



# Nurse Staffing Levels and Quality of Care in Rural Nursing Homes

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## Key Findings

- Hospital-owned nursing homes in rural areas have higher nursing staffing levels than freestanding nursing homes.
- From 2006 to 2011, most quality of care measures for long-stay residents improved in both rural hospital-based and freestanding nursing homes.
- Higher registered nurse (RN) shares of nurse staffing [the ratio of RN FTEs divided by all RN FTEs and licensed practical nurse (LPN) FTEs] were associated with better quality in both rural hospital-based and freestanding nursing homes.
- On average, a rural facility had to have at least one RN FTE per four total nurse FTEs to significantly improve the composite quality measure for long-stay residents.

## Purpose

The purpose of this study was to examine the relationship between nurse staffing levels and care quality in rural nursing homes, and to assess potential differences between hospital-based and freestanding rural nursing homes.

## Background and Policy Context

The health care reform debate has increased attention on potential ways to identify and reward high performing health care providers. Public reporting of quality measures includes process and outcome measures in a variety of health care settings, including hospitals and nursing homes.<sup>1</sup> Multiple studies have examined the relationship between nurse staffing and quality in nursing home settings, using a variety of staffing and quality measures, with mixed results.<sup>2-4</sup> However, few studies have specifically examined the quality of care in rural nursing homes.<sup>5-7</sup>

Current federal minimum staffing levels for certified nursing homes require one RN for at least eight hours per day, seven days per week, and one licensed nurse (RN or LPN) on duty the rest of the time.<sup>8</sup> State minimum staffing level requirements for nursing facilities vary considerably.<sup>7</sup> Consequently, nurse skill mix and nurse staffing levels per resident may vary significantly across facilities, making it important to consider these variables in examining the relationship between nurse staffing and quality of care in nursing homes.

## Approach

This study used three sources of data. The Certification and Survey Provider Enhanced Reports (CASPER) database for 2006-2011 provided data on staffing and facility characteristics. Quality indicators came from Centers for Medicare and Medicaid (CMS) Nursing Home Compare data for Q1 2006 – Q3 2011, and the Minimum Dataset for 2006-2011 provided the Resource Utilization Group Case Mix index for all residents admitted to a facility. All 5,096 rural nursing homes with data for the 2006-2011 time period were in the study, including 663 hospital-based nursing homes (13%) and 4,594 freestanding nursing homes (87%). All nursing homes located in micropolitan and non-core counties according to the Office of Management and Budget were classified as rural.

The outcome measures used in the study included individual quality

indicators and a composite quality score for long-stay residents (residents whose cumulative days in the facility are greater than 100 days at the end of the reporting period). These measures were selected based on their inclusion in the Nursing Home Compare database throughout the study period and “the extent to which the measure is under the facility’s control, statistical performance, and importance,” as reported by the CMS Five-Star Quality Rating System.<sup>9</sup> The individual quality indicators were the percent of high-risk residents with pressure sores, and the percentages of residents who had a catheter inserted and left in their bladder, who were physically restrained, who had a urinary tract infection, and whose need for help with activities of daily living had increased. The composite quality score was created by calculating the unweighted average of the long-stay measures for nursing homes reporting three or more measures. Nurse staffing measures used included work hours per resident per day for RNs, LPNs, and certified nursing assistants (CNAs), as well as the ratio of RN full-time equivalents (FTEs) divided by all RN FTEs and LPN FTEs.

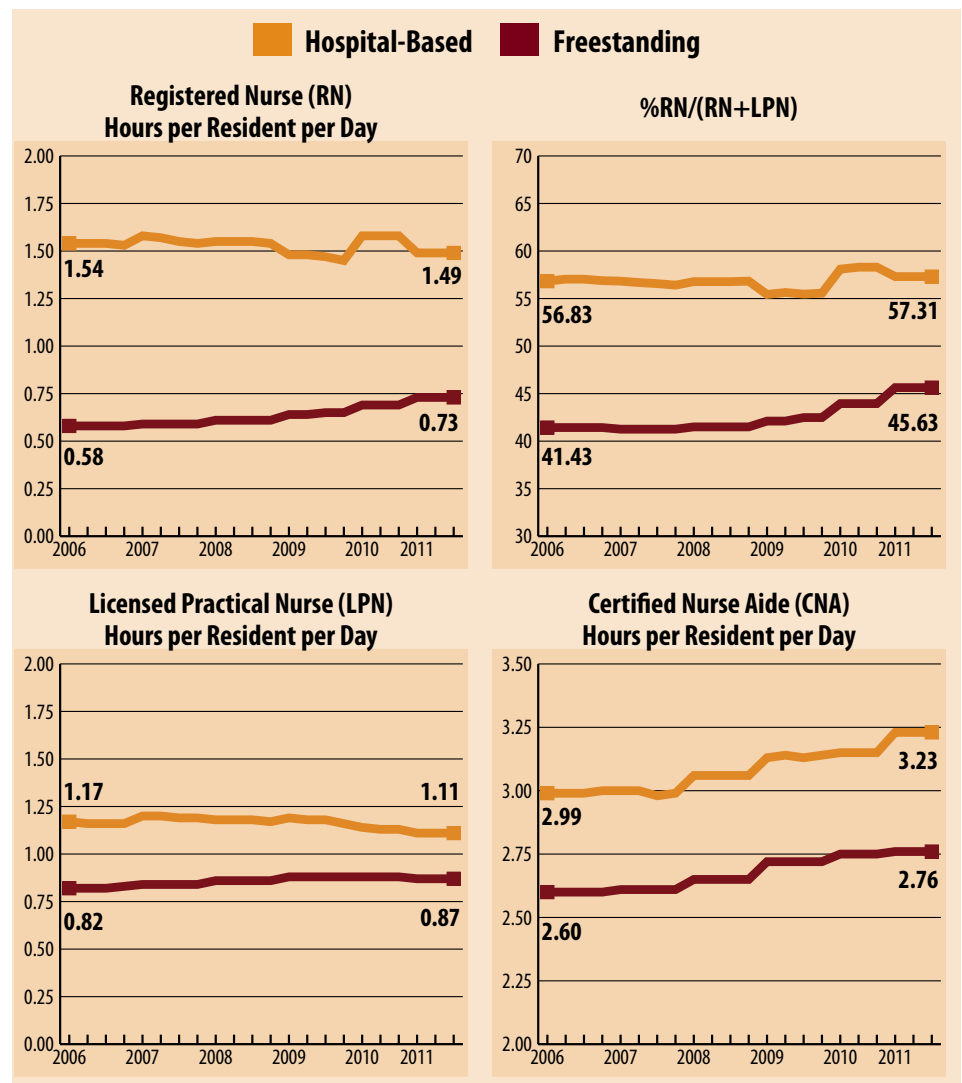
We used multivariate panel data analysis with a generalized estimating equation (GEE) approach clustering in the state-level to examine the relationships between nurse staffing levels and each quality measure for hospital-based and freestanding facilities. The first set of models included all rural nursing homes; the second set of models was stratified into hospital-based and freestanding facilities. The primary

explanatory variables in the models were nurse staffing levels and nursing home structure (hospital-based or freestanding facility). Additional explanatory variables included percent changes in RN FTEs between years, occupancy rates, percent of residents paid for by Medicaid and Medicare, ownership (government, private non-profit, and private for-profit), chain membership, rurality (micropolitan vs. rural noncore), resident case-mix index (CMI) in the given year, interaction between RN staffing levels and CMI, time-fixed effects, and state-fixed effects.

## Results

Figure 1 shows changes in nurse staffing from 2006-2011 in hospital-based nursing homes and freestanding nursing homes. In hospital-based nursing homes, the mean number of RN and LPN hours per resident day decreased, while the mean number of CNA hours increased. In freestanding nursing homes, all three staffing levels increased over this time period. However, hospital-owned nursing homes in rural areas still had higher nursing staffing levels than freestanding nursing homes in 2011.

**Figure 1. Nurse Staffing Levels by Hospital Affiliation Status**



The mean number of RN hours per resident day in hospital-based nursing homes was 1.49, compared to 0.73 in freestanding facilities. On average, LPN hours per resident day were also higher in hospital-based nursing homes (1.11 vs. 0.87), as were CNA hours per resident day (3.23 vs. 2.76).

Table 1 shows the trend of the composite and individual quality indicators from 2006 to 2011. During this period, all quality measures except the activities of daily living (ADL) measure improved in the two types of rural facilities. Pressure sore rates for high-risk long-stay residents decreased from 9.9% to 5.7% in hospital-based facilities and from 11.4% to 6.0% in freestanding facilities. Indwelling catheter or incontinence of bladder also reduced about one-third from 2006 to 2011. Urinary tract infection (UTI) rates decreased similarly from about 9% to 7% in the two settings. Physical restraint rates improved, decreasing

from 3.6% to 1.6% in hospital-based facilities and from 5.8% to 2.1% in freestanding nursing homes.

Table 2 (next page) shows the significant relationships between the individual quality indicators and 1) the number of RN, LPN, and CNA hours per resident day (Model 1) and 2) RN FTEs as a percent of RN and LPN FTEs (Model 2) for all rural nursing homes and for each type of facility.

In Model 1, holding other factors constant at the mean, higher RN staffing per resident day was associated with better scores on the composite, ADL, and pressure sore indicators, but worse scores on the catheter and urinary tract infection indicators. Higher LPN staffing per resident day was independently associated with worse scores on all measures except the physical restraint measure. A one-unit increase in LPN hours per resident day was independently associated with a

0.25% decrease in physical restraints. Higher CNA staffing per resident day was associated with better scores on the composite, ADL and pressure sore measures, but with worse scores on the remaining three measures.

In Model 2, the RN share of nursing FTEs was associated with better scores on all measures. Further analysis showed that facilities with higher RN shares had stronger marginal effects on all measures, but the critical point of RN share varies by measure. For the long-stay composite measure, optimal results were achieved when a facility's RN share of nursing FTEs was at least 25%. For the catheter measure, results were optimal when a facility had a minimum 41% RN share.

The results differed when nursing homes were stratified by hospital-based vs. freestanding status. In hospital-based rural nursing homes, a one unit increase in RN work hours per resident day was associated with a

**Table 1. Rates of Quality Indicators in Rural Hospital-Based and Freestanding Nursing Homes in 2006-11**

	2006		2011		% Change 2006-2011		P-value §
	Hospital owned (N=568)	Freestanding (N=3,937)	Hospital owned (N=454)	Freestanding (N=4,127)	Hospital owned †	Freestanding †	
	Mean (Std)	Mean (Std)	Mean (Std)	Mean (Std)			
Long-stay Composite Measure	8.6 (3.3)	9.2 (3.3)	7.2 (2.8)	7.2 (2.6)	-16%	-22%	<b>P&lt;.001</b>
Increased ADL Need	15.7 (8.5)	16.5 (8.6)	16.7 (8.5)	16.8 (8.8)	6%	2%	0.462
Pressure Ulcers (High Risk)	9.9 (6.3)	11.4 (6.7)	5.7 (4.4)	6 (4.5)	-42%	-47%	<b>0.013</b>
Catheter Inserted and Left in Bladder	6.6 (5.1)	6.2 (4.2)	4.5 (4.6)	4 (3.4)	-32%	-35%	<b>0.019</b>
Urinary Tract Infections	8.8 (5.4)	8.7 (5.4)	7.7 (5.2)	7.4 (5.6)	-13%	-15%	0.451
Physical Restraints	3.6 (5.3)	5.8 (6.7)	1.6 (3.2)	2.1 (3.6)	-56%	-64%	<b>P&lt;.001</b>

Notes: Unit of analysis is nursing home; Std- standard deviation

† Percent changes were calculated among 447 hospital-owned nursing homes and 4,027 freestanding nursing homes that remained open throughout the period 2006-2011.

§ P-value was from generalized linear regressions for the differences in changes of quality measures over time between hospital owned and freestanding nursing homes.

**Table 2. Regression Results of Relationships between Nurse Staffing Levels and Long-Stay Quality Measures**

Higher is worse	All Rural Nursing Homes Coefficient (Standard Error)			
	Model 1: Nurse Staffing Hours Per Resident Per Day			Model 2
	Registered Nurses (RN)§	Licensed Practical Nursing (LPN)	Certified Nurse Aides	% RN/(RN+LPN)
Long-stay Composite Measure	<b>-0.08 (0.02)***</b>	<b>0.06 (0.004)***</b>	<b>-0.03 (0.004)***</b>	<b>-0.81 (0.1)***</b>
Increased ADL Need	<b>-0.23 (3.32)***</b>	<b>0.95 (0.16)***</b>	<b>-0.24 (0.05)***</b>	<b>-1.14 (0.25)***</b>
Pressure Ulcers (High Risk)	<b>-0.27 (2.60)**</b>	<b>0.57 (0.13)***</b>	<b>-0.12 (0.04)**</b>	<b>-0.78 (0.21)***</b>
Catheter Inserted and Left in Bladder	<b>0.69 (1.16)**</b>	<b>1.03 (0.07)***</b>	<b>0.06 (0.02)**</b>	<b>-0.49 (0.11)***</b>
Urinary Tract Infections	<b>0.39 (1.77)***</b>	<b>1.11 (0.10)***</b>	<b>0.17 (0.03)***</b>	<b>-0.58 (0.16)***</b>
Physical Restraints	-0.87 (1.82)	<b>-0.25 (0.08)**</b>	<b>0.19 (0.03)***</b>	<b>-0.48 (0.14)***</b>
<b>Hospital-Based Facilities</b>				
Long-stay Composite Measure	-0.84 (0.82)	<b>0.70 (0.13)***</b>	<b>-0.36 (0.16)*</b>	<b>-0.89 (0.34)**</b>
Increased ADL Need	-0.831 (6.46)	0.48 (0.50)	<b>-0.48 (0.16)**</b>	-1.42 (0.78)
Pressure Ulcers (High Risk)	-0.194 (7.56)	-0.386 (0.47)	<b>-0.36 (0.16)*</b>	-0.14 (0.69)
Catheter Inserted and Left in Bladder	<b>0.803 (2.9)***</b>	<b>1.798 (0.25)***</b>	-0.01 (0.08)	<b>-1.86 (0.39)***</b>
Urinary Tract Infections	<b>-0.368 (3.99)**</b>	<b>1.961 (0.33)***</b>	<b>0.452 (0.10)***</b>	<b>-2.10 (0.49)***</b>
Physical Restraints	-0.695 (4.80)	<b>-0.654 (0.22)**</b>	<b>0.235 (0.1)*</b>	-0.21 (0.41)
<b>Freestanding Facilities</b>				
Long-stay Composite Measure	<b>0.47 (0.23)*</b>	<b>0.56 (0.05)***</b>	<b>-0.30 (0.04)***</b>	<b>-0.78 (0.11)***</b>
Increased ADL Need	<b>0.09 (3.89)***</b>	<b>0.94 (0.17)***</b>	<b>-0.22 (0.05)***</b>	<b>-1.02 (0.27)***</b>
Pressure Ulcers (High Risk)	-0.34 (3.15)	<b>0.53 (0.14)***</b>	<b>-0.09 (0.04)*</b>	<b>-0.77 (0.22)***</b>
Catheter Inserted and Left in Bladder	0.48 (1.49)	<b>0.81 (0.07)***</b>	<b>0.07 (0.02)**</b>	<b>-0.47 (0.11)***</b>
Urinary Tract Infections	<b>0.5 (2.21)**</b>	<b>1.03 (0.11)***</b>	<b>0.15 (0.03)***</b>	<b>-0.42 (0.17)*</b>
Physical Restraints	<b>-0.98 (2.09)**</b>	-0.16 (0.09)	<b>0.16 (0.03)***</b>	<b>-0.59 (0.15)***</b>

Note: \*p<0.05 \*\*p<0.01 \*\*\*p<0.001. Significant results are **bold**.

Covariates include percent changes in number of registered nurse FTEs between years, occupancy rate, percent of residents paid by Medicaid, percent of residents paid by Medicare, ownership, chain membership, rurality (micropolitan vs. rural noncore), average resident case-mix index (CMI) in the given year, and interaction between RN staffing levels and CMI.

§ The marginal effect is calculated by both main effects and interaction effects, holding CMI constant at the mean (1.041).

0.8% increase in rates of catheter use, and a 0.4% decrease in urinary tract infection rates. A 1% increase in RN FTEs as a share of RN and LPN FTEs was associated with a 2.1% decrease in urinary tract infection rates and a 1.9% decrease in catheter rates. There were no significant relationships between RN staffing levels and other

outcome measures. In *freestanding* rural nursing homes, an increase in nurse hours per resident day was associated with poorer quality performance, except on the physical restraint measure. A one-unit increase in RN hours was associated with 1% fewer physical restraints. More CNA hours were associated with better

ADL and pressure sore outcomes. A 1% increase in RN FTEs as a share of RN and LPN FTEs was associated with better quality on all measures.

### Conclusions

The relationships between nurse staffing and quality of care in rural nursing homes were mixed, varying

with the staffing levels and the quality measures. Higher RN shares of nurse staffing were consistently associated with better quality in both rural hospital-based and freestanding nursing homes. However, on average, a rural facility had to have at least one RN FTE per four total nurse FTEs to significantly improve overall care measures for long-stay residents. The higher the RN share was above this critical 25% point, the greater the impact it had on the composite quality measure. However, consistent results were not found when directly

assessing the impact of RN-staffing levels. Future studies are necessary for a better understanding of the impact of different types of nurses' contributions to the quality of long-stay residents' care in rural nursing homes.

While our study results suggest that increasing RN staffing as a proportion of total nurse staffing is a potential means of improving quality, it may be difficult for many rural nursing homes to achieve this. Overall, rural areas in the U.S. have a lower per capita supply of RNs and a higher per capita supply

of LPNs than urban areas. In addition, a higher proportion of the total RN workforce in rural areas already works in nursing facilities (10.6%) compared to urban areas (6.8%).<sup>10</sup> A large proportion of RNs are nearing retirement age, and potential demand for nursing care is increasing as a result of an aging population and increased patient acuity.<sup>10</sup> These factors may make it especially difficult for many rural nursing homes with nursing shortages to increase the supply of RNs. ■

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