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RESEARCH ARTICLE

Effects of State Minimum Staffing Standards on Nursing Home Staffing and Quality of Care

Jeongyoung Park and Sally C. Stearns

Objective. To investigate the impact of state minimum staffing standards on the level of staffing and quality of nursing home care.
Data Sources. Online Survey and Certification Reporting System (OSCAR) merged with the Area Resource File from 1998 through 2001.
Study Design. Between 1998 and 2001, 16 states implemented or expanded staffing standards in excess of federal requirements, creating a natural experiment in comparison with facilities in states without new standards. Difference-in-differences models using facility fixed effects were estimated to determine the effect of state standards.
Data Collection/Extraction Methods. OSCAR data were linked to the data on market conditions and state policies. A total of 55,248 facility-year observations from 15,217 freestanding facilities were analyzed.
Principal Findings. Increased standards resulted in small staffing increases for facilities with staffing initially below or close to new standards. Yet the standards were associated with reductions in restraint use and the number of total deficiencies at all types of facilities.
Conclusions. Mandated staffing standards affect only low-staff facilities facing potential for penalties, and effects are small. Selected facility-level outcomes may show improvement at all facilities due to a general response to increased standards or to other quality initiatives implemented at the same time as staffing standards.

Key Words. Mandated staffing standards, nursing homes, quality improvement, Difference-in-differences

The quality of nursing home care is an important policy issue, especially given the aging of the population. In response to concerns about persistent quality problems in the 1970s, Congress passed the Omnibus Budget Reconciliation Act (OBRA) of 1987, which raised minimum quality standards and strengthened federal and state oversight (Wiener 2003). Among various regulatory processes, minimum staffing standards have become a major subject for

debate because of the importance of nurse staffing to the processes and outcomes of care (Harrington 2005a, b). The federal government strengthened national standards through the Nursing Home Reform Act (NHRA) as part of OBRA 87, which required nursing facilities to have (1) licensed nurses on duty 24 hours a day; (2) a registered nurse (RN) on duty at least 8 hours a day, 7 days a week; and (3) an RN director of nursing. Yet many nursing homes have had continuing quality problems despite the OBRA standards (GAO 1998, 1999, 2000).

Subsequently, many states mandated staffing standards, with some states pursuing a broad array of reforms to help providers recruit and retain a stable, well-trained workforce (PHI and NCDHHS 2004). By 2003, 36 states supplemented the federal guidelines with more stringent standards requiring either a certain number of nursing hours per resident day (HPRD) or a specified staff-to-resident or staff-to-bed ratio. From 1998 to 2001, 16 states implemented or expanded minimum staffing standards with the goal of improving quality of care.

While research has found that higher nursing home staffing leads to higher quality of care (Cohen and Spector 1996; Harrington et al. 2000), information on effects of recent changes in state staffing standards is scanty. Researchers and policymakers had contradictory comments about the use of staffing standards (GAO 2002). This paper investigates how changes in state-mandated staffing standards from 1998 to 2001 affected the level of staffing and quality of care.

BACKGROUND

Variation in State Minimum Staffing Standards

To participate in Medicare and Medicaid, nursing homes must meet federal and state standards. Compliance is monitored through the annual survey and certification process. Unless they apply for and receive an exemption, facilities that are not compliant with staffing standards receive a deficiency and are subject to sanctions (e.g., civil monetary penalties, denial of payment, or termination depending on the scope and severity).

Address correspondence to Jeongyoung Park, Ph.D., Postdoctoral Researcher, Division of General Internal Medicine, University of Pennsylvania, 1234 Blockley Hall, 423 Guardian Drive, Philadelphia, PA 19104; e-mail: parkjeo@mail.med.upenn.edu. Sally C. Stearns, Ph.D., Associate Professor, is with the Department of Health Policy and Administration, University of North Carolina at Chapel Hill, Chapel Hill, NC.

Current federal staffing standards have not changed since 1987 and are far below the levels in many facilities (Zhang and Grabowski 2004; Harrington 2005a, b). State standards are more stringent than federal mandated levels, so more nursing homes may have to respond to the state standards than to federal standards. Furthermore, as states gained additional flexibility in determining state Medicaid policies with the repeal of the Boren Amendment in 1997, it is important to understand whether state mandated staffing standards affect staffing decisions and quality of care.

State staffing standards vary in terms of types of staff regulated and how standards are defined (Harrington 2002; DHHS 2003). Of the 36 states with standards, 29 set standards for total nursing staff and 27 states established direct care staff standards. Thirty-two states have licensed nurse requirements and nine states set specific RN requirements. Twenty-one states had staffing mandates defined as staff HPRD, six states set mandates in ratios, and nine states established standards in terms of both staff hours and ratios. While the details differ by state, 16 states made major changes to existing standards from 1998 to 2001 (Table 1). Fourteen states increased their standards, while two states implemented new standards. Three states (Arkansas, Delaware, and Oklahoma) made more comprehensive changes to requirements using a phase-in period to implement standards by shift and staff type. No state rescinded or lowered minimum requirement during the study period.

Prior Studies on Effects of Federal and State Minimum Staffing Standards

Several early studies examined the impact of federal staffing standards on nursing home staffing and quality of care. Janelli, Kanski, and Neary (1994) found that the implementation of federal standards in New York was associated with a decrease in restraint use that occurred largely without an increase in staffing. Moseley (1996) examined the 1990 implementation of NHRA legislation on catheter use among Virginia nursing home residents and found that post-NHRA catheterization rates were lower than the pre-NHRA rates. These studies, however, were based on simple pre- and postcomparisons in one or several states.

Zhang and Grabowski (2004) used national data and stronger methods to determine whether federal requirements led to higher quality. Using data from 5,092 nursing homes from 22 states linked across the pre-NHRA (1987) and post-NHRA (1993) period, they examined whether changes in staffing were related to changes in quality before and after the federal standards. Their study, which used a first-difference approach while controlling for time-invariant factors across homes, did not find that NHRA was associated

Table 1: Summary of Changes in State Minimum Staffing Standards, 1998–2001

State	*Regulations Before 1998 (If Any)*	*1998*	*1999*	*2000*	*2001*
Arkansas*	Staffing legislation (staff-to-resident ratio) began in 1989			By 6/30/2000, for 1–70 beds LN (RN, LPN)—1:30 days, 1:30 evenings, 1:50 nights CNA—1:8 days, 1:12 evenings, 1:18 nights By 9/30/2000, for 1–70 beds LN (RN, LPN)—1:15 days, 1:15 evenings, 1:35 nights CNA—1:7 days, 1:12 evenings, 1:18 nights	
California	First staffing standard in 1980		3 direct care staff HPRD averaged daily, LN counted twice in practice known as doubling	3.2 direct care staff HPRD with no doubling	
Delaware*	From the early 1980s, 2.5 HPRD for SNF and 2.25 HPRD for ICF				Phase-in of ratios began on 3/1/2001: facilities must provide at least 3.0 direct care staff HPRD in Phase I
Florida				Before 2001, 0.6 LN HPRD averaged daily and 1.7 CNA HPRD averaged daily	Increased HPRD and added ratios in 2001 LN—1 HPRD averaged daily, 1:40 residents CNA—2.6 HPRD averaged daily, 1:20 residents
Georgia		Increased HPRD LN—1 DON RN full-time day shift and 1 LN charge nurse each shift 24 hours/7 days including 1 LN: 7 residents			

continued

Table 1. *Continued*

State	*Regulations Before 1998 (If Any)*	*1998*	*1999*	*2000*	*2001*
		For SNF, 2 direct care staff HPRD averaged daily For Medicaid levels I and II, 2.5 direct care staff HPRD averaged daily			
Iowa	Separate ratios for SNF and ICF			Rescinded ratio for SNF, leaving previously higher ICF ratio to apply to all facilities 2 direct care staff HPRD averaged weekly, of which 20% must be LN time	
Maine				Before 2001, direct care staff-to-occupied bed ratios: 1:8 days, 1:12 evenings, 1:20 nights	Increased direct care staff-to-occupied bed ratios effective 6/1/2001: 1:5 days, 1:10 evenings, 1:15 nights
Minnesota				Before 2001, 0.95 direct care staff HPRD (case-mix adjusted)	Rescinded a ratio and developed standards with conversion to a Medicaid payment methodology based on the Minimum Data Set and Resource Utilization Groups (34 case-mix levels). For all facilities, 2 direct care staff HPRD averaged daily

Mississippi	2.2 direct care staff HPRD averaged daily			Increased to 2.8 direct care staff HPRD averaged daily	
New Mexico	(None)			Established HPRD in 2000 For SNF or SNF/ICF, 2.5 direct care staff HPRD averaged weekly For ICF only, 2.3 direct care staff HPRD averaged weekly	
Ohio				Before 2001, 1 attendant: 15 residents on duty 24 hours/7 days and at least 1 person working 40 hours/week for each 4 residents	Added HPRD 1 direct care staff: 15 residents, or major part thereof, and 2.75 direct care staff HPRD averaged daily, of which 0.2 RN HPRD, 2 CNA HPRD, and 0.55 other HPRD
Oklahoma*			Before 2000, direct care staff ratios: 1:10 days, 1:15 evenings, 1:20 nights	Increased ratios and added HPRD on 9/1/2000 1:8 days, 1:12 evenings, 1:17 nights 0.32 LN HPRD, 2.14 direct care staff HPRD	Increased ratios on 9/1/2001 1:7 days, 1:10 evenings, 1:16 nights 2.44 direct care staff HPRD
Pennsylvania		Before 1999, 2.5 direct care staff HPRD averaged daily	2.7 direct care staff HPRD averaged daily and 1 direct care staff: 20 residents		
South Carolina		Before 1999, CNA-to-resident ratios: 1:11 days, 1:15 evenings, 1:22 nights	Increased CNA-to-resident ratios: 1:9 days, 1:13 evenings, 1:22 nights		

continued

Table 1. *Continued*

State	*Regulations Before 1998 (If Any)*	*1998*	*1999*	*2000*	*2001*
Vermont	(None)				Established HPRD on 12/15/2001 3 direct care staff HPRD averaged weekly, of which 2 CNA HPRD
Wisconsin		Before 1999 For skilled nursing residents, 2.25 direct care staff HPRD averaged daily, of which 0.45 LN HPRD For intermediate care residents, 2 direct care staff HPRD averaged daily, of which 0.4 LN HPRD For limited nursing care residents, 1.25 direct care staff HPRD averaged daily, of which 0.25 LN HPRD	Increased HPRD and added intensive care HPRD category For skilled nursing residents, 2.5 direct care staff HPRD averaged daily, of which 0.5 LN HPRD For intermediate care residents, 2 direct care staff HPRD averaged daily, of which 0.4 LN HPRD For intensive care residents, 3.25 direct care staff HPRD averaged daily, of which 0.65 LN HPRD		

Source: (1) Harrington (2002) and (2) U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003).

*Multiple changes/phase-in.

HPRD, hours per resident day; LN, licensed nurse; RN, registered nurse; LPN, licensed practical nurse; CNA, certified nursing assistant; DON, director of nursing; SNF, skilled nursing facility; ICF, intermediate care facility.

with better quality except in cases where facilities had substandard staffing in the pre-NHRA period.

Two studies analyzed the relationship between state staffing standards and staffing levels in nursing homes. Harrington (2005a, b) found that the median nurse staffing level in 2000/2001 was substantially higher than each state's staffing standards, though these assessments were based on simple comparisons. Mueller et al. (2006) found that facilities in states with high standards had somewhat higher staffing on average than states with no or low standards, whereas staffing levels in states with low standards were not significantly different from staffing in states without standards.

Conceptual Framework

Nearly two-thirds of nursing homes are for-profit facilities (Grabowski and Norton 2006), which have strong incentives to choose the profit-maximizing levels of quantity and quality of care. Nonprofit facilities may have different goals from for-profit facilities but must operate efficiently to maintain financial viability under competitive circumstances and so may try to maximize profits (Konetzka, Norton, and Stearns 2004). Profit-maximization models have been widely used in studying nursing home quality of care in face of regulatory policies, including changes in payment method, payment level, and certificate of need legislation (Scanlon 1980; Nyman 1985; Gertler 1989; Cohen and Spector 1996; Konetzka, Norton, and Stearns 2004).

Within the profit-maximization model, nursing homes will produce quantity and quality of care up to the point where the marginal cost of improvement equals the marginal financial gain from doing so. Federal or state minimum standards serve as constraints for the quantity and mix of staffing chosen by facilities, so that in theory nursing homes can only choose staffing at or above the minimum regulation level (Cawley, Grabowski, and Hirth 2006). If a facility's staffing is below new standards, those facilities must increase their staffing to become compliant with new standards in the next period to avoid any penalty, or must apply for an exemption.

In reality, raising minimum staffing standards may involve substantial production costs (i.e., labor cost for additional staff, administrative cost to comply with standards) and cause some facilities to face severe financial constraints. Some facilities may rationally decide to operate below the minimum standards if the cost of meeting standards exceeds the cost of noncompliance. A study by Harrington and O'Meara (2006) reported that 64 percent

of nursing homes in California did not meet the mandatory standards in 2000, and 27 percent of facilities failed to comply by 2003. A series of GAO reports (1999, 2000) expressed concern that the state survey process and enforcement activities are not strong enough to ensure compliance or better quality of care.

Facilities with staffing in excess of new standards may not change staffing or performance in response to new regulations because of lack of incentive for improvement. Furthermore, as facilities with previously lower staffing hire more staff, all nursing homes may have to pay higher wages given the limited supply of nursing workers in the market. In this case, high-staff facilities may substitute cheaper forms of labor (e.g., licensed practical nurses [LPNs], nurse aides [NAs]) for more expensive forms (e.g., RNs) or they may simply reduce the level of staffing.

Strategic decisions on staffing consequently affect the quality of care provided. Increased staffing is hypothesized to result in higher quality. The effects of new standards on quality might not be straightforward, however, because increased demand for staffing and its consequent effects on quality will depend at least in part on unobserved characteristics. Improvements in organizational processes may cause a facility to achieve higher quality even without increasing staffing hours. Nursing homes may also be able to improve the productivity of nursing workers by increasing job satisfaction or decreasing turnover.

General agreement exists about the factors that affect both input and output decisions in the production of nursing home care. For example, the acuity level of residents may be the most important factor in determining both staffing decisions and observed health outcomes. Facility characteristics and market/state-specific environments affect both staffing and quality of care. Among these factors, many studies found that for-profits have significantly lower staffing and quality than nonprofits (Chou 2002; O'Neill et al. 2003).

In this study, the marginal effects on both staffing and quality are estimated separately according to staffing level before new standards and ownership status to assess three hypotheses:

1. Increased state minimum staffing standards will increase the level of staffing and quality of care in nursing homes.
2. Low-staff facilities (facilities with previous staffing levels below newly mandated standards) are more likely to increase staffing and quality.
3. For-profit facilities are less likely to change staffing and quality.

METHODS

Data Sources

Data on facility characteristics and quality measures came from Online Survey and Certification Reporting System (OSCAR) from 1998 through 2001. The OSCAR data are from state surveys of all federally certified Medicare-skilled nursing facilities and Medicaid nursing facilities in the United States. The OSCAR system, which includes about 96 percent of the nation's nursing homes, is used to determine whether nursing homes are complying with federal regulations. Most OSCAR data elements are self-reported and reflect data at the time of the survey, so concerns exist about the accuracy of these data (Abt Associates 2000, 2001; Zhang and Grabowski 2004). Despite these concerns, OSCAR provides the most comprehensive national source of facility-level information on the operations, resident characteristics, and regulatory compliance of nursing homes in the United States. (Zinn 1993; Cawley, Grabowski, and Hirth 2006).

The OSCAR data were linked to data on specific state staffing standards, state Medicaid per-diem rates, and market (county) conditions. State minimum staffing standards came from two published reports (Harrington 2002; DHHS 2003). State Medicaid per-diem rates were obtained from the Brown University Survey of State Policies and State Data Book on Long-Term Care Program and Market Characteristics (Harrington et al. 1999; Grabowski et al. 2004). Market level variables were obtained from the Area Resource File, a publicly available dataset containing economic and demographic variables for each county (DHHS 2006). Data on the population for each county came from the U.S. Census Bureau.

To eliminate possibly erroneous outliers in staffing from OSCAR, this study adopted the exclusion criteria developed by the Centers for Medicare & Medicaid Services (CMS). Facilities were excluded if they reported (1) more residents than beds, (2) no RN hours and had 60 or more beds (because federal regulations require homes with 60 or more beds to have an RN on duty for 8 hours a day 7 days a week and a licensed nurse on duty evenings and nights), (3) more than 12 HPRD and <0.5 total HPRD (to avoid the unrealistically high or low staffing hours), (4) or zero residents. The original database included 18,275 facilities; on the basis of these exclusion criteria, 436 facilities (2.4 percent) were excluded. In addition, 2,271 hospital-based facilities were eliminated because hospital-based facilities are very different in terms of resident severity and care practice, and 343 Medicare-only-certified facilities were eliminated because of their focus on short-stay residents after

hospitalization. Eight more facilities were excluded due to missing values. A total of 55,248 facility-year observations from 15,217 freestanding Medicaid-only or dually certified facilities from the 50 states and the District of Columbia were analyzed.

Dependent Variables: Staffing and Quality of Care

The staffing variables were constructed as HPRD by licensure type (i.e., RNs, LPNs, NAs) and total staff. Each facility reports the number of full-time equivalent positions (employees or contract workers) over the previous 14 days. To convert the HPRD, the total staff hours reported in a 2-week period was multiplied by 70 hours and then divided by the total residents and by the 14 days in the reporting period, which is a standard conversion used by CMS and other studies (Harrington 2002; Zhang and Grabowski 2004).

The six quality measures chosen for this study are standard measures following the Institute of Medicine (1986) recommendations (Abt Associates 2003; Grabowski, Angelelli, and Mor 2004; Rantz et al. 2004). Resident outcomes were measured by the rates of pressure sores, contractures, and bladder incontinence. Pressure sores, which are preventable and treatable, are an adverse outcome regardless of the residents' underlying health (Grabowski 1999). Contractures, which are related to having a restriction of full passive range of motion of any joint due to deformity, disuse, or pain (Cowles 2002), can be caused by lack of movement that may occur under conditions of limited staff availability. The rates of catheter use and restraint use were used to measure process of care. Urethral catheterization places the resident at greater risk for urinary track infection and other complications (Cawley, Grabowski, and Hirth 2006). Physical restraints may increase the risk of pressure sores, depression, mental and physical deterioration, and mortality (Zinn 1993). Overall facility quality is measured by total number of facility survey deficiencies.

Key Independent Variables: Staffing Standards

The explanatory variables of key interest indicate whether the state changed standards (regardless of staff type) for a given year. Two dummy variables are constructed to specify two different levels of treatment effects: "transition effects" and "steady-state effects." The transition effect variable captures the immediate short-term response, while the persistent (steady-state) effect of policy changes was estimated with a 1-year lag in order to allow for a transition year. Each facility-year observation could be a control or treatment group for

estimating two different policy effects. Presentation of the results focuses on the steady-state effects because the effect of policy changes may occur after some lead time. But OSCAR measurement of staffing may occur before or after the actual start of new standards in a calendar year. Therefore, estimating transition effects should also help to reduce possible measurement error.

To indicate low-staff facilities, both licensed and unlicensed staffing in each year were compared with the required staffing in the next year to see if current staffing was lower than what was required in the next year. A facility was defined as low-staff if current staffing was less in any 1 year than next year required staffing.

Covariates

Several variables were used to control for changes over time in facility, market, and state characteristics. Time-varying facility characteristics available from OSCAR included ownership, whether the facility was part of a chain, percent of residents on Medicare, bed size, occupancy rate, and information on resident case mix. Resident case mix was measured at the facility level by the sum of average activities of daily living (ADL) index and skilled service index (Cowles 2002). The ADL index is the average of the percent of residents who are bedfast or chairbound or need assistance with eating, toileting, and transferring, weighted by the amount of assistance needed. The skilled service index is a sum of the percentages of residents utilizing intravenous therapy, suctioning, respiratory therapy, tracheostomy care, and parenteral feeding. In addition, the rates of pressure sores, contractures, catheter use, and restraint use on admission were included in each quality regression to capture baseline case mix differences between the facilities.

Time-varying market variables included a Herfindahl–Hirschman index (HHI) as a proxy for market competition: the HHI varies from 0 to 1, with 0 indicating perfect competition and 1 indicating monopoly. As in previous studies (Grabowski 2001; Mukamel, Spector, and Bajorska 2005), excess demand was defined as the average number of empty beds per 1,000 community-dwelling elderly (65+) in the county. The annual average per capita income and the unemployment rate were included to control for county economic conditions. The population of the elderly aged 85 and older in the county was used as a market determinant of demand for nursing home care and, therefore, for nursing home staffing. The size of the female population aged 15–44 was used as a proxy for availability of long-term care workers.

Many states implemented other initiatives at the same time they changed their minimum staffing requirements. The Medicaid per-diem rate, which was included because rate increases may affect staffing and quality of care, was used as a continuous measure in 2002 dollars.

Estimation Strategy

A challenge to estimating the effect of minimum staffing standards is controlling for the unobserved heterogeneity associated with staffing/quality changes over time. Staffing and quality are likely to be influenced by unobserved characteristics such as the organizational cultures, practice skill of the nurse workforce, overall population health needs, and state political, regulatory, or fiscal conditions. Ignoring this heterogeneity may result in biased estimates if these unmeasured factors are correlated with variation in minimum staffing standards. For example, if an unobserved measure of facility or state political culture is positively associated with staffing/quality of care but negatively related to the implementation of staffing regulations, then the effect of staffing standard changes will be underestimated.

The policy changes occurred at diverse times across states, so the present study exploits this natural experiment by using a Difference-in-Differences (DD) model with facility fixed effects to estimate the effect of staffing standard changes on staffing/quality of care with pre–post and treatment–control groups. The approach is analogous to a reduced-form model that does not estimate the effect of staffing on quality but instead estimates the effect of the overall package of reforms implemented from 1998 through 2001. The model specification is

$$Y_{ist} = \alpha_0 + \beta \mathrm{MSS}_{st} + \gamma X_{ist} + \delta \mathrm{YearD}_t + \mu_i + \varepsilon_{ist} \qquad (1)$$

where the subscript i indexes nursing home, s indexes state, and t indexes year. Y_{ist} is the actual level of staffing and measures of quality of care. MSS_{st} is a vector of the main treatment effects specified by two policy variables (transition and steady-state) and their interactions with the indicators of low-staff facility and for-profit status. X_{ist} is a vector of facility, county, and state level time-varying covariates. A vector of year dummy variables (YearD_t) accounts for unobserved time fixed effects that might affect staffing/quality of care and are correlated with the implementation or expansion of state standards. The error term consists of a fixed facility-specific error component (μ_i) and a mean zero random error component (ε_{ist}). (Breusch–Pagan and Hausman specification tests confirmed that fixed effects were preferred to random effects specifications.) Triple interaction terms with for-profit status

were included to assess the differential behavior of nursing homes in response to policy changes.

The parameters of equation (1) were estimated with ordinary least squares (OLS) for the models of staffing and outcome (pressure sores, contractures, bladder incontinence, catheter use, and restraint use). A negative binomial (NB) model was used for the number of deficiencies. Regression results for all models can be found in online Appendices. Marginal effects were calculated incorporating the effects of the various interactions in the models. In a nonlinear model such as the number of deficiencies, however, interpretation of the interaction terms is complex and cannot be determined directly from regression results (Ai and Norton 2003). Therefore, marginal effects on deficiencies were determined as the average effects across full samples. Standard errors were generated by using bootstrapping with 300 repetitions.

RESULTS

Descriptive Statistics

The first three columns in Table 2 show summary statistics for all facilities. The low-staff variable in this study does not represent facilities that were below current standards, but instead identifies facilities that had to increase staffing to become compliant with new standards in the next period. By this definition, 49 percent of the facilities ($N = 7{,}248$) were low-staff. The rightmost three columns in Table 2 compare the mean values of all variables for facilities with relatively low staffing and those with relatively high staffing. The low-staff facilities were more likely for-profit and chain affiliated, and had slightly fewer residents on Medicare and fewer beds than their counterparts. The low-staff facilities were more likely to be in counties with relatively greater elderly and female population, while the states where low-staff facilities were located were more likely to increase staffing standards and have less generous Medicaid reimbursement rates.

Effect of State Minimum Staffing Standards on Staffing

Table 3 shows significant variation in the marginal steady-state effects of state standards across the subsets of facilities. Only nonprofit facilities had statistically significant increases at $p < .05$ in RN, NA, and total staff hours in response to the change in standards, with larger increases at low-staff facilities.

Table 2: Summary Statistics by Staffing Status, 1998–2001

	Full Sample			*Low-Staff*		
				No (= 0)	*Yes (= 1)*	
Variables	*Mean*	*Range*	*SD*	*Mean*	*Mean*	*t-Test*
Staffing hours per resident day						
RN HPRD	0.34	(0, 10.23)	0.32	0.42	0.26	***
LPN HPRD	0.65	(0, 9.64)	0.38	0.71	0.60	***
NA HPRD	1.94	(0, 10.65)	0.68	2.20	1.66	***
Total HPRD	2.93	(0.5, 11.98)	0.95	3.33	2.51	***
Quality of care						
% Pressure sores	6.47	(0, 100)	4.77	6.38	6.57	***
% Contractures	25.72	(0, 100)	20.47	27.98	23.38	***
% Incontinence	54.50	(0, 100)	15.91	56.33	52.61	***
% Catheter use	6.05	(0, 100)	4.91	6.07	6.04	
% Restraint use	11.87	(0, 100)	13.02	11.34	12.43	***
Total deficiencies	5.91	(0, 50)	5.88	5.16	6.68	***
Policy: staffing standards						
Transition effect	0.101		0.301	0.083	0.119	***
Steady-state effect	0.103		0.304	0.070	0.136	***
Facility						
Ownership						
For-profit	0.73		0.44	0.64	0.82	***
Nonprofit	0.23		0.42	0.30	0.15	***
Government	0.04		0.21	0.06	0.03	***
Chain	0.58		0.49	0.53	0.63	***
Payer mix						
% Residents paid by Medicare	7.48	(0, 100)	8.68	8.37	6.56	***
% Residents paid by Medicaid	67.89	(0, 100)	19.82	65.58	70.28	***
% Residents paid by others	24.63	(0, 100)	18.78	26.06	23.16	***
Total beds	114.82	(5, 1231)	65.98	118.57	110.95	***
Occupancy rate	84.63	(1.56, 100)	15.28	85.29	83.95	***
Case mix						
Acuity index	10.08	(3, 21.70)	1.54	10.28	9.86	***
% Pressure sores on admission	3.10	(0, 100)	4.17	3.105	3.102	
% Contractures on admission	16.21	(0, 100)	17.13	17.88	14.49	***
% Catheter use on admission	4.24	(0, 93.02)	4.30	4.24	4.23	
% Restraint use on admission	3.82	(0, 100)	8.17	3.46	4.19	***
Low-staff	0.49		0.50	0	1	

continued

Table 2. *Continued*

	Full Sample			*Low-Staff*		
				No (= 0)	*Yes (= 1)*	
Variables	*Mean*	*Range*	*SD*	*Mean*	*Mean*	*t-Test*
Market						
Herfindahl–Hirschman index	0.196	(0.004, 1)	0.228	0.190	0.203	***
Empty beds per 1,000 elderly (65+)	13.08	(0, 173.91)	13.06	11.28	14.93	***
Per capita income (in $1,000s)	26.87	(0, 92.98)	7.62	27.59	26.13	***
Unemployment rate (16+)	4.51	(0.70, 29.90)	2.10	4.42	4.61	***
Population 85+ (in 1,000s)	9.88	(0.01, 114.98)	19.63	7.64	12.20	***
Female population 15–44 (in 1,000s)	160.84	(0.12, 2210.65)	373.79	114.91	208.28	***
State						
Medicaid rate	108.70	(69.55, 285.01)	23.18	115.37	101.80	***
No. of facility-year observations	55,248			28,073	27,175	
No. of facilities	15,217			7,969	7,248	

***Significant at 1%.

HPRD, hours per resident day; SD, standard deviation. Mean comparison tests (*t*-test) by low-staff status.

About two-thirds of the increase in total staff hours was due to increases in NA hours. Staffing did increase slightly ($p<.10$) at a few other facility types, but these changes were substantively small on average across all facilities within the subgroup. Surprisingly, a decrease in total staffing hours was estimated for for-profit facilities with relatively high staffing levels; this effect, which was substantively small and only marginally significant at $p<.10$ despite the large sample size, may reflect a response by for-profit facilities to reduce staffing closer to the legislated minimum.

The substantive implications of staffing increases for nonprofit low-staff facilities are best understood by converting the observed changes to estimated staff time increases. In low-staff nonprofit facilities, the increased standards led to estimated steady-state increases of 0.034 RN HPRD (2.04 minutes), 0.027 LPN HPRD (1.62 minutes), 0.145 NA HPRD (8.7 minutes), and 0.206 total staff HPRD (12.36 minutes). These changes are modest in size on average and

Table 3: Marginal Effect of State Minimum Staffing Standards on Staffing (DD Models)

	RN HPRD	*LPN HPRD*	*NA HPRD*	*Total HPRD*
Panel A: low-staff				
For-profit	0.009	− 0.0004	0.025*	0.033*
	(0.006)	(0.0076)	(0.014)	(0.017)
			[1.5 minutes]	[1.98 minutes]
Nonprofit	0.034***	0.027*	0.145***	0.206***
	(0.011)	(0.014)	(0.026)	(0.033)
	[2.04 minutes]	[1.62 minutes]	[8.7 minutes]	[12.36 minutes]
Panel B: not low-staff				
For-profit	− 0.011	− 0.015	− 0.022	− 0.049*
	(0.008)	(0.011)	(0.020)	(0.025)
				[− 2.94 minutes]
Nonprofit	0.016*	0.006	− 0.029	− 0.007
	(0.008)	(0.011)	(0.021)	(0.026)
	[0.96 minutes]			

*Significant at 10%.

***Significant at 1%.

HPRD, hours per resident day. Standard errors in parentheses. Minutes in brackets.

may not be sufficient to result in significant improvements in quality, as explored in the next section.

Effect of State Minimum Staffing Standards on Quality of Care

The hypothesis that increases in state standards improve the quality of care would be supported by negative estimated effects because the quality measures were constructed as adverse outcomes. None of the coefficients for resident outcomes (rates of onset of pressure sores, contractures, or incontinence) was significantly associated with increases in minimum standards (Table 4).

With respect to the process of care measures, catheter use was similarly not significantly affected by increases in minimum standards, though the rate of restraint use declined significantly ($p<.01$) for all facility subgroups. The largest decline occurred in nonprofit facilities; the decline was smaller in low-staff nonprofit facilities than in nonprofit facilities that did not have low-staff status (1.27 versus 2.45 percentage points).

Similarly, total deficiency citations declined significantly for all facility subgroups except for for-profit facilities with relatively high staffing levels. The

Table 4: Marginal Effect of State Minimum Staffing Standards on Quality of Care (DD Models)

	Resident Outcomes			*Care Process Measures*		*Overall Facility*
	Pressure Sores	*Contractures*	*Incontinence*	*Catheter Use*	*Restraint Use*	*Deficiencies*[†]
Panel A: low-staff						
For-profit	0.170	−0.434	−0.067	−0.077	−0.682***	−0.107**
	(0.108)	(0.322)	(0.351)	(0.088)	(0.254)	(0.051)
Nonprofit	−0.134	0.156	−0.497	0.095	−1.266***	−0.102**
	(0.204)	(0.606)	(0.662)	(0.165)	(0.479)	(0.049)
Panel B: not low-staff						
For-profit	0.019	−0.140	0.228	0.047	−1.152***	−0.023
	(0.157)	(0.467)	(0.510)	(0.127)	(0.369)	(0.055)
Nonprofit	0.263	0.530	−0.598	−0.052	−2.450***	−0.200***
	(0.162)	(0.481)	(0.526)	(0.131)	(0.380)	(0.041)

**Significant at 5%.

***Significant at 1%.

(Standard errors in parentheses).

[†]Effects were shown as the average effects across full samples. Standard errors were generated by using bootstrapping with 300 repetitions.

average effect for nonprofit facilities with relatively high staffing levels showed the largest reduction in deficiencies on average with 0.2 relative to an overall mean number of deficiencies of 5.9.

DISCUSSION

This study assesses the impact of state minimum staffing standards on the level of staffing and quality of care by exploiting differences in the timing of policy changes from 1998 to 2001. The findings for effects on staffing suggest that increased standards matter particularly for nonprofit homes with staffing levels previously below or close to new standards. Those low-staff facilities are more likely to face penalties for failing to meet new regulatory standards; therefore, unless they can obtain an exemption they must increase staffing to avoid penalties in the next period. Facilities already operating higher staffing than new standards did not show any improvement in their staffing level, with an indication (not significant at conventional levels) that for-profit homes with staffing previously above the required level may have reduced staffing slightly. As noted by Kovner and Heinrich (2000) and Mueller et al. (2006), facilities

where staffing exceeded the minimums may actually decrease staffing (i.e., if nursing homes assume they only have to comply with the minimum levels to ensure safe practice).

Analyses of the effects on quality show that increased standards were associated with reduced restraint use and deficiencies on average at all types of facilities. Resident outcomes and catheter use, however, show no change in response to increased standards, possibly for several reasons. First, staffing may be a better predictor of facility care processes than the clinical outcomes examined. Resident outcome aggregated at the facility level may not be very sensitive to the modest level of staffing changes induced by the regulation. Furthermore, the aggregated case-mix severity measures may not adequately control for within-facility variation. Finally, the staffing increases may not have been sufficient to improve average resident outcomes at the facility level.

Reductions in restraint use and total deficiencies that occur in conjunction with increases in staffing standards do not vary by staffing status or ownership type, as the staffing increases did. The findings of improvement in quality even without concomitant increases in staffing are possibly due to either (1) a general response to increased standards or (2) other quality improvements implemented at the same time as minimum staffing standards. Many states implemented various quality initiatives at the same time as they changed staffing standards. State initiatives for the long-term direct care workforce such as wage pass-throughs and major payment changes in Medicaid and Medicare also occurred during the study period. Yet increases in standards could have solicited a general response by nursing homes, and quality of care is influenced by other factors such as physical environment, different methods of treatment, efficient use of staff and nonstaff inputs, and their productivity differences.

Several limitations may have affected the results. First, the dummy policy variables used did not control for the intensity of standards or repeated changes. Some states targeted their regulations toward different types of staff, and three states (Arkansas, Delaware, and Oklahoma) changed legislation more than once from 1998 to 2001. Yet the dummy variable approach should identify the overall average effect of the full set of reforms implemented from 1998 through 2001. Second, even though the DD estimation controls for unobserved time-invariant factors which could have increased staffing or quality of care, the improvements in some quality measures in all facilities despite a lack of increased staffing might be due to omitted factors that are highly correlated with standard changes (ranging from other policies to reactions to publicity about quality problems).

In total, the results from this study are particularly relevant to the era of growth in the aged population and provide important policy implications. First, structural differences in the effects of minimum standards on staffing by previous staffing status or ownership type demonstrate variation in response to regulatory policies. Not surprisingly, mandated staffing standards seem to primarily affect facilities at the low-end of the staffing spectrum and, therefore, some incentive structures need to be developed to improve staffing at all facilities. Second, although the results indicate that the increases in standards were associated with reductions in restraint use and deficiencies, broad improvements in quality of care cannot be achieved merely by the types of staffing standards. Other quality initiatives need to be considered, such as developing training standards, staff education, and retention strategies. Third, the federal and state governments should determine the additional costs and develop a plan to adequately fund the required increases in staffing levels. Fourth, a number of facilities still appear to operate at staffing levels below the mandated levels. In order to achieve the benefits of mandatory staffing standards, monitoring and enforcement of federal and state regulations are necessary.

Lastly, the results are useful to understand the benefits and pitfalls of implementing staffing standards. Further understanding of the effects of minimum staffing standards may be obtained by assessing financial pressures and by exploring the causal pathways between nursing home staffing and quality outcomes.

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SUPPORTING INFORMATION

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

Appendix SA1: Author Matrix.

Appendix S1: Effect of State Minimum Staffing Standards on Staffing (DD Models).

Appendix S2: Effect of State Minimum Staffing Standards on Quality of Care (DD Models).

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