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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

*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 rehospitalizaton rates. However, because this is the first study to address this topic, additional research is needed.



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 SNFVBBP 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).