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RESEARCH BRIEFS

Nursing Home Staffing Requirements and Input Substitution: Effects on Housekeeping, Food Service, and Activities Staff

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Objective. To study the effect of minimum nurse staffing requirements on the subsequent employment of nursing home support staff.

Data Sources. Nursing home data from the Online Survey Certification and Reporting (OSCAR) System merged with state nurse staffing requirements.

Study Design. Facility-level housekeeping, food service, and activities staff levels are regressed on nurse staffing requirements and other controls using fixed effect panel regression.

Data Extraction Method. OSCAR surveys from 1999 to 2004.

Principal Findings. Increases in state direct care and licensed nurse staffing requirements are associated with decreases in the staffing levels of all types of support staff.

Conclusions. Increased nursing home nurse staffing requirements lead to input substitution in the form of reduced support staffing levels.

Key Words. Nursing homes, regulation, staffing requirements, support staff, housekeeping, food service, activities staff

Nurse staffing is an important input in the production of high-quality nursing home (NH) care. Responding to concerns about inadequate nurse staffing levels, between 1999 and 2004, 14 states enacted or strengthened minimum nurse staffing policies. Without nurse staffing requirements, NH administrators choose the optimal amount of nurse staff and non-nurse inputs that maximize the facility's objectives. While requirements may guarantee a minimum level of nurse staff availability, administrators face resource constraints and increases in requirements may cause reductions in the use of non-nurse inputs. This substitution of inputs is likely to result in reduced employment of support staff, such as housekeepers, food service, and activities workers. This article studies whether NHs engage in input substitution by using fewer support staff after changes in nurse staffing requirements.

Numerous studies focus on the effects of regulation on NH quality: use of Medicaid reimbursement (Feng et al. 2008; Mor et al. 2011), regulatory stringency and deficiencies measures (Bowblis et al. 2012; Mukamel et al. 2012), and minimum staffing requirements (Mueller et al. 2006; Kim, Harrington, and Greene 2009; Park and Stearns 2009; Bowblis 2011; Grabowski et al. 2011; Tong 2011). While regulation affects quality to varying degrees, few papers focus on how NH regulation affects aspects of managing NHs that are not the direct intent of the regulation. For example, Bowblis and Lucas (2011) found that more stringent regulation in one dimension of quality is offset by poorer quality in other dimensions. Mukamel et al. (2011) reported that increased regulatory scrutiny increases costs. Closest in the spirit to this article, Thomas et al. (2010) found required nurse staffing increases in Florida was associated with a reduction in housekeeping and activities staffing. Given the need to fully understand all aspects of NH regulation, this article is the first national examination of substitution of non-nurse staff inputs caused by increases in nurse staffing requirements.

CONCEPTUAL FRAMEWORK

Faced with multiple economic and regulatory constraints, administrators must choose the mix of inputs that maximize the objective of an NH, which could be different for NHs owned by for-profit and not-for-profits. The primary input of NHs are three types of nurse staffing: registered nurses (RNs), licensed practical nurses (LPNs), and certified nurse aides (CNAs). Additional labor inputs include nonmedical staff: administrators, maintenance workers, food service staff, activities staff, and housekeepers.

Increases in nurse staffing requirements, especially binding constraints, can force NHs to increase the amount of nursing staff they employ regardless of the objective function of the NH. While increases in requirements are often associated with increases in Medicaid reimbursement, NHs may not be able to fully pass along increased cost to Medicare reimbursed and private pay residents. The net result is more nursing staff, but NHs may be financially challenged to maintain other inputs at the same level. Consequently, NHs may

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choose to reduce the total number of activities, housekeeping, and food services positions, and require increased workloads. For example, a housekeeper may be required to increase the number of rooms cleaned daily, potentially enhancing efficiency or lowering quality of services depending on if the facility is over- or understaffed. Another strategy is factor substitution (Zinn 1993; Cawley, Grabowski, and Hirth 2006), in which nurse staffing time is used as a substitute for other staff time. Specifically, NHs may require nursing staff to perform some tasks that were previously completed by support staff, such as changing linens, cleaning up resident rooms, participating in activities programs, and distributing food to residents.

To identify econometrically the effect of staffing requirements on the use of support staff, a significant number of changes in requirements must be observable. Federal law, unchanged since 1987, requires NHs to “have sufficient nursing staff,” but only specifies that a licensed nurse (RN or LPN) must be on duty at all times, with some of those hours being staffed by an RN (Omnibus Budget Reconciliation Act 1987). However, many states implemented requirements that exceed federal standards. States’ staffing requirements generally require minimum levels of licensed staff and minimum amounts of staff providing direct care (mostly CNAs) to residents. Between 1998 and 2004, four states changed five licensed staff requirements, two states implemented first-time direct care requirements, and 12 states increased direct care requirements 17 times (Bowblis 2011). These changes provide variation to examine the effect of increases in staffing requirements on support staff.

DATA AND EMPIRICAL SPECIFICATION

The Online Survey Certification and Reporting (OSCAR) System is the primary source of data. OSCAR contains yearly regulatory surveys that occur every 9–15 months for all Medicare and Medicaid certified NHs. OSCAR is merged with data on state Medicaid reimbursement rates (Grabowski, Angelelli, and Mor 2004a; Grabowski et al. 2004b, 2008), state staffing requirements (Bowblis 2011), and state-level weekly NH wages (NAICS code 623110) from the Bureau of Labor Statistics. To construct a panel of NHs, the survey history of each NH is followed for the period between January 1, 1999 and December 31, 2004. The unit of observation is an NH survey for facility i in state s , and time t represents the number of times the facility is observed. The resulting sample contains 17,436 unique facilities with a total of 90,734 survey observations and excludes NHs from the states

of Alaska and Hawaii because Medicaid reimbursement data are not available.

The dependent variable is one of four support staff measures (S_{ist}). Each dependent variable is regressed on the state minimum direct care staffing requirements 365 days prior to the OSCAR survey date ($MDCS_{st-1}$), indicator variables for change in state licensed staff requirement 365 days prior to the OSCAR survey date (LS_{st-1}), time-varying variables (X_{ist}), and facility-specific heterogeneity (δ_i). The following linear fixed effect panel regression is to be estimated as follows:

$$S_{ist} = \alpha MDCS_{st-1} + \pi LS_{st-1} + \beta X_{ist} + \delta_i + \varepsilon_{ist}.$$

The facility-specific heterogeneity is treated as a fixed effect and captures both observed and unobserved differences across facilities that are constant over time that can be correlated with the explanatory variables.¹

The four measures of support staff are constructed for housekeeping, food service, activities staff, and the summative total of these three types of support staff. Housekeepers include all staff necessary to maintain the environment, including those in the maintenance department. Food service workers carry out the functions of dietary services (e.g., prepare and cook food, service food, wash dishes). Activities staff design and implement ongoing activities of interest for residents that meet their physical, mental, and psychosocial needs. To adjust for the number of residents in the facility, each staff variable is measured in terms of hours per resident day (HPRD). Occasionally, some facilities report improbable staffing values. These observations are identified and excluded from the analysis using the following algorithm: (1) more than 24 hours of staffing; (2) zero staffing (except for activities staff); and (3) among facilities that do not fall into the first two categories, those that are outside four standard deviations of the mean staffing value (Bowblis 2011).

The key explanatory variables are the state staffing requirements. The first staffing regulation is the minimum direct care staffing requirement. As there were 19 changes in direct care staffing requirements over the study period, this requirement is measured in terms of HPRD. Some states vary this requirement by the size of the facility, and the HPRD used corresponds to a facility of 100 beds. To capture the nonlinear effect of this requirement, the variable is entered into the model as a quadratic. The second staffing regulation is licensed staff requirements. Four states changed these requirements five times over the study period. The effects of licensed staff requirements are identified by indicator variables for each change because there are not enough changes in licensed staff requirements to accurately estimate the effect of

changes in HPRD. Changes in licensed staff requirements occurred in the following states: Arkansas, Delaware (twice), Florida, and Ohio. As NHs may need time to adjust to regulatory changes, lags of staffing requirements are utilized. Using the specific date of each survey, all requirements are measured as the effective requirement 365 days prior to the survey date.

Additional control variables capture time-varying variables that may affect the amount of support staff. These include ownership status, the size of the facility, multi-facility chain membership, payer mix, occupancy rate, presence of specialty care units, Medicaid reimbursement, weekly wage rates, and year indicator variables. Facilities of different ownerships may have a propensity to invest in support staff differently, while chain membership, size, and occupancy rates can measure efficiency. Facilities in states receiving higher Medicaid reimbursement and those with less reliance on Medicaid may be able to invest in more support staff. Finally, the presence of specialty care units may indicate an NH's investment in differentiating themselves from their competitors, increasing the chance of having more support staff.

RESULTS

Table 1 reports the summary statistics and regression results. The average staffing levels of housekeepers, food service workers, activities staff, and all support staff are 0.554, 0.729, 0.183, and 1.435 HPRD, respectively. Support staffing levels are found to be lower than nursing staffing levels. Although not shown in the table, RN, LPN, and CNA staffing levels were 0.465, 0.763, and 2.113 HPRD, respectively. Furthermore, support staffing levels exhibit about half the variability in nurse staffing levels as measured by standard deviations.

The coefficient estimates for the direct care staffing requirements are negative for the linear term and positive for the quadratic term. Over the relevant support of staffing requirements (1.78–3.70 HPRD), support staffing levels are declining at a decreasing rate as the requirement becomes larger. The quadratic term is statistically significant for all of the regressions except the activities staff, indicating that the effect of direct care requirements on support staff is nonlinear. In all, increased direct care staffing requirements statistically affects each of the support staff levels with the exception of activities staff. The effects for licensed staff requirements are generally negative, except for the state of Delaware. However, only the effect for activities staff in Arkansas and non-activities staff in Ohio are statistically significant.

Table 1: Support Staffing Levels: Summary Statistics and Regression Results

Variables	Summary Statistics	Dependent Variable: Support Staffing (HPRD)			
		Housekeeping	Food Service	Activities Staff	Combined
<i>Dependent variables</i>					
Housekeeping (HPRD)	0.541 (0.337)				
Food service (HPRD)	0.729 (0.469)				
Activities staffing (HPRD)	0.183 (0.194)				
Combined—All three (HPRD)	1.435 (0.745)				
<i>State nurse staffing requirements</i>					
State minimum direct care staffing requirement (HPRD)	1.735 (1.201)	-0.036* (0.019)	-0.025 (0.020)	-0.012 (0.013)	-0.055* (0.032)
State minimum direct care staffing requirement squared (HPRD)		0.009** (0.004)	0.008* (0.004)	0.003 (0.003)	0.016** (0.007)
<i>Arkansas licensed staff change</i>					
Arkansas licensed staff change	0.005 (0.072)	-0.017 (0.017)	-0.024 (0.018)	-0.018** (0.008)	-0.036 (0.033)
<i>Delaware licensed staff change</i>					
Delaware licensed staff change	0.001 (0.034)	-0.007 (0.061)	0.049 (0.079)	-0.024 (0.032)	0.014 (0.151)
<i>Delaware second licensed staff change</i>					
Delaware second licensed staff change	0.001 (0.028)	-0.018 (0.055)	0.075 (0.068)	0.015 (0.020)	0.099 (0.139)
<i>Florida licensed staff change</i>					
Florida licensed staff change	0.014 (0.117)	-0.008 (0.014)	-0.019 (0.018)	-0.001 (0.008)	-0.033 (0.027)
<i>Ohio licensed staff change</i>					
Ohio licensed staff change	0.021 (0.143)	-0.016* (0.009)	-0.029*** (0.010)	0.001 (0.005)	-0.039** (0.017)
<i>Facility characteristics</i>					
Not-for-profit ownership	0.281 (0.449)	0.002 (0.008)	0.023** (0.011)	0.008* (0.004)	0.027 (0.016)
Government ownership	0.063 (0.242)	0.028 (0.021)	0.062** (0.027)	-0.004 (0.011)	0.091** (0.036)
Number of beds (10 s)	10.926 (7.308)	-0.012*** (0.004)	-0.017*** (0.006)	-0.008*** (0.003)	-0.032*** (0.011)
Multi-facility chain	0.542 (0.498)	-0.009** (0.005)	-0.010* (0.005)	-0.008*** (0.003)	-0.020** (0.008)
% Medicaid reimbursed residents	62.127 (25.442)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001 (0.000)

Continued

Table 1. Continued

Variables	Summary Statistics	Dependent Variable: Support Staffing (HPRD)		
		Housekeeping	Food Service	Activities Staff
% Medicare reimbursed residents	13.379 (20.121)	0.000 (0.000)	0.000 (0.000)	0.000* (0.000)
Occupancy rate	82.329 (18.044)	-0.009*** (0.000)	-0.011*** (0.000)	-0.005*** (0.000)
Alzheimer's special care unit	0.178 (0.383)	0.011* (0.006)	0.015** (0.007)	0.016*** (0.004)
Other type of special care unit	0.060 (0.237)	-0.001 (0.007)	-0.014* (0.008)	-0.002 (0.003)
<i>State policy and year indicator variables</i>				
State medicare reimbursement rate (10 s)	12.467 (2.598)	0.004*** (0.001)	0.005*** (0.002)	0.002*** (0.001)
State weekly nursing home work wage rate (100 s)	5.237 (0.857)	0.018** (0.009)	-0.009 (0.011)	0.017*** (0.005)
Year 2000	0.169 (0.374)	-0.007** (0.003)	-0.006* (0.003)	-0.003* (0.002)
Year 2001	0.171 (0.377)	-0.008** (0.003)	-0.002 (0.004)	-0.003 (0.002)
Year 2002	0.173 (0.378)	-0.012*** (0.004)	-0.003 (0.005)	-0.009*** (0.002)
Year 2003	0.158 (0.365)	-0.021*** (0.005)	-0.015*** (0.006)	-0.015*** (0.003)
Year 2004	0.162 (0.368)	-0.028*** (0.005)	-0.017*** (0.006)	-0.019*** (0.003)
Constant		1.310*** (0.079)	1.872*** (0.101)	3.337*** (0.180)
Observations	90,734	89,420	93,796	87,308
R-squared	0.654	0.742	0.636	0.760

Note. Summary statistics report the mean and standard deviation for the entire sample. Regression results report standard errors in parentheses that are robust to clustering within nursing facility.
 *** $p < .01$; ** $p < .05$; * $p < .1$.

The empirical strategy is developed to draw inference regarding the staffing requirements, and interpretation of conclusions drawn from control variables should be viewed with caution. However, it should be noted that these variables perform as expected. Consistent with efficiency (Sloan, Ostermann, and Conover 2003), larger facilities, chains, and those with higher occupancy rates have lower support staff levels. Facilities that are more reliant on Medicaid are found to have lower support staff HPRD, but this is offset by higher Medicaid reimbursement. The year indicator variables suggest a secular trend toward use of fewer support staff.

To interpret the effects of the regression, Table 2 reports the average staffing levels, and the absolute and percentage change in support staff levels associated with increasing staffing requirements. Compared to having no direct care staffing requirements, a 2.0 HPRD direct care staffing requirement reduces the HPRD for housekeepers by 0.036, food service workers by 0.021, activities staff by 0.013, and total support staff by 0.046 HPRD. These correspond to 6.7, 2.1, 7.0, and 3.2 percent reductions. The effects for direct care staffing requirements of 2.5 and 3.0 HPRD are smaller, but generally consistent with reductions in housekeeping staff of 6.7–5.0 percent, respectively, and for all support staff of 2.7 and 1.5 percent. Increases in licensed staff requirements are found to reduce housekeeping staff for all states and reduce other types of support staff in all states except Delaware, although many of the effects are statistically insignificant.

Sensitivity analyses are performed to ensure that the results are robust to alternative specifications. First, the models are estimated with only year indicator variables and fixed effects. The results are found to be robust to these model specifications. Second, regressions added measures of resident case mix; the Acuinex (Cowles 2002) and the percentage of residents with dementia and psychiatric illnesses. Case mix did not statistically predict support staffing levels or affect the coefficient estimates of the staffing requirement variables. The third sensitivity analysis included state-specific time trends. State-specific linear time trends were highly correlated with the changes in the staffing requirements because many states implemented requirements at the start of calendar years. The inclusion of state time trends increased the standard errors associated with the staffing requirements, without significantly changing the coefficient estimates. A fourth robustness check used alternative definitions of staffing, such as the number of full-time equivalents and the number of full-time equivalents per bed. These alternative definitions resulted in similar conclusions and therefore results are reported using the more familiar and accepted HPRD measure for staffing levels. Since facilities of different ownership type may react differently to staffing requirements, the final

Table 2: Absolute and Percentage Changes in Support Staffing Associated with Staffing Requirements

	<i>Support Staffing (HPRD)</i>			
	<i>Housekeeping</i>	<i>Food Service</i>	<i>Activities Staff</i>	<i>Combined</i>
Average of the dependent variables	0.541 (0.337)	0.729 (0.469)	0.183 (0.194)	1.435 (0.745)
<i>Change in support staff relative to 0 HPRD requirement</i>				
Minimum direct care staffing requirement of 2 HPRD	-0.036*** -6.70%	-0.021*** -2.09%	-0.013*** -7.00%	-0.046*** -3.24%
Minimum direct care staffing requirement of 2.5 HPRD	-0.034*** -6.28%	-0.012*** -1.16%	-0.013*** -6.95%	-0.038*** -2.66%
Minimum direct care staffing requirement of 3 HPRD	-0.027*** -5.03%	0.003 0.35%	-0.011*** -6.17%	-0.022*** -1.52%
<i>Change in support staff associated with licensed staff</i>				
Arkansas licensed staff change	-0.017 -3.14%	-0.024 -3.29%	-0.018** -9.84%	-0.036 -2.51%
Delaware licensed staff change	-0.007 -1.29%	0.049 6.72%	-0.024 -13.11%	0.014 0.98%
Delaware second licensed staff change	-0.018 -3.33%	0.075 10.29%	0.015 8.20%	0.099 6.90%
Florida licensed staff change	-0.008 -1.48%	-0.019 -2.61%	-0.001 -0.55%	-0.033 -2.30%
Ohio licensed staff change	-0.016* -2.96%	-0.029*** -3.98%	0.001 0.55%	-0.039** -2.72%

Note. The table reports the average of the dependent variable, the absolute and percentage change in each type of support staff associated with minimum direct care staffing requirements compared to no requirements, and the absolute and percentage change in support staff for each licensed staff requirement change. Note that percentages may be different from actual affect due to rounding. *** $p < .01$; ** $p < .05$; * $p < .1$.

sensitivity analysis interacted ownership with each of the staffing requirement variables. These interaction terms are found to be statistically insignificant.

CONCLUSION

There exists a gap in the literature on how NHs substitute inputs after the implementation of new regulation. This article uses national data to study the effect of increased nurse staffing requirements on the level of support staff employed by NHs. Higher direct care staffing requirements are found to be

associated with reductions in the level of support staff. Furthermore, increasing licensed staff requirements are generally found to be associated with declines in support staff levels, but many of these results are statistically insignificant. This may be due to the limited number of licensed staff changes that occurred during the study period or the lack of substitution between licensed nurses and support staff. Overall, the results are consistent with NHs offsetting the cost of hiring more nurses by reducing the number of non-nurse staff.

One explanation for this decline is that more nurses are available to perform tasks that would normally be completed by support staff (Thomas et al. 2010). For example, having a large number of CNAs could allow the NH to use this staff to replace dirty linens, provide minor cleaning to residents' rooms, distribute food, or set up activities that residents enjoy. These are all tasks that may have been previously performed by support staff. This hypothesis is supported by Hyer, Temple, and Johnson (2009), who found that to comply with staffing requirements in Florida, some NHs actively recruited from housekeeping and food service staff. Another possibility is that NHs offset the higher cost of direct care staff by cutting support staff without requiring nursing staff to assume additional tasks. This suggests that the workload of the remaining support staff increases, and it may decrease the quality of services provided.

The research design is limited in that it cannot distinguish whether the reduction in support staff was associated with nursing staff assuming the tasks traditionally provided by support staff or if the quality of services provided by support staff deteriorated. Further work is needed that examines changes in quality that may be associated with reduced support staff. It is clear, however, that support staff levels decline after increases in staffing requirements, consistent with regulation causing input substitution.

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NOTE

1. Fixed effect captures any unobserved factors that are fixed over time, but time-varying unobserved variables could make contemporaneous staffing requirements

correlated with the contemporaneous error term. For this reason and to allow NHs time to adjust to the regulations, lagged staffing requirement variables are utilized, following earlier work (Bowblis 2011).

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.