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Shaina Shapera March 10, 2017

The Role of Nursing Home Resources in Reducing Pressure Ulcers and Falls

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Abstract

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This paper investigates the relationship between staffing and capital measures and negative health outcomes in nursing homes using Centers for Medicare and Medicaid Services provider information and quality measures data from 2011 to 2015. Increased time devoted to residents may prevent common negative health outcomes and injuries, but workers with different scopes of practice may have varying effects on quality of care. Additionally, capital resources may improve care alone or in conjunction with labor. This study finds that reported staffing hours do not have a significant effect on the quality metrics studied. However, facilities that fall short of an ideal number of hours staffed by registered nurses may have more pressure ulcers.

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Table of Contents

1. Introduction

Safety in nursing homes is becoming an increasingly important public health concern. After media reports of nursing home abuse and neglect brought elder care to the public's attention, the Institute of Medicine published their influential report *Quality of Care in Nursing Homes* in 1986 (Gruneir & Mor, 2008). This report lead to substantial legislation to promote quality nursing home care, most notably the Nursing Home Reform Act (NHRA) (Gruneir and Mor, 2008). The NHRA entitled nursing home residents to appropriate nursing services, pharmaceuticals, care plans, and assessments ("Nursing Home Reform Act, n.d.). Care improved in many areas, most notably with a decrease in restraint use, but many risks and deficiencies continue.

Today, two of the most common adverse events in nursing homes are falls and pressure ulcers (bed sores). Falls harm the physical and psychological wellbeing of patients and erode their dignity. Dangerous environments increase the risk of fractures among populations with high rates of osteoporosis. An average of 1.5 falls per bed per year occur in nursing homes (Simmons, et al., 2016). Fractures occur in 4% of these falls and other serious injuries including lacerations (deep cuts) or head trauma occur in 11% (Simmons, et al., 2016). Falls are also a financial burden for often underfunded facilities. Nursing homes may face litigation for falls caused by neglect or improper care. As of 2009, Center for Medicare and Medicaid Services (CMS) ceased their coverage of costs of care from inpatient falls as those injuries are considered to be preventable (Quigley & White).

Between 2.3% and 23% of nursing home residents have pressure ulcers while 35% are admitted with an existing pressure ulcer (Gruneir & Mor, 2008). The true prevalence of pressure ulcers is difficult to ascertain as early-stage sores and damaged skin without ulceration are difficult to detect. However, it is well-known that nursing home residents are at particularly high risk of developing pressure ulcers due to their impaired mobility, poor circulation, incontinence, and nutritional deficiencies (Gruneir & Mor, 2008). Pressure ulcers can result in infection and death.

Falls and pressure ulcers are two metrics receiving substantial research because a majority are preventable. Adequate staffing levels, protective technologies, and layers of oversight have been cited as critical for promoting safety in nursing homes. Nursing organizations universally consider these two measures to be indicative to the quality of care given.

This project will analyze how capital resources and labor interact to produce health outcomes in nursing homes. Most current research focused on nursing home quality and resident health outcomes comes from the fields of nursing, medicine, and epidemiology. Quantitative research on nursing home outcomes often focuses solely on staffing and does not address the effects of physical capital. This project builds on the existing literature by analyzing the effects of both staffing and physical capital on facility quality using a large nationwide survey of diverse facilities over a five-year period. This discussion of staffing also includes more measures than simply number of hours worked; it also includes a way to measure noncompliance to a standard of care. This analysis seeks to convey a more complex story than the one presented in the existing literature.

2. Literature Review

Labor is often considered to be the primary input of nursing home services. Fittingly, many epidemiological, economic, and nursing studies examine the effects of staffing levels, education, and healthcare legislation on quality measures and adverse events.

Using data from the Centers of Medicare and Medicaid Services (CMS) and staffing reports, Schnelle et al. (2016) created a simulation to determine the number of nurse aide hours per resident per day (HPRD) required to provide adequate activities of daily living care for residents with differing functional ability. Schnelle et al. find that nurse aides inevitably omit some percentage of activities of daily living care, and current average staffing levels will cause nurse aides to forgo more than 10% of care, putting residents at risk for adverse events.

In a review of 54 quantitative studies analyzing the effects of registered nurse (RN) staff levels on nursing home quality, Dellefield et al. (2015) finds that higher levels of RN staffing improves nursing home quality. Higher RN staffing is associated with fewer pressure ulcers, better quality measures, lower restraint use, decreased probability of hospitalization, fewer deficiency citations, decreased mortality, and decreased incidence of urinary tract infections. A higher RN ratio to other nursing staff increases the professional skill mix, indicating that not all nursing home labor inputs contribute to quality equally. However, one reviewed study found no significant relationship between RN staffing and quality outcomes. This may be due to the lower educational attainment of RNs working in nursing homes; currently, there are no federal requirements for RNs to have specialized education in gerontological nursing.

By comparing states with differing certified nursing assistant (CNA) training requirements, Trinkoff et al. (2015) find that states with higher training requirements have better quality nursing homes. Higher clinical hours as a proportion of total training hours are associated with decreased risk of residents with depression, pain, antipsychotic use, and weight loss. Increased in-service are associated with lower odds of falls with injury and depression regardless of facility size. These results indicate that staff education and hours both affect the risk of adverse events. However, the relationship between CNA education and pressure ulcers is ambiguous. The association between CNA education and pressure ulcers depends on the size of the facility and may indicate greater proficiency at identifying pressure ulcers in early stages.

In order to combat chronic understaffing in nursing homes, many state legislatures have passed minimum staffing requirements for nursing homes. Chen and Grabowski (2015) use several difference in difference (DID) models to assess the effectiveness and unintended consequences of minimum staffing standards. Chen and Grabowski find that the number of total nursing care hours increases and the number of deficiencies decrease due to policy. However, since the policy does not distinguish between various types of direct care staff, nursing homes increase their numbers of low-paid CNAs and licensed practical nurses (LPNs) instead of more educated RNs. The minimum staffing standards also had no significant relationship with physical restraint use, pressure ulcers, urethral catheter use, and psychoactive medication use. Foster and Lee (2015) also found no significant relationship between minimum nursing hours and pressure ulcer worsening rate. Chen and Grabowski indicate that CNAs and LPNs can improve nursing home quality in some dimensions while RNs are needed for improvement in others.

An additional policy to improve nursing home quality uses subsidies provided with Medicaid reimbursements for direct care staff in order to encourage nurse hiring. Foster and Lee (2015) find that wage pass-through is associated with a decreased pressure ulcer worsening rate. Wage pass-through was not found to have a significant relationship with other adverse events. For nursing homes with a lower proportion of Medicaid patients, quality improved through increased hiring while nursing homes with a higher proportion of Medicaid patients improved quality by increasing wages.

From existing literature concerning nursing home labor inputs, it seems that staffing hours and education influence health outcomes of nursing home residents. However, not all labor inputs affect quality in the same way. The benefits from direct care staff labor depends on overall staff training, the professional skill mix, and wages.

Hitt and Tambe (2015) use bed count as a proxy for capital resources. They justify this proxy by citing New York State's Certificate of Need laws, which regulate nursing home capital investment. Certificate of Need laws seek to reduce healthcare price inflation by preventing the overbuilding of facilities and the purchase of needless expensive equipment ("CON-Certificate of Need State Laws, 2016). Nursing homes in states with Certificate of Need laws typically make infrequent capital investments and operate at a high utilization rate. Today thirty-five states maintain some form of Certificate of Need program. Bed count may be a better proxy for capital in these states than in others.

3. Data

I used data from the Centers for Medicare and Medicaid Services Nursing Home Compare, a national survey of all Medicare and Medicaid certified nursing facilities and skilled nursing facilities in the United States, Puerto Rico, Guam, and the Virgin Islands. The dataset includes provider information supplied by individual nursing facilities, health inspection results, and resident health outcomes pertinent to facility quality. Provider information includes, but is not limited to, total number of certified beds, total number of residents, ownership, certification, overall rating, and various staffing measures. Prior to 2013, provider information was collected quarterly; it is currently collected annually. Eighteen health outcomes commonly used to determine quality of care in nursing facilities are collected quarterly. I examined annual provider information and resident health outcomes from 2011 to 2015, focusing on staffing measures, number of certified beds, resident falls, and pressure ulcers.

The Centers for Medicare and Medicaid Services Nursing Home Compare provides several methods to measure staffing. I measured staffing using Reported Registered Nurse Hours per Resident per Day, Reported Licensed Practical Nurse Hours per Resident per Day, and Reported Aide Hours per Resident per Day for some regressions. Reported values are derived from those reported by nursing homes on CMS forms 671 and 672. CMS calculates each indicator by dividing the number of hours worked by staff each day in the two-week period leading up to inspection by the total number of residents (Staffing Charts, n.d.)[1].

[1] Staffing values deemed unrealistic or invalid by the Centers for Medicare and Medicaid Services have been omitted; however, the standards used by CMS for omitting staffing values are unclear.

Some regressions used a metric for staffing differentials, the percentage of an ideal number of hours devoted to each resident per day. The ideal number of hours per resident per day is based on CMS's Expected Hours, a value that quantifies the number of hours of care that should be given to each resident based on the facility's case mix. Expected Hours are calculated using CMS Staff Time Measurement Studies and resident case-mix using Resource Utilization Group (RUG) categories. That is, the Centers for Medicare and Medicaid Services estimates the number of hours per day nursing staff would ideally devote to each patient based on the case mix of a nursing home. Facilities with more care-intensive residents would have higher values for expected staffing hours. Differential Staffing was calculated using the following:

$$Differential = 1 - (\frac{Expected - Reported}{Expected})$$

with a differential of one indicating full compliance to the expected staffing value. Values greater than one represent staffing above an ideal value, while those lower than one indicate noncompliance with the ideal. Summary statistics for all staffing values by year can be found in Table 1.

The number of certified beds in the facility is used as the capital measure due to nursing home patterns of investment and Certificate of Need Laws, as described in the literature review. Beds may be certified by Medicare, Medicaid or both. The average facility in the sample has approximately 106 certified beds, with the smallest facility containing one certified bed and the largest facility containing 1389 certified beds. The standard deviation for the number of certified beds is 62.453. Table 1 contains summary statistics for the number of certified beds by year. Included in the analysis are regressions that restrict the size of the

facility to those with fewer than one hundred certified beds or those with more than two hundred certified beds. These restricted samples are used to investigate the interaction between staffing and bed size.

Other provider characteristics included in the CMS datasets may be correlated with nursing home inputs and resulting quality outcomes. Regressions include dummy variables for year, certification, and ownership type. All facilities are certified by Medicare only, Medicaid only or both. Approximately 91% of facilities are certified by Medicare and Medicaid. A tabulation of certifications by year can be found in Table 2. Nursing homes analyzed in this paper are owned by various types of for-profit, government, and non-profit entities. A majority of facilities are owned by a for-profit corporation. This analysis does not control for changes in ownership over the 2011 through 2015 period; however, these facilities rarely change certification or ownership type. A tabulation of ownership types by year can be found in Table 3.

All quality measures come from the Minimum Data Set (MDS) 3.0. The MDS is a federally-mandated process to clinically assess all residents in Medicare or Medicaid certified nursing homes. These records measure the functional abilities of residents, allowing staff to identify health concerns and formulate individual care plans. MDS assessments are performed by professionals employed by the facility and occur upon admission, periodically throughout residency, and upon discharge. Eighteen health outcomes are reported as single quarter quality measures, two of which are used in this paper: “Percentage of high risk long stay residents with a pressure ulcer” and “Percentage of long stay residents experiencing one or more falls with injury.” The Center for Medicare and Medicaid Services defines a long stay as

an episode whose cumulative days in the facility exceeds one hundred and one days at the end of the target period.

The percentage of high risk long stay residents with a pressure ulcer is calculated using resident assessments indicating a high risk of developing pressure ulcers and a stage two, three, or four pressure ulcer.[2] Residents are high risk if they possess impaired bed mobility or transfer, are comatose or present as malnourished or at risk for malnutrition. Excluded are admission assessments, PPS 5-day and readmission or return assessments (MDS Quality Measures 3.0 User's Manual, 2016). That is, residents entering a facility with a preexisting pressure ulcer are not included in this measure. All pressure ulcers must have occurred during residency at the facility. The average percentage of high risk long stay residents with a pressure ulcer has decreased from 6.864% in 2011 to 5.728% in 2015 (Table 1). Each year shows a marked decrease from the previous year, showing a downward trend in nursing home pressure ulcers over time. This decrease seems to indicate improvements in pressure ulcer prevention during that period.

The percentage of long stay residents experiencing one or more falls with major injury is calculated using resident look-back scan assessments indicating one or more falls with major injury.[3] The look-back scan assessment selection period includes assessments within the current episode that have target dates less than 275 days prior. The adverse event may have occurred anytime during the one year period (MDS Quality Measures 3.0 User's Manual, 2016).

[2] Measures indicating a small number of long stay residents have been omitted by CMS. The threshold for inclusion is unclear.

[3] Measures indicating a small number of long stay residents have been omitted by CMS. It is also unclear what is considered to be a major injury.

The average percentage of long stay residents experiencing one or more falls with major injury decreased slightly from 3.431% in 2011 to 3.324% in 2015, with the lowest proportion of falls occurring in 2014 (Table 1). There seemed to be a downward trend between 2011 and 2014 with an uptick in 2015.

4. Methods

The regressions used here are based off a standard production function, which relates output to labor and capital inputs:

$$y_{it} = F(K_{it}, L_{it})$$

In this case, nursing home quality is the output while nursing hours and certified beds are the inputs. Nursing hours are further divided into RN hours, LPN hours, and aide hours. I used a translog model with fixed effects to investigate the effects of staffing and capital on nursing home resident health outcomes:

$$\log Y_{it} = \beta_0 + \sum_{j=1}^{n} \phi^{it}(logX_{it}^{j}) + \sum_{j=1}^{n} \gamma^{it}(logX_{it}^{j})^2 + \sum_{j=1}^{n}\sum_{j\neq k}^{n} \delta^{jk}(logX_{it}^{j})(logX_{it}^{k}) + \varepsilon_{it}$$

For nursing home *i* in year *t*. The error term ε_{it} is equal to the following:

$$\varepsilon_{it} = \mu_i + \psi_{it} + \xi_{it} + t$$

Where μ_i represents fixed effects, ψ_{it} represents nursing home characteristics, t represents time, and ξ_{it} represents the error term. This translog model was used to provide flexibility to the regression. The marginal effects of the inputs were determined by taking the derivative of the regression, with respect to each input. Robustness was tested by using a similar model that excludes the squared terms and interaction terms.

5. Results

5.1 Reported Staffing

None of the inputs significantly reduced the percentage of high risk long stay residents with a pressure ulcer (Table 4). RN hours, aide hours, LPN hours, and the number of certified beds had a statistically significant effect on pressure ulcers. None of the inputs significantly reduced the percentage of long stay residents experiencing one or more falls with major injury (Table 4). Reported registered nurse hours slightly increased resident falls, significant at the ten-percent level. A 1% increase in reported RN hours per resident per day was associated with a 0.0244% increase in the percentage of long stay residents experiencing one or more falls with major injury. No other inputs displayed significance. Results from an alternative Cobb Douglas specification corroborated those found using the translog specification for both pressure ulcers and falls (Table 6).

5.2 Staffing Differentials

An increase in the RN differential metric was associated with a decrease in the percentage of high risk long stay residents with a pressure ulcer, significant at the five-percent level (Table 5). That is, as the RN differential gets closer to or exceeds one (equal to the ideal value), pressure ulcers decrease. A 1% increase in the RN differential metric was associated with a 0.036% decrease in the percentage of high risk long stay residents with a pressure ulcer. An increase in the aide differential metric was associated with an increase in the percentage of high risk long stay residents with a pressure ulcer, significant at the ten-percent level. A 1% increase in the aide differential metric was associated with a 0.0413% increase in the

percentage of high risk long stay residents with a pressure ulcer. None of the other inputs displayed significance. An increase in the RN differential metric was associated with an increase in the percentage of long stay residents experiencing one or more falls with major injury, significant at the ten-percent level (Table 5). A 1% increase in the RN differential metric was associated with a 0.0244% increase in falls. Other inputs did not display significance. The alternative Cobb Douglas specifications corroborated these results (Table 6).

5.3 Outcomes by Facility Size

In facilities with fewer than 100 beds, reported staffing and capital inputs did not display any significant effect on the percentage of high risk long stay residents with a pressure ulcer or the percentage of long stay residents experiencing one or more falls with major injury (Table 7). Increased RN differential metric was associated with a decrease in pressure ulcers, significant at the five-percent level (Table 7). A 1% increase in the RN differential metric is associated with a 0.0552% decrease in the percentage of high risk long stay residents with a pressure ulcer. No other staffing differentials displayed significance. Staffing differentials displayed no significant reductions in falls (Table 7).

In facilities with more than 200 beds, reported staffing and capital inputs did not significantly reduce the percentage of high risk long stay residents with a pressure ulcer or the percentage of long stay residents experiencing one or more falls with major injury (Table 8). An increase in the aide differential was associated with increased pressure ulcers (Table 8). A 1% increase in the aide differential metric was associated with a 0.124% increase in the percentage of high risk long stay residents with a pressure ulcer, significant at the ten-percent level. No

other staffing differentials or capital displayed significance. None of the staffing differential metrics had a significant effect on the percentage of long stay residents experiencing one or more falls with major injury. The number of certified beds also did not display significance.

6. Conclusion/Discussion

The results of this analysis indicate that reported staffing and capital inputs do not significantly affect nursing home outcomes, as measured by the percentage of high risk long stay residents with a pressure ulcer and the percentage of long stay residents experiencing one or more falls with major injury. However, having RN staffing hours below the expected ideal value may contribute to higher rates of pressure ulcers. Meeting an ideal expected number of hours of RN staffing may be particularly important for small facilities with fewer than 100 beds. These results corroborate what was found in the existing literature.

The results from this investigation yield some interesting implications. While more staffing does not necessarily cause better outcomes, meeting an ideal federally-constructed value may improve nursing home quality. During the investigation period, the average nursing home exceeded the ideal staffing hours for aides and LPNs by approximately 20% each. It is possible that increased aide and LPN hours did not improve quality because nursing homes already tend to exceed the ideal amount of these inputs. Adding aide and LPN hours after reaching the ideal is not likely to improve outcomes. This finding implies that nursing homes should not increase aide and LPN staffing beyond the ideal expected value for the facility based on case mix.

The average nursing home fell short of the ideal staffing hours for RNs. While the gap between ideal hours and reported hours shrunk between 2011 and 2015, the average nursing home reported staffing only 77.4% of the ideal RN hours in 2015. In more practical terms, the

difference between the ideal RN hours and reported RN hours in 2015 equaled approximately 14 minutes per resident per day. Closing this gap could measurably reduce pressure ulcers.

Possible policies to reduce the percentage of high risk long stay residents with a pressure ulcer would provide incentives for facilities to staff at the ideal levels. At current staffing levels, that would mean substituting away from aides and LPNs toward RNs. While aides and LPNs certainly contribute to creating safe, high-quality facilities, the average nursing home may be oversaturated with these workers. Many nursing homes, when faced with laws increasing total staff hours devoted to residents, tend to hire more aides and LPNs to moderate labor costs. Laws that specifically require higher RN staffing or wage-pass through mentioned in the literature review may be viable solutions.

Unfortunately, nursing homes can be unattractive to RNs as the wages provided by hospitals are often higher. Any solution that requires nursing homes to increase RN hiring must acknowledge these difficulties. Nursing homes may not be able to compete with hospitals in terms of wages, but they may become more attractive workplaces by providing other benefits. Employee benefits, staff education, leadership opportunities, and improved working hours may be provided to entice RNs.

This paper had several limitations that may affect the results. By investigating the effects of staffing on quality using staffing hours, some endogeneity was introduced. While increased staffing may improve quality in nursing homes, facilities with favorable reputations may attract more staff. This endogeneity may be eliminated by using an instrumental variable for staffing. Possible instruments include county-level nurse wages and changes in state

nursing home staffing laws. Nursing home staffing laws are determined by state legislatures, providing exogenous changes to staffing that would not be effected by the quality of a particular facility.

The results may be influenced by the measures used to evaluate quality. The quality measures that I used have some ambiguity. Facilities reporting a high percentage of pressure ulcers may not be of poor quality; high levels may be driven by improved identification of early-stage pressure ulcers. From the metric's construction, it is difficult to ascertain what drives the percentage of pressure ulcers for an individual facility. Similarly, the metric used for falls may not accurately show the prevalence of falls in facilities. Falls causing minor injury or no injury are not reported in the CMS database. Falls without an injury may not be reported in facility records at all since staff may be concerned about the consequences of reporting. The true prevalence of falls is certainly higher than what CMS reports would suggest.

7. Figures

Table 1: Summary Statistics

	2011	2012	2013	2014	2015
Reported Staffing					
RN Hours	0.743	0.768	0.786	0.816	0.841
	(0.565)	(0.570)	(0.592)	(0.594)	(0.594)
Aide Hours	2.455	2.451	2.455	2.460	2.460
	(0.614)	(0.628)	(0.630)	(0.624)	(0.614)
LPN Hours	0.830	0.827	0.826	0.833	0.836
	(0.403)	(0.398)	(0.402)	(0.402)	(0.403)
Expected Staffing					
Expected RN Hours	1.146	1.080	1.056	1.065	1.077
	(0.240)	(0.238)	(0.237)	(0.235)	(0.235)
Expected Aide Hours	2.408	2.410	2.426	2.430	2.432
	(0.193)	(0.194)	(0.198)	(0.194)	(0.192)
Expected LPN Hours	0.690	0.666	0.655	0.656	0.658
	(0.107)	(0.102)	(0.098)	(0.097)	(0.096)
Differential Staffing					
RN Differential	0.637	0.694	0.732	0.756	0.774
	(0.369)	(0.390)	(0.413)	(0.415)	(0.423)
Aide Differential	1.022	1.019	1.014	1.015	1.014
	(0.260)	(0.265)	(0.266)	(0.264)	(0.259)
LPN Differential	1.204	1.238	1.262	1.272	1.274
	(.0527)	(0.534)	(0.551)	(0.568)	(0.571)
Capital					
Certified Beds	107.0569	106.9604	106.1497	105.9676	106.05
	(63.163)	(63.027)	(62.915)	(61.682)	(61.613)
Outcomes					
Pressure Ulcers	6.864	6.218	5.976	5.834	5.728
	(4.637)	(4.413)	(4.287)	(4.295)	(4.165)
Falls	3.431	3.258	3.215	3.187	3.324
	(2.702)	(2.638)	(2.626)	(2.610)	(2.668)

Standard deviations in parentheses.

Table 2: Frequency of Certification Type by Year

	2011	2012	2013	2014	2015
Medicaid	3.38%	3.59%	3.64%	3.31%	3.08%
	477	507	557	523	486
Medicare	5.03%	4.98%	5.00%	5.06%	4.94%
	710	704	765	799	779
Medicare and Medicaid	91.58%	91.43%	91.36%	91.63%	91.98%
	12,915	12,921	13,971	14,480	14,509

Table 3: Frequency of Ownership Type by Year

	2011	2012	2013	2014	2015
For profit - Corporation	57.03%	57.35%	56.74%	57.78%	57.73%
	7,951	8,035	8,678	9,130	9,106
For profit - Individual	3.41%	3.62%	3.53%	3.48%	3.89%
	476	507	540	550	614
For profit - LLC	-	-	1.10%	.84%	.77%
	-	-	168	132	121
For profit - Partnership	8.18%	8.04%	7.31%	7.45%	7.26%
	1,140	1,126	1,118	1,178	1,145
Government - City	.60%	.55%	.57%	.59%	.60%
	83	77	87	93	94
Government - City/County	.47%	.51%	.53%	.59%	.61%
	65	71	81	93	96
Government - County	2.80%	2.93%	2.95%	2.96%	3.18%
	390	410	451	467	501
Government - Federal	.04%	.05%	.05%	.04%	.04%
	6	7	7	6	7
Government - Hospital District	.93%	.86%	.88%	.87%	.99%
	130	120	134	137	156
Government - State	.93%	.90%	.92%	.99%	1.01%
	129	126	140	156	160
Non profit - Church Related	4.77%	4.76%	4.64%	4.35%	3.99%
	665	667	709	687	629
Non profit - Corporation	19.02%	18.64%	18.94%	18.23%	18.01%
	2,652	2,611	2,896	2,880	2,841
Non profit - Other	1.83%	1.81%	1.86%	1.85%	1.93%
	255	253	284	293	304

Table 4: Effects of Reported Staffing on Pressure Ulcers and Falls

VARIABLES	ln_Pressure_Ulcers	ln_Falls
ln_rnhrd	-0.0215	0.0244*
	(0.0143)	(0.0139)
ln_aidhrd	0.0154	-0.0286
	(0.0228)	(0.0213)
ln_vochrd	0.00927	-0.0203
	(0.0159)	(0.0152)
ln_bedcert	0.00228	-0.0161
	(0.0620)	(0.0580)
Observations	47,159	52,736

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Marginal effects reported. Standard errors clustered on the facility level

Table 5: Effects of Staffing Differentials on Pressure Ulcers and Falls

VARIABLES	ln_Pressure_Ulcers	ln_Falls
ln_rn_diff	-0.0360**	0.0263*
	(0.0140)	(0.0136)
ln_lpn_diff	-0.00519	-0.0159
	(0.0157)	(0.0149)
ln_aide_diff	0.0413*	-0.0114
	(0.0225)	(0.0211)
ln_bedcert	-0.00525	-0.0244
	(0.0620)	(0.0579)
Observations	47,132	52,694

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Marginal effects reported. Standard errors clustered on the facility level.

Table 6: Cobb Douglas

	Reported		Differential	
VARIABLES	ln_Pressure_Ulcers	ln_Falls	ln_Pressure_Ulcers	ln_Falls
ln_rnhrd	-0.0196	0.0187	-0.0296**	0.0221*
	(0.0138)	(0.0134)	(0.0135)	(0.0131)
ln_aidhrd	0.0110	-0.0224	0.0218	-0.0125
	(0.0161)	(0.0159)	(0.0161)	(0.0157)
ln_vochrd	0.00133	-0.0118	-0.00628	-0.00710
	(0.0134)	(0.0128)	(0.0132)	(0.0126)
ln_bedcert	0.0572	-0.0187	0.0533	-0.0237
	(0.0539)	(0.0415)	(0.0543)	(0.0411)
Constant	1.539***	1.305***	1.559***	1.317***
	(0.257)	(0.195)	(0.259)	(0.193)
Observations	47,159	52,736	47,132	52,694
Number of prov_group	12,419	14,142	12,414	14,138
R-squared	0.016	0.003	0.016	0.003

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Standard errors clustered on the facility level

Table 7: Facilities with Fewer than 100 Beds

	Reported		Differential	
VARIABLES	ln_Pressure_Ulcers	ln_Falls	ln_Pressure_Ulcers	ln_Falls
ln_rnhrd	-0.0405	0.0286	-0.0552**	0.0327
	(0.0257)	(0.0215)	(0.0249)	(0.0207)
ln_vochrd	0.00663	-0.0169	-0.0115	-0.0136
	(0.0266)	(0.0210)	(0.0260)	(0.0205)
ln_aidhrd	0.00473	-0.0145	0.0205	-0.00169
	(0.0381)	(0.0301)	(0.0381)	(0.0297)
ln_bedcert	-0.0581	-0.0230	-0.0504	-0.0288
	(0.153)	(0.113)	(0.153)	(0.113)
Observations	16,662	22,767	16,650	22,744

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Marginal effects reported. Standard errors clustered at the facility level.

Table 8: Facilities with More than 200 Beds

	Reported		Differential	
VARIABLES	ln_Pressure_Ulcers	ln_Falls	ln_Pressure_Ulcers	ln_Falls
ln_rnhrd	0.00299	0.0545	-0.0206	0.0425
	(0.0410)	(0.0548)	(0.0409)	(0.0515)
ln_vochrd	-0.0257	0.0655	-0.0436	0.0629
	(0.0483)	(0.0671)	(0.0492)	(0.0647)
ln_aidhrd	0.0781	-0.0112	0.124*	0.0305
	(0.0759)	(0.0987)	(0.0745)	(0.0959)
ln_bedcert	0.194	0.626	0.153	0.606
	(0.359)	(0.398)	(0.358)	(0.394)
Observations	4,296	4,204	4,293	4,201

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Marginal effects reported. Standard errors clustered at the facility level.

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