHs with higher staffing levels before the pandemic might be less susceptible to shortages
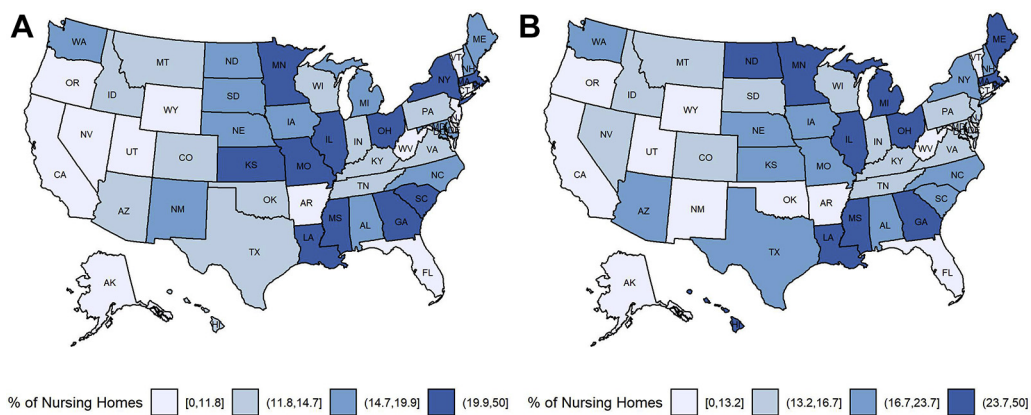
Fig. 1. Percentage of nursing homes reporting staff shortages by state. (A) Reported shortage of licensed nurse staff (including the RN, LPN, and vocational nurse as reported by the provider). (B) Reported shortage of nurse aides (including the CNA, nurse aide, medication aide, and medication technician as reported by the provider).
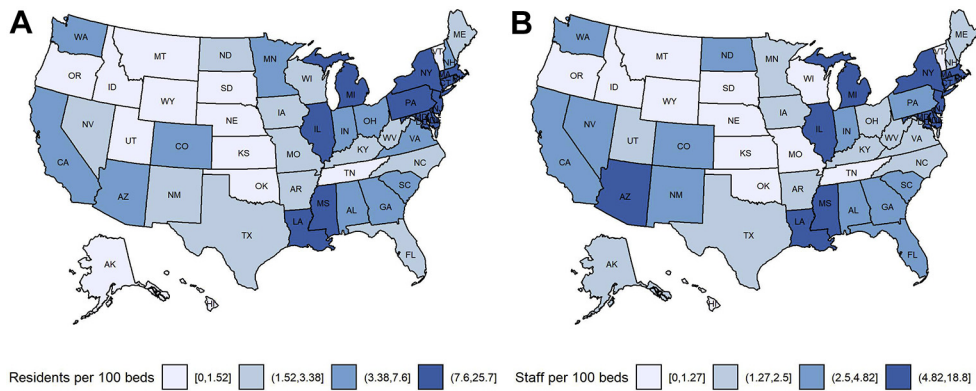
Fig. 2. Prevalence of nursing home residents and staff with COVID-19. (A) Total number of residents with COVID-19 per 100 beds. (B) Total number of staff with COVID-19 per 100 beds. Number of cases were scaled to 100 beds to account for differences in nursing home size.

during the pandemic: better RN staffing was related to fewer shortages in licensed nurses and nurse aides (marginally), but not to clinical staff or other staff.[35] More CNAs before the pandemic was marginally related only to fewer shortages in nurse aides. Unexpectedly, more CNAs was related to higher clinical staff shortages, possibly indicating that those NHs were more likely to rely on post-acute care. Shortage of

clinical staff is different from shortage of front-line staff. Clinical staff are often only present some days of the week and many respond through phone or video calls.

NHs that took care of more post-acute, Medicare-paid residents were less likely to have shortages in clinical staff, as did nonprofit NHs. A reason for this may be states putting temporary bans on elective

Table 2
Multivariate Logistic Regression Models Examining Factors Associated With Reported Shortages of Licensed Nurse, Nurse Aide, Clinical and Other Staff in NHs on May 31, 2020

Variables	Licensed Nurse Staff	Nurse Aides	Clinical Staff	Other Staff
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
COVID-19 factors				
Any resident with COVID-19	1.60*** (1.38−1.85)	1.44*** (1.25−1.67)	2.10*** (1.54−2.87)	1.71*** (1.43−2.05)
Any staff with COVID-19	1.37*** (1.19−1.58)	1.34*** (1.17−1.53)	1.43*** (1.05−1.94)	1.38*** (1.17−1.64)
Has 1-week supply of N95 masks	1.14 (0.90−1.43)	1.02 (0.84−1.25)	1.25 (0.87−1.79)	0.98 (0.78−1.24)
Has 1-week supply of eye protection	0.70*** (0.55−0.89)	0.64*** (0.52−0.79)	0.46*** (0.31−0.69)	0.78* (0.61−1.01)
Has 1-week supply of gowns	0.53*** (0.44−0.64)	0.55*** (0.47−0.65)	0.77 (0.54−1.10)	0.57*** (0.47−0.70)
NH staffing				
RN staffing level (HPRD)	0.66*** (0.49−0.89)	0.80* (0.62−1.04)	1.18 (0.70−1.99)	0.81 (0.58−1.13)
LPN staffing level (HPRD)	0.91 (0.72−1.15)	0.97 (0.78−1.22)	0.97 (0.61−1.55)	0.94 (0.69−1.28)
CNA staffing level (HPRD)	1.00 (0.87−1.14)	0.88* (0.77−1.00)	1.34* (0.98−1.84)	1.00 (0.85−1.19)
NH structure				
Ownership (Ref: for-profit)				
Government	1.31* (0.99−1.72)	1.20 (0.92−1.55)	1.07 (0.58−1.97)	1.35* (0.99−1.85)
Not-for-profit	1.00 (0.86−1.18)	1.08 (0.93−1.26)	0.67** (0.45−0.99)	0.99 (0.82−1.19)
Chain-affiliated	0.96 (0.85−1.08)	0.90* (0.80−1.00)	1.25 (0.96−1.62)	0.91 (0.78−1.06)
Number of beds†	0.98 (0.91−1.05)	1.01 (0.94−1.08)	0.92 (0.78−1.08)	0.91** (0.83−1.00)
Occupancy rate†	0.86*** (0.80−0.92)	0.91*** (0.85−0.98)	0.98 (0.82−1.17)	0.90** (0.82−0.99)
Dementia special care unit	1.08 (0.92−1.25)	1.07 (0.92−1.24)	1.29 (0.91−1.85)	1.22* (1.00−1.49)
NH resident and payer mix				
% Medicaid paid†	1.00 (0.92−1.10)	1.06 (0.98−1.15)	0.97 (0.81−1.16)	1.09* (0.98−1.21)
% Medicare paid†	0.79*** (0.70−0.90)	0.82*** (0.74−0.91)	0.81* (0.65−1.01)	0.80*** (0.70−0.92)
Case-mix acuity index†	1.01 (0.93−1.10)	0.99 (0.92−1.07)	1.02 (0.87−1.19)	1.02 (0.94−1.12)
Rurality (ref: urban)				
Micropolitan	0.96 (0.79−1.16)	0.83* (0.70−1.00)	0.95 (0.62−1.48)	0.90 (0.71−1.15)
Rural	1.11 (0.90−1.37)	0.96 (0.78−1.17)	0.98 (0.60−1.58)	0.97 (0.75−1.26)
Overall 5-star rating ≥4	0.79*** (0.70−0.89)	0.83*** (0.74−0.93)	0.89 (0.68−1.16)	0.85** (0.73−0.98)
Market factors				
Primary care physician†	0.92* (0.85−1.01)	0.98 (0.90−1.06)	1.04 (0.91−1.19)	1.01 (0.90−1.14)
Competitive market (HHI < 0.15)	1.01 (0.85−1.19)	0.93 (0.79−1.09)	0.86 (0.58−1.29)	0.75*** (0.62−0.92)
% Medicare Advantage penetration†	1.11* (1.00−1.22)	1.07 (0.97−1.17)	1.02 (0.84−1.24)	1.02 (0.90−1.17)
Median household income ($)†	0.96 (0.88−1.03)	0.94 (0.87−1.02)	0.99 (0.84−1.15)	1.05 (0.95−1.15)
% Older population (≥65)†	1.04 (0.96−1.13)	1.04 (0.97−1.12)	1.07 (0.93−1.24)	1.08 (0.98−1.18)
Medicaid reimbursement Rates	0.97 (0.90−1.03)	0.97 (0.91−1.04)	1.04 (0.86−1.27)	1.00 (0.92−1.09)
Observations	10,870	10,928	10,666	10,859

CI, confidence interval; OR, odds ratio.
Micropolitan = Large Rural City/Town; Rural = Small Rural Town/ Isolated Small Rural Town.
Standard errors were clustered at county level; State fixed-effects were not presented.
***P < .01, **P < .05, *P < .1.
†Continuous variables were standardized with a mean of 0 and an SD of 1.

surgeries, which led to reduced Medicare post-acute care stays. Although previous work suggests that COVID-19 cases were higher in urban areas,[7] we found no difference in reported staff shortages in rural versus urban NHs. The lack of available workforce in the rural market before the pandemic makes rural NHs more vulnerable to COVID-19, even if they were less likely to have staff with COVID-19 compared with urban NHs (21.8% vs 5.5%).[40] NHs with overall star rating ≥4 were less likely to report staff shortages, suggesting they might be more resilient to the pandemic.[35]

Our results suggest that self-reported shortages in NH staffing are primarily associated with COVID-19–related factors. However, NHs are still faced with multiple other challenges. Media attention has put pressure on regulators to punish NHs given the large number of deaths seen nationally. However, the structure of NH care, the fact that NH residents are frail and more susceptible to the virus, and early miss-steps such as not providing NHs PPE when supplies were scarce and sending patients with coronavirus to NHs may have led to this situation. CMS has recently increased the civil monetary penalties up to $20,000 per instance for noncompliance with infection control.[41] This places great financial challenges on NHs, especially considering that most NH care is reimbursed by Medicaid at lower than operating cost. Even before the pandemic, NHs were reliant on higher margin Medicare residents to provide financial cushion to invest in staff and quality.[42] Indeed, NHs with higher Medicare prevalence were less likely to suffer staff shortages. Securing the financial health of NHs that allows them to address these staff shortages needs to be a priority that might help NHs ensure that fewer residents are exposed to COVID-19.

Although our study highlights staffing shortages in the NHs, we acknowledge several limitations. Our findings may not be generalizable to all NHs, as 20% of NHs did not pass the data quality check of CMS. Information regarding the COVID-19 factors and whether the NH had a staff shortage are self-reported and may be inaccurate. Finally, the most up-to-date information regarding facility characteristics is unavailable, requiring us to rely on resident and payer-mix characteristics from 2018–2019, and Medicaid reimbursement rates from 2016.

Conclusions and Implications

Approximately 1 of 6 NHs self-reported having a shortage in licensed nurse and nurse aide staffing during the COVID-19 pandemic. These shortages are not evenly distributed across states. Staff shortages are mainly driven by COVID-19 factors, such as resident and staff with COVID-19, as well as PPE supply. Policymakers should further support NHs to prevent the transmission of COVID-19 among their vulnerable residents and valuable workforce, and help them acquire sufficient PPE. Current policy efforts that focus on preventing the spread of the infection within and across NHs include (dis)incentives such as large fines, which might be counter-productive. Monetary penalties might motivate NHs to avoid violation of infection control, but without funds to hire and retain staff, NHs lack the capacity to fulfill the requirement. The availability of high-quality direct care workers becomes even more critical as many states are reopening the economy and lifting bans on visitors to NHs.

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