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Original Study

Urban-Rural Differences in Skilled Nursing Facility Rehospitalization Rates



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A B S T R A C T

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Objectives: To examine the association of rurality with skilled nursing facility (SNF) all-cause 30-day risk-adjusted rehospitalization rates.

Design: Cross-sectional study combining Center for Medicare and Medicaid Services Nursing Home Compare (CMS-NHC) website for 30-day risk-adjusted rehospitalization rates for 2014–2015 with SNF organizational and community variables.

Participants: 12,261 non-hospital based skilled nursing facilities in the US.

Measurements: We estimated a multiple linear regression model of percentage all-cause unplanned risk-adjusted rehospitalization rate within 30 days after a hospital discharge and admission to the SNF averaged over the third and fourth quarters of 2014 and the first and second quarters of 2015. The model uses robust standard errors.

Results: After controlling for community- and SNF-level resources, the risk-adjusted rehospitalization rates for SNFs are lowest in rural areas and large rural towns followed by SNFs in suburban and then urban areas.

Conclusion: The rural culture that includes a strong sense of connectedness among residents may contribute to lower SNF rehospitalization rates. Our results suggest that rural SNFs may avoid future reimbursement penalties and decreased admissions from patients discharged from hospitals because of their lower rehospitalization rates. However, because this is the first study to address this topic, additional research is needed.

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The rehospitalization rate of post-acute care patients from skilled nursing facilities (SNFs) exceeds the rate from patients discharged from hospitals to other locations.¹ Because readmission is costly, may reflect poor quality of care, and harm patients by increasing the risk of additional morbidity, functional and cognitive decline, and anxiety, reducing hospital readmission rates of Medicare patients is a national priority in the United States.^{2–4}

Two Medicare payment program changes also make reducing SNF rehospitalization rates important for preserving the financial viability of SNFs. The Hospital Readmissions Reduction Program (HRRP)

implemented on October 1, 2012, which assesses penalties on hospitals with high rehospitalization rates of Medicare patients for selected conditions, has led hospitals to partner with SNFs to lower rehospitalization rates.^{5–9} If SNFs with high rehospitalization rates are excluded from such arrangements, they may receive fewer referrals of new post-acute care patients and, therefore, less revenue.⁵ The Skilled Nursing Facility Value-Based Purchasing Program (SNFVBPP), to be implemented on October 1, 2018, will adjust payments based on their rehospitalization rates.⁶ The SNFVBPP is expected to lower payments to 40% of SNFs. There is recent evidence of a small reduction in the average SNF rehospitalization rate, likely in reaction to these Medicare payment program changes.^{7,8}

The volume of post-acute patients and the reimbursement rate are important for a SNF's financial viability. Post-acute care, which is often paid for by Medicare, is reimbursed at a higher rate and is more profitable than other services such as long-term care where the most

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common payer is Medicaid.⁹ Thus, reductions in the volume of Medicare post-acute admissions or the reimbursement rate increase the risk of financial stress and closure for SNFs.

Rural SNFs may be particularly vulnerable to these risks because they have fewer community and organizational resources that are frequently recommended to lower rates of rehospitalization, such as additional access to physicians, advanced practice providers (APPs), and registered nurses (RNs).^{2,10–16} Rural SNFs are also less likely to have the technological ability for sharing information with hospitals and laboratories through interoperable information systems.¹⁷ With the nearly 16 percent decrease in the number of rural SNFs from 2006 to 2014 (5009 to 4201 SNFs), additional financial pressure may contribute to less access to post-acute and long-term care in rural area at a time when the proportion of elderly population is increasing in rural areas.^{18,19}

The purpose of this study was to examine the relation of rurality to all-cause 30-day risk-adjusted rehospitalization rates for US SNFs in 2014–2015. This time period is after the HRRP was implemented and the SNFVBBP was passed but not implemented.

Methods

Data Sources

Data are derived from 4 publicly available sources. First, the Center for Medicare and Medicaid Services Nursing Home Compare (CMS-NHC) website provides data for all-cause risk adjusted SNF rehospitalization rates, quality of care, and staffing information for all Medicare- and Medicaid-participating SNFs in the United States for 2014–2015.²⁰ Second, the US Department of Agriculture Economics Research Service provides data for urban-rural designation.^{21,22} Third,

SNF characteristics come from the Long-Term Care Focus (LTCF) Project at Brown University for 2014.²³ Lastly, data on community characteristics come from the Area Health Resource File (AHRF) database, which provides county-level information on a broad range of health resources and socioeconomic indicators.²⁴

Variables

The variables along with their definitions and sources are presented in Table 1. The outcome variable is the SNF's all-cause unplanned risk-adjusted rehospitalization rate within 30 days after a hospital discharge and admission to the SNF averaged over the third and fourth quarters of 2014 and first and second quarters of 2015. Rehospitalization rates are risk-adjusted for numerous variables including demographic characteristics, functional status, diagnosis, comorbidities, treatments, length of hospital stay, whether the patient was disabled, and the number of prior hospitalizations in the previous 365 days.²⁵ Rahman et al recently concluded that this measure reflects true differences in rehospitalization rates and that the differences are not attributable to case-mix differences.⁵

The key independent variable is the degree of rurality. Although most studies of SNFs classify them as either urban or rural, research shows that a more refined categorization may be important for evaluating quality differences.^{26,27} In the current study, rurality of SNFs is measured using the Rural-Urban Commuting Area Code 3.10 definitions based on the 2010 census and is assigned based on the zip code in which the SNF is located. The Rural-Urban Commuting Area Code codes classify U.S. census tracts using measures of population density, urbanization, and daily commuting.^{21,22,28,29} We measure the spectrum of rurality using a nominal variable with 4 categories

Table 1
Variables and Data Sources

Variables	Definition	Source
Outcome variable		
Rehospitalization rate (%)	Percent all-cause unplanned 30-day risk-adjusted rehospitalization, averaged for third and fourth quarters of 2014 and first and second quarters of 2015	CMS-NHC
Independent variables		
Rurality		
Urban	1, if RUCA = 1, 1.1*	USDAER
Suburban	1, if RUCA = 2, 2.1, 3*	USDAER
Large rural town	1, if RUCA = 4, 4.1, 4.2, 5, 5.1, 5.2, 6, 6.1*	USDAER
Rural (reference)	1, if RUCA = 7, 7.1, 7.2, 7.3, 7.4, 8, 8.1, 8.2, 8.3, 8.4, 9, 9.1, 9.2, 10, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6*	USDAER
Community and health care market characteristics (county)		
Competition (HHI)	Herfindahl Index for SNF competition in the county. Sum of square of market share of each SNF in the market	CMS-NHC
Older population	% of population in the county above 65 years of age	AHRF
Percent poverty	Percentage of population below poverty level	AHRF
Percent Medicare Advantage	Percentage of population enrolled in a Medicare Advantage plan	AHRF
Family practitioners	Total number of nonfederal family and general physician MDs/1000 total population	AHRF
Hospital beds	Hospital beds/1000 total population	AHRF
Organizational characteristics		
Advanced practice provider	1, if nursing home employs a nurse practitioner or physician assistant; 0, otherwise	LTCF
% RN staff	(RN hours/patient day)/(RN + LPN hours/patient day) × 100	CMS-NHC
% Medicare	% facility residents whose primary support is Medicare	LTCF
% Medicaid	% facility residents whose primary support is Medicaid	LTCF
Certified beds	Number of Federally Certified Beds in the nursing home	CMS-NHC
System member	1, if member of nursing home chain; 0, otherwise	LTCF
Ownership		
Government	1, if government owned; 0, otherwise	CMS-NHC
Not-for-profit	1, if not-for-profit owned; 0, otherwise	CMS-NHC
Average Activities of Daily Living (ADL) score	Average ADL score of all residents in the skilled nursing facility	LTCF
Overall quality ranking 4 or 5 (High quality)	1, if NHC ranking is 4 or 5; 0, otherwise	CMS-NHC
Overall quality ranking 1 or 2 (Low quality)	1, if NHC ranking is 1 or 2; 0, otherwise	CMS-NHC
% admissions from hospital	Average of % of admissions to the nursing home that were from a hospital in year 2011 and 2012	LTCF

AHRF, Area Health Resources File; LTCF, Long-term Care Focus; USDAER, US Department of Agriculture and Economics Research.

*RUCA: Rural Urban Commuting Area Codes for zip codes Version 3.10 based on the 2010 census available at <https://ruralhealth.und.edu/ruca>. Subcounty classification of RUCA into 4 rurality categories based on the Washington State Department of Health Guidelines for Using Rural-Urban Classification Systems for Community Health Assessment (2016) available at <http://www.doh.wa.gov/Portals/1/Documents/5500/RUCAGuide.pdf> (page 12).

modeled with three indicator variables: urban, suburban, and large rural town designation of the nursing home zip code based on the consolidation scheme created by the Washington State Department of Health.^{21,22,30} Rural is the reference category.

We control for community characteristics, including health care market, and organizational resources drawing upon previous research.^{31–35} We use the county in which the SNF is located for the community resource and health care market variables. These variables include competition from other nursing homes using the Herfindahl index, percentage population older than 65 years, percentage population below the poverty level, percentage population older than 65 years enrolled in a Medicare Advantage plan, availability of family physicians, and availability of hospital beds. Organizational resource variables are skilled staffing, including use of APPs; percentage RN hours of the total licensed nursing staff hours; payer mix; system membership; number of beds, and the SNF residents' average activities of daily living (ADL) score.^{32,33,36,37} The score is the average of 7 ADL categories (bed mobility, transfer, locomotion, dressing, eating, toilet use, and personal hygiene) ranging from 0 to 28 (complete independence to complete dependence).

Because overall quality of care at a SNF may influence rehospitalization rates, we include the overall quality ranking from the CMS-NHC website with 2 binary indicators, one for a high (4 or 5 stars) and another for a low rating (1 or 2 stars).^{2,32,33,37–39} The 3 star rating is the reference category. To control for the degree of dependence on hospital admissions, we include the SNF's proportion of all admissions from an acute care hospital. To avoid possible endogeneity, we use the average for 2 years: 2011 and 2012. Finally, we include state-level fixed effects to control for differences in health policy climates across the states.

Sample

The merged data set consists of 15,717 SNFs. We excluded 769 hospital-based SNFs because the resources and constraints of

hospital-based SNFs are very different from other SNFs.⁴⁰ Other exclusions were SNFs having no Medicare patients (755), one or more variable values that were obvious outliers (121), missing rehospitalization rates (1079), or missing data on other independent variables (732). Thus, the final analytical sample consists of 12,261 Medicare- and Medicaid- participating non-hospital based SNFs.

Analysis

We compared the means for SNFs in urban, suburban, and larger rural town categories to the means in rural areas after a Bonferroni correction for multiple comparisons. Next, we estimated a multiple linear regression model of all-cause 30-day risk-adjusted rehospitalization rate with robust standard errors using Stata 14. We used Wald tests to test for differences among the coefficients for the binary rurality variables.

Results

Table 2 shows descriptive statistics for the full sample for the variables used in the regression model and for each of the 4 rurality categories, the number of SNFs in each area, and significant differences in variable means between rural and other SNFs. The mean average risk-adjusted rehospitalization rate is lowest in rural areas (19.84%). It is significantly higher for SNFs in all other locations. Rural SNFs face less competition from other SNFs. They have a higher proportion of elderly and poor populations but lower Medicare Advantage enrollment in their community. In addition, the number of hospital beds per 1000 population is significantly lower in rural than in urban areas and large rural towns, although it is higher than in suburban areas. The rural communities also have a significantly higher ratio of family practitioners to population than suburban areas and large rural towns, but not higher than urban areas do.

Table 2
Descriptive Statistics by Rurality of Location

Variables	All	Geographic Location of Skilled Nursing Facility			
		Urban	Suburban	Large Rural Town	Rural
Outcome variable					
Rehospitalization rate (%) [*]	21.15 (5.80)	21.65 [†] (5.38)	21.02 [†] (6.16)	20.35 [†] (5.73)	19.84 (6.97)
Independent variables					
Community and health care market characteristics (county)					
Competition (HHI)	0.19 (0.23)	0.08 [†] (0.10)	0.35 [†] (0.31)	0.31 [†] (0.21)	0.45 (0.28)
Older population	15.25 (3.80)	14.17 [†] (3.55)	15.85 [†] (3.40)	16.55 [†] (3.25)	18.36 (3.31)
Percent poverty	16.08 (5.52)	15.41 [†] (5.06)	15.54 [†] (5.80)	17.93 [†] (5.92)	17.48 (6.17)
Percent Medicare Advantage	28.18 (13.95)	31.72 [†] (13.26)	26.27 [†] (13.33)	21.93 [†] (12.63)	19.93 (12.53)
Family practitioners	0.31 (0.16)	0.32 (0.15)	0.26 [†] (0.16)	0.30 [†] (0.17)	0.31 (0.21)
Hospital beds	3.08 (2.32)	3.35 [†] (1.95)	2.02 [†] (2.12)	3.04 [†] (2.54)	2.54 (3.22)
Organizational characteristics					
Advanced practice provider	0.52	0.59 [†]	0.45 [†]	0.42 [†]	0.34
% RN of licensed staff	47.54 (15.13)	48.34 (15.19)	44.95 [†] (14.79)	45.53 [†] (14.80)	47.35 (15.06)
% Medicare	15.43 (11.72)	16.98 [†] (13.21)	12.06 (7.54)	14.30 [†] (8.76)	11.55 (6.68)
% Medicaid	60.15 (20.80)	58.00 [†] (23.05)	64.66 (16.09)	63.45 (15.29)	63.93 (15.20)
Certified beds	115.22 (57.83)	126.62 [†] (64.09)	95.30 [†] (37.49)	103.20 [†] (39.31)	87.73 (33.42)
System member	0.60	0.59	0.59	0.63	0.59
Government owned	0.05	0.03 [†]	0.05 [†]	0.07	0.09
Not-for-profit owned	0.21	0.21	0.18	0.20	0.21
Average ADL score	16.64 (2.41)	17.06 [†] (2.31)	16.14 [†] (2.51)	16.16 [†] (2.31)	15.60 (2.46)
Overall quality ranking 4 or 5	0.37	0.39	0.36	0.32 [†]	0.37
Overall quality ranking 1 or 2	0.25	0.25	0.24	0.27 [†]	0.22
% Admissions from hospital	84.68 (11.05)	87.15 [†] (10.21)	80.80 [†] (11.13)	82.48 [†] (10.71)	78.13 (11.16)
N	12,261	7798	902	1746	1815

Mean (Standard Deviation) for Continuous Variables or Proportion for Binary Variables.

Multiple comparison adjustment using Bonferroni adjustment. Urban, Suburban and Large rural town categories are compared to Rural category for significance testing. χ^2 tests were used for binary and categorical variables. Paired *t* tests were used for continuous variables.

^{*}Percent all-cause unplanned 30-day risk-adjusted rehospitalization, averaged for third and fourth quarters of 2014 and first and second quarters of 2015.

[†]*P* < .05 comparison with rural SNFs.

Table 3

Results from Multiple Linear Regression Model of Skilled Nursing Facility Percent All-Cause Unplanned 30-Day Risk-Adjusted Rehospitalization, N = 12,261

Variable	Coefficient	Robust Standard Error	P Value
Rurality			
Urban	1.20	0.23	<.001
Suburban	0.57	0.26	.03
Large rural town	0.07	0.31	.76
Rural (reference)			
Community characteristics and health care market (county)			
Competition (HHI)	−0.72	0.35	.04
Older population	−0.04	0.02	.01
Percent poverty	0.01	0.01	.61
Percent Medicare Advantage	0.02	0.01	.003
Family practitioners	−3.12	0.39	<.001
Hospital beds	0.03	0.02	.27
Organizational characteristics			
Advanced practice provider	−0.08	0.10	.42
% RN staff	−0.01	0.004	<.01
% Medicare	0.02	0.01	<.001
% Medicaid	0.004	0.004	.27
Certified beds	−0.002	0.001	.02
System member	−0.25	0.11	.03
Ownership			
Government owned	−0.44	0.30	.14
Not-for-profit owned	−0.16	0.14	.25
For-profit owned (reference)			
Average ADL score	−0.13	0.03	<.001
Overall quality ranking 4 or 5	−0.49	0.12	<.001
Overall quality ranking 1 or 2	0.21	0.13	.11
% admissions from hospital	0.06	0.01	<.001
Intercept	19.46	0.95	<.001

Rural SNFs are smaller and less reliant upon hospitals for admissions and Medicare reimbursement. Their average patient ADL score is lower but they do not differ by ownership, system membership, or overall quality ranking. They use a higher percentage of RN staffing than SNFs in suburban areas and large rural towns but are similar in this regard to urban SNFs.

Results from the linear regression model are presented in Table 3. Rural SNFs have lower rehospitalization rates than urban and suburban SNFs, but do not differ from SNFs in large rural towns. In addition, Wald tests show that urban SNFs have higher rates than suburban SNFs. Thus, SNFs in rural areas and large rural towns have the lowest rehospitalization rates, followed by SNFs in suburban areas and then SNFs in urban areas. After controlling for community and organizational variables, as well as extensive risk adjustment, urban SNFs rehospitalize an additional 1.20 percent of their admissions from hospitals within 30 days compared to rural SNFs.

Table 3 also shows that rehospitalization rates are higher for SNFs in areas with more Medicare Advantage enrollment. Rates are lower in areas where competition is lower (the Herfindahl index is higher), the percentage of elderly population is higher, and there are more family practitioners per capita. Measures of SNF organizational resources are also significantly related to rehospitalization rates. Lower rehospitalization rates are associated with a higher percentage of RN staff, more beds, system membership, a higher average ADL score, and having a 4- or 5-star overall CMS-NHC quality rating. Rehospitalization rates are higher for SNFs with a higher percentage of Medicare patients and those with more admissions from hospitals.

Discussion

This study examines the relationship of rurality to all-cause unplanned 30-day risk-adjusted rehospitalization rate (percentage) for 2014–2015 for non-hospital based SNFs. After controlling for

community and organizational differences, as well as risk adjusting the rate, SNFs in rural and large rural towns had the lowest rehospitalization rates, followed by SNFs in suburban areas. SNFs in urban areas had the highest rates.

The contribution of rurality in lower rehospitalization rates may be related to the often cited unique rural culture, which is not measured in this study.⁴¹ The social network and disadvantages prominent in rural areas, for example, extreme weather conditions, distance, and isolation may contribute to the often strong sense of community connectedness among rural residents.^{42,43} As Phillips et al note, “it may be that nursing home care in isolated areas is nested within a wealth of other social networks in ways not seen, or even possible, in other locales.”²⁶ It is also possible that risk adjustment of the rehospitalization rate is incomplete and that patients admitted to rural SNFs differ from those admitted to urban and suburban SNFs. Because this is the first study to address the relation between rurality and SNF rehospitalization rates, additional research is important to support any conclusions.

Our results suggest that rural SNFs may not be at risk for payment decreases after Medicare incorporates the risk-adjusted rehospitalization rate into its SNF payment formula or for fewer Medicare post-acute admissions. In addition, hospitals who want to control rehospitalization rates should not ignore rural SNFs as they develop formal or informal relationships for post-acute patient care. However, rural SNFs may need to increase awareness among patients as well as hospital personnel about their lower rehospitalization rates. Although many patients are interested in finding an SNF close to home and family, meaning that potential patients who reside in urban or suburban areas will not seek care in rural SNFs, for rural residents, rural SNFs may be able to prevent the phenomenon of bypassing rural health care providers as has been observed with critical access hospitals in rural areas.^{44,45}

If rural SNFs do increase the volume of their post-acute patients, they will likely face additional challenges. Because the most rural SNFs are currently less reliant on hospital discharges for new patients than SNFs in other areas, increases in the volume of patients, especially more complex patients, may strain resources. Hiring and training more skilled staff may be difficult in rural areas. In addition, rural SNFs or their partner hospitals would have to address the lower information technology capability in rural areas to make sure rural SNFs continue to be able to keep rehospitalization rates low.^{2,14} Phillips et al note that rural SNFs did not move into post-acute care aggressively but those in urban areas did, and not always successfully.²⁶ Rural SNFs may not be successful either if they do not have the resources to care for these residents.

This study has several limitations. First, only 1 year of rehospitalization data were available on the CMS-NHC website. Second, we do not have data on steps taken by the SNFs to address rehospitalization rates. Despite these limitations, our study suggests that the advantage of rural SNF low rehospitalization rates may avoid future reimbursement penalties (and potential closings) and attract more post-acute care admissions from hospitals, an important source of revenue. Further, rural SNFs can increase awareness of their low rehospitalization rates among patients, families, and hospital personnel advising patients on availability of post-acute care in SNFs. However, attention to rural SNF resources is essential for these SNFs' ability to handle an increase in complex patients. Finally, more research is needed to understand the role that rural SNFs may play in lowering rehospitalization rates and other quality indicators.

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