Staffing Ratios and Quality: An Analysis of Minimum Direct Care Staffing Requirements for Nursing Homes

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Objective. To study the impact of minimum direct care staffing (MDCS) requirements on nurse staffing levels, nurse skill mix, and quality.

Data Sources. U.S. nursing home facility data from the Online Survey Certification and Reporting (OSCAR) System merged with MDCS requirements.

Study Design. Facility-level outcomes of nurse staffing levels, nurse skill mix, and quality measures are regressed on the level of nurse staffing required by MDCS requirements in the prior year and other controls using fixed effect panel regression. Quality measures are care practices, resident outcomes, and regulatory deficiencies.

Data Extraction Method. Analysis used all OSCAR surveys from 1999 to 2004, resulting in 17,552 unique facilities with a total of 94,371 survey observations.

Principle Findings. The effect of MDCS requirements varied with reliance of the nursing home on Medicaid. Higher MDCS requirements increase nurse staffing levels, while their effect on nurse skill mix depends on the reliance of the nursing home on Medicaid. MDCS have mixed effects on care practices but are generally associated with improved resident outcomes and meeting regulatory standards.

Conclusions. MDCS requirements change staffing levels and skill mix, improve certain aspects of quality, but can also lead to use of care practices associated with lower quality.

Key Words. Minimum direct care staffing ratios, quality, nursing homes

Nursing homes are faced with the challenge of providing "acceptable" levels of quality at low costs. States attempt to influence this trade-off between cost and quality by regulating the amount of nurse staffing a nursing home must employ per resident. Specifically, some states have implemented two types of nurse staffing requirements. The first requirement mandates the minimum amount of licensed nurse staffing that must be employed per nursing home or nursing home unit. Licensed nurse staffing includes registered nurses (RNs) and licensed practical nurses (LPNs). The second requires the minimum

number of nurses that must be on duty to provide direct care to residents. These nurses can include licensed staff and lower-skilled certified nurse aides (CNAs). These minimum direct care staffing (MDCS) requirements are defined as a ratio of the number of residents or beds in a facility and are the focus of this paper.

States with any staffing requirement have nursing homes with higher staffing levels (see Harrington 2005a, b; Mueller et al. 2006; Park and Stearns 2009) and these higher levels of nurse staffing should improve quality (Aaronson, Zinn, and Rosko 1994; Zhang and Grabowski 2004). However, mandated staffing levels could hurt nursing homes financially if they are not offset by increases in Medicaid reimbursement (Harrington, Swan, and Carrillo 2007; Kim et al. 2009b). In particular, if nursing homes become unprofitable because of unfunded staffing mandates, other nonmandated services could be cut and overall quality could decline. This is one reason why Arkansas and Delaware postponed increases in minimum staffing rates in 2003 when they faced budgetary problems (Tilly et al. 2003). In addition, minimum staffing requirements could also reduce staffing quality by changing staff skill mix to less costly alternatives; for example, substituting LPNs for RNs or CNAs for licensed nurse staff.

Most prior research finds no change or small improvements in quality associated with any type of staffing requirement (Kim, Harrington, and Greene 2009a; Park and Stearns 2009). Using changes in MDCS requirements across states from 1998 to 2004, this paper studies how the implementation of and changes in MDCS requirements impact nurse staffing levels, nurse skill mix, and the quality of nursing homes in the contiguous United States. This paper differs from earlier work by primarily focusing on MDCS requirements and the specific level of staffing mandated in those requirements. Further, this study uses more quality measures and breaks them into measures related to care practices, resident outcomes, and regulatory deficiencies.

BACKGROUND ON STAFFING REQUIREMENTS

The federal government strengthened federal and state oversight of nursing homes with the passage of the Omnibus Budget Reconciliation Act (OBRA) of

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1987. As part of OBRA, nursing homes are required to "have sufficient nursing staff to provide nursing and related services to attain and maintain the highest practicable physical, mental, and psychosocial well-being of each resident." Further, the legislation requires there to be a licensed nurse for 24 hours a day, 7 days a week with at least 8 of those hours being an RN (OBRA 1987).

Since OBRA affected all nursing homes in the United States, studies that analyze OBRA's impact on nursing home staffing and quality compare the pre-OBRA to the post-OBRA period without a pure control group. Janelli, Kanski, and Neary (1994) found that the implementation of OBRA is associated with a decrease in the use of physical restraints in New York without a net increase in nurse staffing, but this result could be due to restrictions placed on the use of physical restraints under OBRA. Moseley (1996) found catheterization rates to be lower after the implementation of OBRA in Virginia. Zhang and Grabowski (2004) use data from 22 states and find OBRA did not lead to better quality except in cases where facilities have substandard staffing before OBRA.

In addition to federal standards, states have the ability to implement additional staffing requirements above and beyond those in OBRA. States have implemented two types of staffing requirements: those that mandate the minimum amount of licensed staff and those that mandate the minimum amount of staff that provides direct care to residents. If states do not implement licensed staff requirements, then the federal standard is the de facto state-licensed staffing standard. In 2004, 40 states had any additional requirements for nursing home staff above the federal standard, with 33 states having a MDCS requirement (Mueller et al. 2006). Table 1 reports which states in the contiguous United States that have legislation regarding MDCS requirements between 1998 and 2004. These ratios are presented in terms of hours per resident day (HPRD) for a facility with 100 beds and range from 1.78 to 3.70 HPRD in 2004. Two states, New Mexico and Vermont, implemented MDCS requirements during the period while 12 states with MDCS requirements in 1998 increased them by 2004. Of these 12 states, four gradually increased MDCS requirements over multiple years. Although not reported in Table 1, only the states of Arkansas, Delaware, Florida, and Ohio changed their licensed staff requirements during the same period.

Multiple studies examine the relationship between state staffing mandates, staffing levels, and quality in nursing homes, although none solely focused on MDCS requirements. Using data from 2000/2001, Harrington (2005a, b) finds median nurse staffing levels are higher in states with any

Table 1:   Minimum Direct Care Staffing Laws—1998–2004

States	Any MDCS Requirement	Changed MDCS Requirement	Years Changes Are Effective	HPRD of MDCS Requirement	
				1998	2004
Alabama	No	No			
Arkansas	Yes	Yes	2001; 2003	3.20	3.50
Arizona	No	No			
California	Yes	Yes	1999	2.80	3.50
Colorado	Yes	No		2.00	2.00
Connecticut	Yes	Yes	2001	1.90	2.60
Delaware	Yes	Yes	2001; 2002	2.50	3.28
Florida	Yes	Yes	2002; 2003	2.30	3.60
Georgia	Yes	No		2.00	2.00
Iowa	Yes	No		2.00	2.00
Idaho	Yes	No		2.40	2.40
Illinois	Yes	No		2.50	2.50
Indiana	No	No			
Kansas	Yes	No		2.00	2.00
Kentucky	No	No			
Louisiana	Yes	No		2.60	2.60
Massachusetts	Yes	No		2.00	2.00
Maryland	Yes	No		2.00	2.00
Maine	Yes	Yes	2000	2.60	3.70
Michigan	Yes	No		2.25	2.25
Minnesota	Yes	No		2.00	2.00
Missouri	No	No			
Mississippi	Yes	Yes	2000	2.33	2.80
Montana	Yes	No		1.78	1.78
North Carolina	Yes	No		2.10	2.10
North Dakota	No	No			
Nebraska	No	No			
New Hampshire	No	No			
New Jersey	Yes	No		2.50	2.50
New Mexico	Yes	Yes	2000		2.50
Nevada	No	No			
New York	No	No			
Ohio	Yes	Yes	2001	2.50	2.75
Oklahoma	Yes	Yes	2000; 2001; 2003	2.20	3.60
Oregon	Yes	No		2.10	2.10
Pennsylvania	Yes	Yes	1999	2.50	2.70
Rhode Island	No	No			
South Carolina	Yes	Yes	1999	2.48	2.78
South Dakota	No	No			
Tennessee	Yes	No		2.00	2.00

Table 1. *Continued*

States	Any MDCS Requirement	Changed MDCS Requirement	Years Changes Are Effective	HPRD of MDCS Requirement	
				1998	*2004*
Texas	No	No			
Utah	No	No			
Virginia	No	No			
Vermont	Yes	Yes	2001		3.00
Washington	No	No			
Wisconsin	Yes	Yes	1998	2.25	2.50
West Virginia	Yes	No		2.00	2.00
Wyoming	Yes	No		2.25	2.25

Notes. The table reports which states have MDCS requirements and whether they changed from 1998 to 2004. The MDCS requirements in the last two columns are reported in terms of hours per resident day (HPRD), assuming there are 100 residents in the facility.
MDCS, minimum direct care staffing.

staffing standards. Mueller et al. (2006) look across states and find staffing levels to be higher in states with high staffing standards compared with low or no standards. In California, meeting minimum staffing requirements is associated with fewer regulatory deficiencies (Kim, Harrington, and Greene 2009a) and fewer skilled nursing patients discharged due to death (Tong 2011). Park and Stearns (2009) look at states that increase any staffing standard from 1998 to 2001 and find small staffing increases for facilities that are below or close to the new standards. Further, they find standards are associated with reductions in physical restraint use and total number of deficiencies.

CONCEPTUAL FRAMEWORK

Nurses are the primary input in producing nursing homes and consist of three different types of nurses: RNs, LPNs, and CNAs. Each type of nurse has a different level of certification. The implementation of and changes of MDCS requirements should increase overall nurse staffing levels. The net results may be an increase in the quality of care because there is evidence that higher staffing levels are associated with higher quality (Aaronson, Zinn, and Rosko 1994; Cohen and Spector 1996; Zhang and Grabowski 2004; Konetzka, Stearns, and Park 2008). However, nursing homes may react to MDCS

requirements by changing their skill mix of nurse staffing towards cheaper but lower skilled CNAs. Further, MDCS requirements require nursing homes to hire more labor. This may affect equilibrium wages, alter non-staff resources, and may change the mix of quality through a substitution effect as nursing homes change their use of labor and material intensive care practices (Cawley, Grabowski, and Hirth 2006).

In order to fully identify the effect of MDCS requirements, it is important to control for the changes in licensed staff requirements. Licensed staff requirements place constraints on the skill mix a faculty must employ, and they will cause differentiated effects when MDCS requirements are increased in conjunction with a licensed staff requirement. For example, nursing homes that face an increase in MDCS requirements may hire more licensed staff to fulfill state requirements if there is a corresponding increase in licensed staff requirements than if there is no increase in licensed staff requirements.

An additional factor that affects the impact of MDCS requirements is the reliance of the nursing home on Medicaid. Although nursing homes are required to provide the same level of care to all residents regardless of payer source (Grabowski et al. 2008), each payer source can reimburse at different rates causing Medicare and private-pay nursing home residents to cross-subsidize Medicaid (Troyer 2002). Nursing homes that are more reliance on Medicaid have fewer financial resources and may need to alter quality and nonstaffing resources more after a change in MDCS requirements.

Taking these issues into consideration, this paper uses reduced form models to look at two effects of MDCS requirements. The first part of the analysis is to understand how MDCS requirements impact the level and skill mix of nurse staffing. It is expected that states that with higher MDCS requirements have higher total staffing and lower quality skill mix of staff. The second part of the analysis studies how MDCS requirements impact quality. Although Park and Stearns (2009) find the presence and change of any state staffing requirement results in higher quality, the effect of MDCS requirements is likely to have a mixed and nonlinear effect on quality.

DATA AND EMPIRICAL SPECIFICATION

The primary data source for this analysis is the Online Survey Certification and Reporting (OSCAR) System. OSCAR is a uniform database of yearly regulatory reviews of nursing homes. All CMS-certified nursing homes are required to report facility, census, and staffing information as part of their

yearly recertification review process. These reviews occur every 9–15 months with an average period of 12 months between surveys. Data are validated during on-site surveys completed by state surveyors operating under CMS oversight. Many studies find that OSCAR measures are appropriate for research (Feng et al. 2005; Harrington, Carrillo, and LaCava 2006) and OSCAR allows for the construction of a panel dataset with a unit of the observation of the nursing facility. The study sample includes all OSCAR surveys in the lower 48 states that occur between January 1, 1999 and December 31, 2004. Alaska and Hawaii are excluded because they do not have Medicaid reimbursement data. This results in a sample of 17,552 unique nursing facilities with a total of 94,371 survey observations.

OSCAR is supplemented with data from three additional sources. State Medicaid reimbursement rates are obtained from Grabowski, Angelelli, and Mor (2004a), Grabowski et al. (2004b, 2008), and Grabowski, Gruber, and Angelelli (2008). Weekly nursing home worker wages are obtained from the Bureau of Labor Statistics using North American Industry Classification System code 623110. The number of HPRD for each MDCS requirement is constructed from multiple sources. First, nurse staffing requirements are obtained from Harrington (2001, 2008). Since these sources only provide a cross-sectional perspective of MDCS requirements, statutes, and regulations on state websites are reviewed with follow-up phone calls to state agencies/associations to identify and confirm MDCS requirements for each specific year from 1998 to 2004.

Linear reduced form models are estimated to study the impact of MDCS requirements on nursing home staffing and quality for the years of 1999–2004. For each nursing home, the dependent variable is either a measure of nurse staffing (S_{ist}) or quality (Q_{ist}) for nursing facility i in state s observed in year t. Each dependent variable is regressed on the MDCS requirement in the state 365 days before the OSCAR survey date ($MDCS_{ist-1}$), an indicator variable for change in licensed staff requirement in the state 365 days before the OSCAR survey date (LS_{ist-1}), time-varying variables (X_{ist}), state-specific linear time trends (τ_{st}), and facility-specific heterogeneity (δ_i). Specifically, the staffing and quality regressions, respectively, are

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

and

$$Q_{ist} = \alpha MDCS_{ist-1} + \pi LS_{ist-1} + \beta X_{ist} + \theta \tau_{st} + \delta_i + \varepsilon_{ist}$$

The facility-specific heterogeneity is treated as a fixed effect and captures both observed and unobserved differences across facilities that are constant over

time. The indicator variables that capture a change in the licensed staff requirement and facility-specific heterogeneity capture the impact of the level and change in level of licensed staff requirements. The state-specific time trends capture unobserved trends that can be different across states. Both regressions calculate standard errors that are adjusted for heteroskedasticity.

In the first set of analyses, the dependent variables are nurse staffing levels and nurse skill mix. Staffing levels are constructed as HPRD of total staff. Two staffing skill mix variables are constructed: RN as a percentage of total staff, and licensed staff (RN+LPN) as a percentage of a total staff. Since there are occasional improbable staffing values in OSCAR, observations with unreliable staffing are excluded from the regressions in the first analysis. This results in a sample of 87,293 surveys of 17,250 unique facilities. Improbable staffing levels are identified using a method found in Bowblis (2011): (A) more than 24 hours of staffing; (B) zero staffing; and (C) among facilities that do not fall into the first two categories, those that are outside three standard deviations of the mean.

Various quality measures are used in the second set of analyses. These quality measures are broken into three types: care practice measures, outcome quality measures, and deficiency citations. Case mix variables are included as explanatory variables in the regression to adjust the quality measures for differences in resident need across facilities and time. Traditionally, a higher number implies lower quality for most quality measures.

Care practice quality measures are indicators of care practices and processes used by the facility to provide service to residents. They include the proportion of residents that are physically restrained, use catheters, use feeding tubes, and take psychoactive and antipsychotic medications. The percentage of residents that acquired physical restraints and catheters at the nursing home are also included as process measures. For example, facility-acquired catheter measure is calculated as the total number of residents with catheters minus those ordered to use catheters before admission to the nursing home.

The outcome quality measures capture health outcomes of residents within the facility. The proportion of residents with pressure ulcers, are incontinent (bladder and bowel), have significant weight change, and have a rash are outcome measures. Additionally, the percentage of residents with facility-acquired pressure ulcers is used as an outcome quality measure.

The total number of deficiencies and seven individual deficiency citations are used as dependent variables. Federal regulations set minimum quality standards for nursing home industry in the *States Operations Manual*

(Centers for Medicare and Medicaid Services [CMS] 2004). Each standard is written in terms of what a nursing home must do, and if the nursing home does not meet the standard, regulators can issue deficiency citations. A high total number of deficiency citations and the issuance of individual deficiency citations are indicators of poor quality. Individual deficiencies are chosen because they are the most prevalent, reflect improper care practices or outcome quality, and are likely to be affected by nurse staffing. Individual deficiencies are named for the standard that is not met and include free from physical restraints (F221), pressure ulcers (F314), prevention of urinary tract infections (F316), adequate supervision to prevent accidents (F324), free from unnecessary drugs (F329), free of medication error rate of over 5 percent (F332), and sufficient number of staff (F353). Specific details on each deficiency are available in Table 2.

The explanatory variable of interest is the effective MDCS requirements of the state 365 days before the OSCAR survey date. Requirements can be stated in terms of HPRD or number of staff per resident. Further they can vary in the number of staff required for each time of day or number of beds in the facility. Therefore, the MDCS requirement is converted to HPRD for a 100-bed facility and captures the total staff needed throughout the entire day. States without MDCS requirements are given the value zero. Since the effect of MDCS is likely to be nonlinear, the level of the MDCS requirement enters into the empirical model as a quadratic.

In addition to MDCS requirements, the model also controls for changes in licensed staff requirements. Since only four states changed their licensed staff requirements over the study period, the facility-specific heterogeneity captures most of the differences across states in the level of licensed staff requirements. To address the confounding that the four states that changed licensed staff requirements may have on MDCS requirements, indicator variables are included that identify changes in the licensed staff requirement in the prior year.

The summary statistics for time-varying variables are reported in Table 3 and are broadly broken into the following categories: ownership status, nursing home structure, payer mix, occupancy rate, case mix, real average Medicaid reimbursement, and real weekly wage for nursing facilities. Ownership status is defined as for-profit, not-for-profit, and government facilities and captures differences in staffing and quality that occur because of how each ownership status values quality.

Nursing home structure includes the number of beds, an indicator variable for member of a multifacility chain, and indicator variables for the

Table 2:   Individual Deficiency Definitions

Deficiency	State Operation Manual Regulation
F221—Free from physical restraints	The resident has the right to be free from any physical or chemical restraints imposed for purposes of discipline or convenience, and not required to treat the resident's medical symptoms. This regulation pertains to the use of physical restraints
F314—Pressure ulcers	Based on the comprehensive assessment of a resident, the facility must ensure that—(1) A resident who enters the facility without pressure sores does not develop pressure sores unless the individual's clinical condition demonstrates that they were unavoidable; and (2) A resident having pressure sores receives necessary treatment and services to promote healing, prevent infection, and prevent new sores from developing
F316—Prevention of urinary tract infections	A resident who is incontinent of bladder receives appropriate treatment and services to prevent urinary tract infections and to restore as much normal bladder function as possible
F324—Adequate supervision to prevent accidents	The facility must ensure that the resident environment remains as free of accident hazards as is possible
F329—Free from unnecessary drugs	Each resident's drug regimen must be free from unnecessary drugs. An unnecessary drug is any drug when used (i) in excessive dose (including duplicate therapy); or (ii) for excessive duration; or (iii) without adequate monitoring; or (iv) without adequate indications for its use; or (v) in the presence of adverse consequences which indicate the dose should be reduced or discontinued; or (vi) any combinations of the reasons above
F332—Free of medication error rates of 5%+	The facility must ensure that it is free of medication error rates of 5 percent or greater
F353—Sufficient numbers of staff	The facility must have sufficient nursing staff to provide nursing and related services to attain or maintain the highest practicable physical, mental, and psychosocial well-being of each resident, as determined by resident assessments and individual plans of care

Source: CMS (2004).

presence of an Alzheimer's special care unit and any non-Alzheimer's special care unit. Larger facilities may have economies of scale in quality while facilities that are part of a chain may have standardized care practices that improve quality across the entire organization. The presence of a special care unit implies specialized care is provided and can require additional staffing or affect quality.

Payer-mix and occupancy rate can impact staffing and quality. Payer mix can affect the availability of financial resources a nursing home could

Table 3:   Summary Statistics

Variables	Mean	Standard Deviation
Facility staffing levels		
Total nursing staff HPRD	3.281	1.294
Percent RN to total nursing staff	11.758	9.366
Percent RN/LPN to total nursing staff	34.423	10.684
Process quality measures (% of residents)		
Restraints	9.340	11.316
Facility-acquired restraints	6.766	9.139
Catheters	7.250	7.898
Facility-acquired catheters	1.844	4.359
Feeding tubes	6.643	8.455
Psychoactive medications	56.563	17.267
Antipsychotic medications	22.453	14.330
Outcome quality measures (% of residents)		
Pressure ulcers	7.447	6.616
Facility-acquired pressure ulcers	3.385	4.445
Incontinent (bladder)	52.944	17.926
Incontinent (bowel)	43.187	18.509
Significant weight change	8.126	7.583
Rash	5.246	6.432
Total number of deficiencies	6.066	5.721
Individual deficiencies for not meeting standard		
F221—Free from physical restraints	0.103	0.304
F314—Pressure ulcers	0.167	0.373
F316—Prevention of urinary tract infections	0.104	0.306
F324—Adequate supervision to prevent accidents	0.185	0.388
F329—Free from unnecessary drugs	0.122	0.327
F332—Free of medication error rates of 5%+	0.097	0.296
F353—Sufficient numbers of staff	0.039	0.195
Explanatory variables		
Prior year minimum direct care staff ratio (HPRD)	1.733	1.203
Prior year change in licensed staff requirement (Arkansas)	0.005	0.071
Prior year change in licensed staff requirement (Delaware first)	0.001	0.034
Prior year change in licensed staff requirement (Delaware second)	0.001	0.029
Prior year change in licensed staff requirement (Florida)	0.014	0.116
Prior year change in licensed staff requirement (Ohio)	0.020	0.142
Not-for-profit facility	0.283	0.450
Government facility	0.062	0.242
Number of beds	108.571	73.316
Member of multifacility organization	0.542	0.498
% of Residents with Medicaid	61.514	26.093
% of Residents with Medicare	13.965	21.174
Occupancy rate	81.768	18.922
% of Residents with dementia	43.087	19.918
% of Residents with psychiatric diagnosis	16.619	16.212
% of Residents with depression	39.393	21.487

Table 3. *Continued*

Variables	Mean	Standard Deviation
% of Residents with developmental disability	2.979	6.307
Facility acuity level	10.128	1.655
% of Residents bedfast	5.159	8.164
% of Residents chairfast	52.361	21.421
Presence of an Alzheimer's special care unit	0.177	0.381
Presence of another type of special care unit	0.060	0.237
Real Average State Medicaid Reimbursement	124.438	25.952
Real Average State Medicaid Reimbursement	523.147	85.603

Notes. The sample size is 94,371 OSCAR surveys for 17,552 facilities between 1998 and 2004 except for facility staff levels, which are 87,293 OSCAR surveys for 17,250 facilities.
HPRD, hours per resident day.

employ in hiring more staff and in increasing quality. Occupancy rate is a measure of operating efficiency (Sloan, Ostermann, and Conover 2003), with lower occupancy indicating less efficient production of services and potentially lower quality.

Case mix controls adjust quality for differences in the level of need of residents across nursing homes and time. The case mix controls include physical case mix and mental health case mix variables. Physical case mix is measured using the Acuindex and the percentage of residents who are bed and chair bound. The Acuindex is the sum of the activities of daily living index and the proportion of residents that require special treatments with higher values indicating a higher level of resident need (Cowles 2002). Mental health case mix is measured as the percentage of residents who are diagnosed with dementia, depression, psychiatric illness other than dementia and depression, and developmental disability.

The state average Medicaid reimbursement and weekly wage for nursing facilities are included and adjusted for inflation. States that are more concerned about quality may increase MDCS requirements. However, failure to pay for the requirements could decrease nursing home quality and is one reason why Medicaid reimbursement is concurrently increased when MDCS requirements are changed (Tilly et al. 2003). Failure to control for Medicaid reimbursement would cause MDCS requirements to be endogenous and would bias the coefficient estimates. Further, holding wages fixed, higher Medicaid reimbursement provides more financial resources to nursing homes and may result in higher quality.

RESULTS

The first analysis studies the relationship between MDCS requirements and staffing levels. Since the effect of MDCS requirement can be different for nursing homes that are more or less reliant on Medicaid, two separate staffing regression models are estimated. In the first, the effect of MDCS requirements is treated to be the same regardless of the reliance of the nursing home on Medicaid. This is called the overall effect. In the second regression, the effect of MDCS requirements is allowed to be different based on the reliance of the nursing home on Medicaid. A nursing home is defined as more (less) reliant on Medicaid if the percentage of residents paid for by Medicaid is above (below) the sample median of 67.81 percent. The marginal effects of a one HPRD change in the MDCS requirement are reported in Table 4.

As expected, higher MDCS requirements increase the total amount of staff in a nursing home. Interestingly, treating the effect of MDCS requirements as nonlinear results in marginal effects that are larger as the requirement is higher. This could be a result of low MDCS requirements being nonbinding for many facilities. For staffing skill mix, MDCS requirements are associated with using more RNs but fewer licensed staff, although the result for licensed staff is not statistically significant. If the MDCS initial requirement is 2.0 HPRD, a one HPRD increase in the MDCS requirement results in a 0.77 percentage point increase in the skill mix of nurse staff that are RNs and a 0.33 percentage point decrease in licensed staff. This implies that skill mix moved slightly toward using more CNAs, while among licensed staff, LPNs are substituted for RNs.

However, these effects are different by the reliance of the nursing home on Medicaid. All nursing homes increase total staffing, but nursing homes that are more reliant on Medicaid have larger increases in their staffing. Interestingly, the staff skill mix results are driven by reliance on Medicaid. Nursing homes that have low reliance on Medicaid do not change RN skill mix in response to MDCS requirements but decrease the proportion of nurses that are licensed. In contrast, nursing homes highly reliant on Medicaid increase the proportion of nurses that are RNs but do not change overall licensed skill mix.

Table 5 contains the marginal effects of MDCS requirements on quality. The first two rows of Table 5 report the results for care practice quality measures, the third and fourth rows are outcome quality measures, and the final two rows are the deficiency outcomes. Again, the overall effect of MDCS requirements and the effect of MDCS requirements by reliance on Medicaid are reported.

Table 4:   Marginal Effects of Staffing Regressions Evaluated at Different Minimum Direct Care Staff Ratios

Staffing Level Marginal Effects	Total Nursing Staff HPRD				% RN to Total Staff				% RN/LPN to Total Staff			
	Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference		Low	High	Difference		Low	High	Difference
Staff ratio = 2	0.181***	0.109***	0.240***	0.131***	0.342**	0.011	0.608***	0.597**	− 0.325	− 0.524**	− 0.171	0.353***
Staff ratio = 2.5	0.383***	0.253***	0.491***	0.239***	0.770***	0.212	1.236***	1.024***	− 0.328	− 0.626**	− 0.078	0.548***
Staff ratio = 3	0.630***	0.428***	0.798***	0.370***	1.293***	0.457*	2.002***	1.545***	− 0.331	− 0.750**	0.036	0.786***

Notes. The sample size is 87,293 OSCAR surveys for 17,250 facilities between 1998 and 2004. All regressions are estimated using linear panel regression with facility fixed effects, state-specific linear time trends, and also control for the following: ownership status, number of beds, member of multifacility chain, payer mix, occupancy rate, case mix, presence of special care units, changes in licensed staff requirements, real average state Medicaid reimbursement, and real weekly nursing home wages. Standard errors are adjusted for the heteroskedasticity. The marginal effect is change in the dependent variable for a one unit change in the minimum staffing ratio evaluated at the ratio reported in each row. Low (high) reliance on Medicaid is defined as below (above) the median percentage of residents on Medicaid in the sample (67.81%).

***p < .01;

** *p* < .05;

* *p* < .1.

HPRD, hours per resident day.

Table 5: Marginal Effects of Quality Regressions Evaluated at Different Minimum Direct Care Staff Ratios

Band 1

Minimum Direct Care Staff Ratio (HPRD)	Restraints				Facility-Aquired Restraints				Catheters				Facility-Aquired Catheters			
	Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference		Low	High	Difference		Low	High	Difference		Low	High	Difference
Staff ratio = 2	−0.647*	−0.668*	−0.637**	0.031	1.318***	1.232***	1.392***	0.161	0.110	0.198	0.035	−0.162***	−0.149	−0.050	−0.235	−0.184
Staff ratio = 2.5	−1.477***	−1.473***	−1.481***	−0.008	1.651***	1.493***	1.787***	0.294	0.403**	0.562***	0.267	−0.296***	−0.204	−0.019	−0.364**	−0.345
Staff ratio = 3	−2.493***	−2.458***	−2.514***	−0.056	2.057***	1.812***	2.269***	0.457*	0.762***	1.008***	0.550***	−0.458***	−0.272	0.020	−0.522**	−0.543***

Band 2

Minimum Direct Care Staff Ratio (HPRD)	Feeding Tubes				Psychoactive Medications				Antipsychotic Medications			
	Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference		Low	High	Difference		Low	High	Difference
Staff ratio = 2	0.362***	0.089	0.598***	0.964***	−1.265**	−1.569***	−1.010*	0.559***	0.344	−0.742***	1.267***	2.009***
Staff ratio = 2.5	0.471***	−0.048	0.916***	0.964***	−2.566***	−3.094***	−2.113***	0.981***	0.710***	−1.243***	2.388***	3.631***
Staff ratio = 3	0.604***	−0.215	1.305***	1.520***	−4.157***	−4.957***	−3.461***	1.496***	1.157***	−1.856***	3.758***	5.614***

Band 3

Minimum Direct Care Staff Ratio (HPRD)	Pressure Ulcers				Facility-Acquired Pressure Ulcers				Incontinence (Bladder)				Incontinence (Bowel)			
	Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference		Low	High	Difference		Low	High	Difference		Low	High	Difference
Staff ratio = 2	0.000	0.127	−0.106	−0.233***	−0.664***	−0.586***	−0.727***	−0.141**	0.147	0.280	0.025	−0.254	2.483***	2.330	2.608***	0.277
Staff ratio = 2.5	0.209	0.790***	0.024	−0.401***	−1.184***	−1.059***	−1.290***	−0.232***	0.027	0.311	−0.218	−0.529	5.057	4.809***	5.270***	0.461
Staff ratio = 3	0.466*	1.221***	0.183	−0.607***	−1.819***	−1.637***	−1.979***	−0.343***	−0.120	0.349	−0.516	−0.865	8.204	7.840***	8.524***	0.685

Table 5.   Continued

Significant Weight Change

	Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference
Staff ratio = 2	0.135	−0.166	0.394	0.560***
Staff ratio = 2.5	0.580**	0.021	1.061***	1.039***
Staff ratio = 3	1.124***	0.250	1.875***	1.625***

Rash

	Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference
Staff ratio = 2	−0.382*	−0.182	−0.560***	−0.377***
Staff ratio = 2.5	−0.716***	−0.315	−1.062***	−0.747***
Staff ratio = 3	−1.125***	−0.477*	−1.676***	−1.199***

Total Number of Deficiencies

	Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference
Staff ratio = 2	−0.322***	−0.161	−0.453***	−0.292***
Staff ratio = 2.5	−0.799***	−0.535***	−1.025***	−0.491***
Staff ratio = 3	−1.382***	−0.991***	−1.725***	−0.734***

F221—Free from Physical Restraints

	Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference
Staff ratio = 2	−0.021*	0.017	−0.024**	−0.007
Staff ratio = 2.5	−0.028**	−0.021*	−0.033***	−0.012
Staff ratio = 3	−0.036**	−0.027*	−0.044***	−0.017*

F314—Pressure Ulcers

	Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference
Staff ratio = 2	−0.080***	−0.075***	−0.083***	−0.009*
Staff ratio = 2.5	−0.142***	−0.136***	−0.147***	−0.011
Staff ratio = 3	−0.218***	−0.211***	−0.224***	−0.014

F316—Prevention of Urinary Tract Infections

	Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference
Staff ratio = 2	−0.091***	−0.082***	−0.098***	−0.016***
Staff ratio = 2.5	−0.176***	−0.161***	−0.190***	−0.029***
Staff ratio = 3	−0.281***	−0.257***	−0.301***	−0.044***

	F324—Adequate Supervision to Prevent Accidents				F329—Free from Unnecessary Drug				F332—Free of Mediation Error Rates of 5%+				F353—Sufficient Numbers of Staff			
	Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid			Overall Effect	Effect by Reliance on Medicaid		
		Low	High	Difference		Low	High	Difference		Low	High	Difference		Low	High	Difference
Staff ratio = 2	−0.059***	−0.051***	−0.065***	−0.014***	−0.049***	−0.056***	−0.042***	0.014***	0.002	−0.004	0.008	0.012***	−0.029***	−0.030***	−0.028***	0.002
Staff ratio = 2.5	−0.133***	−0.120***	−0.144***	−0.025***	−0.087***	−0.100***	−0.076***	0.024***	−0.005	−0.017	0.005	0.022***	−0.049***	−0.051***	−0.047***	0.004
Staff ratio = 3	−0.223***	−0.203***	−0.241***	−0.038***	−0.135***	−0.154***	−0.118***	0.036***	−0.015	−0.033**	0.001	0.034**	−0.073***	−0.076***	−0.069***	0.007

Notes. The table reports the marginal effect of a one unit change in the minimum staffing ratio for initial staffing ratios based on the coefficient estimates from Table 3. Marginal effects are calculated for when minimum direct care staffing is treated as linear and quadratic. All regressions used to calculate marginal effects are estimated using linear panel regression with facility fixed effects, state-specific linear time trends, and also control for the following: ownership status, number of beds, member of multifacility chain, payer mix, occupancy rate, case-mix, presence of special care units, changes in licensed staff requirements, and real average state Medicaid reimbursement and real weekly nursing home wages. Individual deficiencies reflect receiving a deficiency citation for not meeting regulatory standards in the *States Operation Manual.* Low (high) reliance on Medicaid is defined as below (above) the median percentage of residents on Medicaid in the sample (67.81%).

***$p<.01$;

**$p<.05$;

*$p<.1$.

HPRD, hours per resident day.

The regressions that treat the relationship between the care practices and MDCS requirements are mixed. Higher MDCS requirements are associated with fewer residents being physically restrained, but more residents acquiring the physical restraints at the facility. The case for catheters is the opposite, with MDCS requirements associated with more catheter use but has no statistically significant effect on facility-acquired catheters. Antipsychotic medication use is higher in facilities with higher MDCS requirements. One result that is consistent across all care practices is the effect of MDCS requirements becomes larger when the level of staffing mandated under the MDCS requirement is higher.

There is little difference in the effect of MDCS requirements by reliance on Medicaid for the use of restraints or facility-acquired restraints, but the other care practice quality measures are mixed. Nursing homes that are more reliant on Medicaid decrease their use of catheters and facility-acquired catheters compared with nursing homes that are less reliant on Medicaid. For the other three care practice quality measures of use of feeding tubes, psychotropic medications, and antipsychotic medications, the effect is the opposite.

The overall effect of MDCS requirements on outcome quality measures is also mixed. Higher MDCS requirements are associated with fewer facility-acquired pressure ulcers and rashes. In contrast, higher MDCS requirements are also associated with worse quality in terms of bowel incontinence and significant weight change. One result that stands out is the differences in the effect of MDCS requirements by reliance on Medicaid. For four of the six quality measures, nursing homes with more reliance on Medicaid show improvements in quality relative to those less reliant on Medicaid. Among the other two quality measures, only the effect for significant weight change is statistically significant.

The dependent variables of deficiencies are consistent across all measures. Higher MDCS requirements are associated with fewer deficiencies and a lower probability of receiving a specific deficiency. Nursing homes that are more reliant on Medicaid are found to have larger declines in the total number of deficiencies, but the results for reliance on Medicaid are mixed for the individual deficiencies.

Sensitivity analyses are performed to make sure the results are robust to alternative specifications. The first concern is quality changes associated with MDCS requirements could feed back into payer-mix and occupancy rates. Regression models that exclude payer-mix and occupancy rates find the MDCS requirement coefficients to be essentially the same as including these variables. A second concern is MDCS requirements may impact the wages of

nursing home workers and confound the MDCS requirement coefficient estimates. Using the effective minimum wage and wages of hotel/motel workers as exclusion restrictions, instrumental variable regressions found the coefficient estimates of MDCS requirements to be robust. A third concern is staffing levels may need to be included as an explanatory variable in the quality regression even though they are highly collinear with the MDCS staffing level and are potentially endogenous. Robustness checks that included staffing levels did not significantly change the results. Finally, there is a concern that states with high perceived quality are less likely to increase MDCS requirements, leading to a potential endogeneity problem between MDCS requirements and quality. Endogeneity is less of a concern if there are no systematic differences in quality between states that do and do not increase MDCS requirements. Comparisons of average quality between nursing homes in each of these groups for 1999 found no systematic differences in quality.

CONCLUSION

This paper studies the impact of MDCS requirements on nurse staffing levels, nurse skill mix, and the quality of nursing home care from 1999 to 2004. Higher MDCS requirements increase the total number of nurse staff employed in nursing homes. The effect is larger the higher the level of staffing mandated by the MDCS requirement and for nursing homes that are more reliant on Medicaid. This result is consistent with nursing homes facing a binding staffing constraint with high MDCS requirements.

There is evidence that nursing homes in states with high MDCS requirements employ more RNs, but the result is only found for nursing homes that are more reliant on Medicaid. Further, high Medicaid reliant nursing homes do not change licensed staff composition. This suggests high Medicaid reliant nursing homes proportionally increase licensed staff to keep licensed skill mix similar to levels before the increase in MDCS requirements, but are hiring more RNs relative to LPNs. Interestingly, nursing homes that are less reliant on Medicaid reduce the total percentage of staff that is licensed but keep the proportion of staff that is an RN constant. One possible explanation for this result is nursing homes that are less reliant on Medicaid are required to increase staffing but cannot increase non-Medicaid reimbursement to offset the cost of this staff. It may be more cost-effective for the low Medicaid reliant nursing homes to meet staffing requirements by hiring CNAs compared with licensed nurses.

Although the nursing home quality literature finds higher staffing is associated with higher quality, the skill mix of staffing is also an important factor in determining nursing home quality (Cohen and Spector 1996). Each type of nurse has a different set of skills and may be better or worse at addressing particular resident needs. Highly trained RNs may be better than CNAs at recognizing diseases and initiating proper care plans when interacting with residents. However, CNAs are responsible for the majority of direct care of residents, and increased CNA presence in the nursing home reduces the cost of labor-intensive care practices. Since nursing homes choose labor and material intensive care practices that minimize cost, the net increase in staffing caused by MDCS requirements may make nursing homes change the care practices they use. This factor substitution (Zinn 1993; Cawley, Grabowski, and Hirth 2006) may be one reason the direction of the care practice quality measures are mixed and there is no systematic pattern for how high Medicaid reliant nursing homes change care practices in response to MDCS requirements compared with low Medicaid reliant nursing homes.

Although there is evidence of input substitution, MDCS requirements improve quality in terms of resident health outcomes and meeting federal standards for all nursing home regardless of reliance on Medicaid. That is, the change in use of labor and material intensive inputs associated with higher MDCS requirements result in improved health outcomes and fewer regulatory deficiencies. Moreover, nursing homes that are more reliant on Medicaid are more likely to show greater improvements in health outcomes after increases in MDCS requirements.

The findings of this paper are important for public policy. They suggest that efforts to increase the amount of nursing home staff may directly conflict with efforts to improve quality in other areas, such as use of material intensive care practices. Additionally, changes in care practices result in improved health outcomes of residents and nursing homes being more likely to meet regulatory standards. Further, these effects are found to be different based on how reliant the nursing home is on Medicaid for funding. Given these trade-offs, it is important to understand and further study the complex relationship between regulation, reliance on Medicaid, staffing, input use, and quality.

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