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Fall Rates in Urban and Rural Nursing Units: Does Location Matter?

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Abstract

Patient falls remain a leading adverse event in hospitals. In a study of 65 rural hospitals with 222 nursing units and 560 urban hospitals with 4,274 nursing units, we found that geographic region, unit type, and nurse staffing, education, experience, and outcomes were associated with fall rates. Implications include specific attention to fall prevention in rehabilitation units, creating better work environments that promote nurse retention, and provide RN-BSN educational opportunities.

Keywords

Falls; Geographic Region; National Database Of Nursing Quality Indicators®; Nurse Outcomes; Nurse Staffing; Rural; Urban

Patient falls are considered one of the most expensive adverse events with a fall with injury on average adding more than \$14 000 in cost and 6.3 days to a hospital stay.¹ After decades focusing on efficient and effective implementations to prevent falls, the Agency for Healthcare Research and Quality reported a decline of 2.9% in fall rates (FR) from 2011–2015. However, with 220 000 in-hospital falls in 2015,² there is room for improvement. Understanding that a fall is usually the result of interactions between patient-specific risk factors, nursing care, and the physical environment, numerous studies and reports have examined bundled preventive care approaches that include fall risk assessments and patient specific interventions³ and changes to the physical environment.^{3,4} DiBardino⁵ conducted a systematic review and found that multifaceted fall prevention strategies overall have a significant but small effect on fall rates whereas another review⁶ concluded that successful fall prevention programs should include changes to the physical environment, the care processes, and technology. Another well studied factor impacting fall rates includes the work environment. An integrative review of studies from 1999–2016 concluded that findings regarding the effects of work environment on patient safety outcomes including falls were inconclusive.⁷ Most studies include factors at 3 of the 4 levels recommended by the National Academy of Medicine (NAM): the patient, the microsystem or nursing unit, and the organization.⁸ Less studied factors are community environment including the geographic location of hospitals. In this era of population health, this study adds to the body of

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knowledge about fall rates by focusing on national and regional statistics, versus facility-specific data.

Geographic location includes rural/urban location and geographic region. In the US, 14% of the population lives in rural areas and receive most of their healthcare in the nations approximately 2000 rural hospitals.^{9,10} Comparisons of quality indicators in rural and urban hospitals show mixed results. For example, Bae and Yoder¹¹ found that rural hospitals had higher injurious fall rates than non-rural hospitals, but had lower rates on other hospital acquired conditions. Numerous studies have documented regional variation in utilization and cost¹² while studies on regional differences in quality and safety measures are fewer and with no consistent trend.^{13,14} For example, patient satisfaction was lowest in the South in 1 study¹⁵ while another study found readmission rates in the mid-Atlantic regions were the highest and lowest in the Mountain and Pacific regions.¹⁶ Using NAM's recommendation to examine quality across the environment, organization, microsystem, and patient,⁸ this study examined associations between fall rates and the environment (geographic location), organization (hospital characteristics), and microsystem (nursing unit characteristics).

METHODS

Design

This cross-sectional study used data from the National Database of Nursing Quality Indicators® (NDNQI®), which is a database that provide participating hospitals quarterly quality benchmark data at the nursing unit level.¹⁷ Hospitals submit data on organizational characteristics, quality indicators, and staffing every quarter and can elect to conduct a registered nurse (RN) survey once annually, in quarters 2, 3, or 4. We created a database with variables of interest from data for more than 1700 hospitals with over 30 000 nursing units aggregated to the nursing unit level.¹⁷ A total of 4,496 units in 625 hospitals had at least 5 RN surveys/unit and an RN work environment survey in a quarter after or at the same time as reported fall rates. For the nurse work environment hospitals had 3 survey options. The study used the Practice Environment Scale of the Nursing Work Index (PES-NWI) option which had the largest number of participating units in 2009. The study was granted exemption by 2 Institutional Review Boards.

Measures

Geographic location—Geographic location had 2 variables: rural/urban and region. Rural/urban was dichotomized so urban was metropolitan (an area of 50,000 or more population) and micropolitan (an area of at least 10,000 (but less than 50,000) population) statistical areas whereas rural were all other areas.¹⁸ Region was the 4 census regions: Northeast, Midwest, South, and West.

Hospital and nursing unit characteristics—Hospital characteristics had 1 variable: number of beds which was divided into 3 categories from less than 100 beds, 100–199 beds, and 200 or more beds. Nursing unit characteristics had 7 variables: unit type, staffing (all nursing staff and RNs), education, experience, the practice environment (5 subscales and a composite score), and 2 nursing outcomes (job satisfaction and intent-to-stay). Unit type was

critical care, medical/surgical, or rehabilitation units. Staffing was measured in 2 ways: All nursing staff hours per patient day, which is total number of hours worked by RNs, Licensed Practical Nurses and Licensed Vocational Nurses, and unlicensed assistive personnel per patient day, and RN staff, which is nursing hours provided by RNs per patient day. Education was measured as percent of RNs who held a Bachelor of Science in Nursing (BSN) or above. Experience was measured as percentage of RNs with less than 2 years in practice and with more than 10 years in practice. Other experience options were not included as they were not significant in preliminary analyses.

The practice environment was measured using the 31 item PES-NWI consisting of 5 subscales and a composite score: (1) Nurse Participation in Hospital Affairs (9 items), which refers to the opportunities for staff nurses to participate in hospital and nursing committees and hospital policy decisions; (2) Nursing Foundation for Quality of Care (9 items), which refers to the hospital's quality system and nurses continuing education programs for development; (3) Nurse Manager Ability, Leadership, and Support (5 items), which refer to nurse manager's support of nurses in practice; (4) Staffing and Resource Adequacy (4 items), which refers to whether units have enough nursing staff to provide quality patient care; and (5) Collegial Nurse-Physician Relations (3 items), which refers to the working relationships between physicians and nurses. Subscales 1–2 reflect the unit-perceived hospital environment, whereas subscales 3–5 reflect the environment at the nursing unit level.¹⁹ All 31 items were rated from strongly disagree (1) to strongly agree (4).

Nurse outcomes had 2 variables. Job satisfaction was measured as the degree to which people like their work. This 7-item Likert scale was scored from strongly disagree (1) to strongly agree (6) where higher scores represent higher satisfaction. Intent-to-stay was measured as percentage of RNs who did not plan to leave their current position within the next year. This includes leaving their current unit for another unit within the hospital.

Nursing-unit fall rates—Nursing-unit fall rate was the outcome of interest, defined as all patients in a unit who fell in a quarter and calculated as number of falls per 1000 patient days. A fall is an unplanned descent to the floor with or without injury to the patient.

Data analyses

Multilevel negative binomial regression was used to examine the association of nursing-unit fall rate with explanatory factors at nursing-unit and hospital levels. Specifically, a 2-stage random-intercepts models was used. This method provides a means to examine the explanatory variables simultaneously at the nursing-unit and hospital levels while accounting for the hierarchical structure of nursing units nested within hospitals as well as the variation among hospitals.²⁰ Negative binomial regression with log link function was used because it is more appropriate for highly skewed data such as the nursing-unit fall rates.²¹ First, the model that included 1 factor alone to examine the univariate association was used. Subsequently, the multivariable model that included all factors of interest to examine the joint association was used. Because the 2 nurse staffing variables (all nursing staff and RN staff) were highly correlated, they were individually included in the multivariable models to avoid collinearity. Similarly, the practice environment variables and the 2 nurse outcomes

variables (job satisfaction and intent-to-stay) were highly correlated and were therefore individually included in the multivariable models. Analyses were performed for the entire sample and then separately for urban and rural units. Results are presented as rate ratios in comparison to the reference group.

RESULTS

The sample had 65 rural hospitals with 222 nursing units and 560 urban hospitals with 4,274 nursing units (Supplemental Digital Content, Table 1). Most of the rural hospitals (43.1%) were in the Midwest while most of the urban hospitals (33.8%) were in the South. More than half of the rural hospitals had less than 100 beds whereas 58% of the urban hospitals had more than 200 beds. Type of nursing unit was distributed similarly across urban and rural hospitals. Rural nursing units had slightly higher hours per patient day for all nursing staff and RNs compared to urban units (mean: 11.54 vs 10.91 and 8.32 vs 8.26, respectively). Rural nursing units had lower percentage of RNs with at least a BSN than urban units (32.4% and 50.2%, respectively). RNs' level of experience was similar in rural and urban nursing units (percentage of RNs having less than 2 years of experience: 20.5% rural and 22.0% urban, and percentage of RNs having more than 10 years of experience: 41.0% rural and 40.5% urban). Across all 5 subscales, the practice environment was rated higher by the rural RNs compared to their urban colleagues' ratings. In contrast, compared to urban RNs, rural RNs were less satisfied with their job but also more likely to stay (3.64 vs 3.72 and 78.5% vs 76%, respectively). Unit-level fall rates were 3.30 falls per 1000 patient-days in rural nursing units and 3.24 in urban units. Fall rates were highly skewed with the majority of units having 1–5 falls per 1000 patient days.

Multilevel models that included all variables simultaneously (Supplemental Digital Content, Table 2) revealed that compared to the Northeast region, the Midwest, South, and West regions had 13%, 16%, and 14% higher fall rates. Compared to rehabilitation units, critical care and medical/surgical units had 55% and 50% lower fall rates. For staffing, an hour increase in care by all staff or RNs was associated with 8% and 10% decrease in fall rates respectively. Further for every 10 % increase in RNs with BSNs there is a 1% decrease in fall rates ($p=.072$). A 10% increase in unit-level percentage of RNs with practice <2 years was associated with 4% increase in fall rates, while a 10% increase in practice >10 years was associated with 2% decrease in fall rates. Every 1-point score increase in job satisfaction was associated with 6% decrease in fall rates, and every 10% increase in percentage of RNs who intent-to-stay was associated with 2% decrease in fall rates. Rural location, number of hospital beds, and the practice environment were not significantly associated with fall rates. Multilevel models stratified by rural or urban location found similar results for each sample.

DISCUSSION

Falls are the most common adverse event reported in hospitals. Reviews of observational studies in acute care hospitals show that fall rates range from 1.3 to 8.9 falls/1,000 patient days²² so this study's fall rates are comparable to other estimates. Geographic region and several nursing unit characteristics were associated with fall rates. The nursing unit

characteristics: unit type, staffing, education, and experience were all associated with fall rates.

In this study nursing units in the Northeast region had the lowest fall rates and the South regions the highest. The lowest performance in the South is similar to Girotra and colleagues¹⁶ reporting of lowest patient satisfaction in the South across the 4 regions, but different than Wang and colleagues²³ who found that more hospitals in the South received the highest patient experience star ratings (53.6% of patients gave 5 stars) and had lower readmission rates, and the Northeast region had the lowest ratings (6.3% of patients gave 5 stars). Regional differences have been reported for decades and are often explained by differences in the environment, hospital characteristics, and local practices.¹⁵ In contrast to other studies of regional differences, the current study did include some local practice at the nursing unit level (staffing, education, and experience) but regional variation remained. Clearly regional differences is still an area that needs more exploration.

The current study found no association with rural/urban location and fall rates as is also reported in other studies that included fall rates.¹¹ In contrast, for other quality indicators differences have been found. For example, when studying readmissions rates across 5 classifications for metropolitan statistical areas, Horwitz and colleagues¹⁶ found that the most urban and most rural areas had higher readmissions rates. As is often the case with studies of rural-urban differences perhaps the current study's results would be different with a more detailed classification of rural-urban that better capture the heterogeneity of rural areas.²⁴

The study's result that rehabilitation units had the highest fall rates is different from previous studies that found medical/surgical units had the highest fall rates.²⁵⁻²⁷ However, reviews of studies in acute care hospitals show that higher fall rates occur in units that focus on eldercare, neurology, and rehabilitation.²² Further, Ruroede and colleagues²⁸ argue that patients on inpatient rehabilitation units are different from other patients since all rehabilitation patients have mobility issues and many also balance issues. The current study's categorization of units where rehabilitation is a separate category supports that fall prevention strategies are especially important in this type of unit.

The nursing unit characteristics that influence fall rates were staffing, education, and experience. An hour increase in care by all staff decreased fall rates by 8%, and an hour increase in RNs decreased fall rates by 10%, which is validated in findings from previous studies and disputed in others. He et al²⁹ also found both staffing variables associated with lower fall rates while others found that only higher RN staffing was associated with lower fall rates.^{30,31} Studies of non-RN staff also show mixed results.^{31,32} Further, other studies found a non-linear relationship where higher fall rates had a positive relationship with RN staffing levels.^{25,27} Other unit characteristics significantly associated with fall rates were education and experience. More education (BSN and above) and more experience (more than 10 years) were associated with lower fall rates while more nurses with less than 2 years' experience was associated with higher fall rates.

The association of higher educational levels and lower fall rates in this study is supported by the Future of Nursing Report,³³ which concluded that higher education of nurses is associated with better patient outcomes. The national focus on increasing the number of nurses with at least a BSN has resulted in an increase in both the number of RN-BSN programs and enrollment in them. However, the increase in BSN prepared nurses only rose by 2% from 2010–2014 (from 49% -51%),³⁴ suggesting a need to continue to support that more nurses receive their BSN degree. This is especially relevant in the rural hospitals where in our study only 32% of nurses had a BSN or above compared to 51% in urban areas.

The current study's findings that better staffing, higher education, and more experience were associated with lower fall rates are mirrored in Manojlovich et al's³⁵ study that found fall rates were more influenced by a combination of education, experience, and skill mix than staffing intensity (ie, actual number of staff). When staffing on a nursing unit is determined all 3 variables, this is the best combination to prevent adverse events such as falls.

In contrast to previous findings, the current study did not find that the practice environment was associated with fall rates.³⁶ However, both rural and urban nurses rated their practice environment favorable (above 2.5). High ratings of the practice environment are linked to higher job satisfaction,³⁷ which was associated with lower fall rates in the current study and also in previous studies,³⁸ suggesting that creating better work environments will improve both patient and nurse outcomes. The current study did find an association between lower fall rates and higher rates of intent-to-stay, in contrast to previous work.³²

An astounding almost 24% of nurses in the current study reported they intend to leave their job within the next year. This is not only detrimental for patients who may experience an increase in adverse events but also rather costly for the institutions. The average turnover cost per nurse ranges from \$20,561 to \$48,790 across countries⁴⁰ with an estimated turnover cost of more than \$2 billion/year for the US alone.⁴⁰ Hence, decreasing turnover rates can produce significant savings. Given almost 22% of nurses in the current study had less than 2 years of experience, and 17.5% of new nurses resign within their first year,⁴⁰ it is prudent to suggest strategies targeting new graduate nurses. One strategy is nurse residency programs, which decrease turnover rates among new graduates⁴¹ and produce significant net savings.⁴² However, it is important to note that both nurse residency programs and RN-BSN programs in rural areas face logistical challenges for participants because of fewer resources and greater distances to educational programs.⁴³ The study's results imply that staffing models that include more than only number of staff, such as opportunities for more education, work environment, a specific focus on the vulnerable new graduate nurse group, and consideration of local resources, are warranted in order to improve fall rates.

Limitations

This study had several limitations. First, patient data were not included. For falls a patient's mental status and age are especially important.⁴⁴ However, Lake and colleagues³¹ found that hospital case mix index and nursing unit average of patient demographics (age and gender) contributed minimally to explain variance in fall rates. Second, the study used a convenience sample of NDNQI hospitals. These hospitals are different than other hospitals. For example, in 2004 NDNQI hospitals reported almost 2 RN hours per patient-day higher than US

general hospitals,³¹ and the study had fewer rural hospitals than a national representative sample would have. Still, the study found that higher RN staffing was associated with lower fall rates. Third, our study did not specify falls according to injury or non-injury. Though Staggs and colleagues⁴⁵ argue that whether a fall results in injury is often due to patient's characteristics, the all fall rate needs to be included in any fall-related quality measure. Finally, the results reflect the definition of rural/urban that was available in the dataset, which was at the county level. Although this is a commonly utilized federal definition in research comparing rural and urban areas, it is not as granular as other studies. which therefore may produce different results.²⁴

CONCLUSION

Along with more research into geographic differences, the current study has several organizational and policy implications that relate to fall rates. Administrators, health care quality professionals, and frontline nurses may use these results to inform staffing decisions, especially for patients in rehabilitation units, which are at higher risk for falls. These units should also focus on more interventions to prevent falls. Further, given that higher staffing (both total number and skill mix), number of nurses with a BSN degree, and more experienced nurses may decrease fall rates, staffing models should include more than only number of staff. Finally, hospitals that pay attention to work environments so nurse job satisfaction is higher and rates of intent-to-leave are lower may decrease their fall rates.

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