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# Isolated, Small, and Large Hospitals have Fewer Nursing Resources than Urban Hospitals: Implications for Rural Health Policy

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## Abstract

**Objective:** The purpose was to compare nurse education, patient-to-nurse staffing, nursing skill mix, and nurse work environments across hospitals depending on extent of rurality.

**Design:** Cross sectional, comparative, and descriptive.

**Sample:** The final sample included 566 urban, 49 large, 18 small, and nine isolated hospitals from California, Florida, and Pennsylvania.

**Measurement:** Data collected from large random samples from the 2005–2008 Multi-State Nursing Care and Patient Safety Study funded by the National Institute of Nursing Research and National Institutes of Health were linked to 2005–2006 American Hospital Association data. Rural-Urban Commuting Area codes developed by the University of Washington and the United

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States Department of Agriculture Economic Research Service were used to determine the extent of hospital rurality across the sample.

**Results:** Hospital percentages of baccalaureate prepared nurses differed significantly among urban (38%), large (28%), small (31%) and isolated rural hospitals (21%). Patient-to-registered nurse ratios in urban (4.8), large (5.6), small (5.6), and isolated rural hospitals (7.3) differed. Rural hospital nursing skill mix differed, and was lowest in isolated rural hospitals (65%). Nursing foundations for quality care were poorer in large, small and isolated rural hospitals.

**Conclusion:** Results support bolstering rural nursing resources in more remote locations, potentially through rural health policies.

## Keywords

Nursing workforce; work environment; surveys; rural health; quantitative research

One in five United States (U.S.) residents lives in a rural area (The National Academies of Sciences Engineering Medicine [NASEM], 2018). Compared to urban residents, rural residents are older, face more economic hardship, and have a higher prevalence of chronic conditions (Agency for Healthcare Research and Quality [AHRQ], 2014), which represent worrisome social determinants of health for rural residents (Hege et al., 2018; Meit et al., 2014). Social determinants of health are “conditions […] in which people are born, live, work, play, worship, and age that affect […] health, functioning, and quality of life outcomes and risks” (Office of Disease Prevention and Health Promotion, 2014). Limited healthcare access is a social determinant of health for rural populations that threatens health outcomes (Anderson, Saman, Lipsky, & Lutfiyya, 2015; Hege et al., 2018; Meit et al., 2014). However, it is not known how nursing resources, a nuanced micro-structural social determinant of health within healthcare access, vary across hospitals based on extent of rurality.

The purpose of this study was to describe and compare the extent to which nursing resources in urban, large, small and isolated hospitals differ in California, Florida, and Pennsylvania. Nursing resources studied were the nurse work environment, nurse education, nursing skill mix, and patient-to-registered nurse (RN) ratios. The nurse work environment, defined as “the organizational characteristics of a work setting that facilitate or constrain professional nursing practice” (Lake, 2002, p. 178), is globally regarded as a modifiable resource with potential to improve patient care outcomes (Warshawsky & Havens, 2011). Nurse education refers to a Bachelor of Science in Nursing (BSN), which American Association of Colleges of Nursing (AACN) supports as the requisite nursing degree needed to begin professional nursing practice given complexities of 21$^{st}$ century healthcare (American Association of Colleges of Nursing [AACN], 2008). Nursing skill mix is the proportion of RNs to all nursing staff in a care setting (Duffield et al., 2011). Patient-to-RN ratios refer to the number of patients assigned to RNs (Aiken et al., 2011). Understanding the extent to which rural and urban hospitals’ resources differ might inform healthcare policies for equitable nursing resource allocation across geographical areas.

This study is framed using the Commission on Social Determinants of Health (CSDH) Model from the World Health Organization (WHO) (2010), which proposes the health

system as a social determinant of health (World Health Organization [WHO], 2010). The CSDH model proposes theoretical dynamic relationships among socio- and political economic forces, material circumstances, and health systems, which affect population health outcomes. Our study extends the CSDH model by proposing that rural hospital nursing resources is a micro-structural social determinant of health within the larger problem of limited rural healthcare access (WHO, 2010). Comprehensive identification of the most under-resourced U.S. rural areas for acute care is important for informing rural-relevant health policies (Hart, Larson, & Lishner, 2005).

## Background

Rural hospitals face numerous challenges in providing adequate nursing resources (Newhouse, Morlock, Pronovost, & Sproat, 2011). Evidence suggests that rural nurses across healthcare settings in the U.S. are less educated (Baernholdt, 2018; Baernholdt & Mark, 2009; Newhouse et al., 2011; Skillman, Palazzo, Keepnews, & Hart, 2006), less skilled (Baernholdt & Mark, 2009), and have a greater number of patients to care for per nurse (Baernholdt, 2018). Evidence suggests that rural nurses prefer in-person experiential simulation learning to improve their skill level, but face difficulties in driving long distances to attend educational programs (McCafferty, Ball, & Cuddigan, 2017). Fewer nursing resources in rural healthcare settings is worrisome given global evidence documenting how a well-prepared, well-supported nursing workforce is essential to provide safe, high quality, continuous acute care for hospital patients (Aiken et al., 2017; Aiken et al., 2014).

Compared to global evidence (Aiken et al., 2017; Aiken et al., 2014), we identified few published studies to describe rural hospital nursing resources (Baernholdt, 2018; Baernholdt & Mark, 2009; Skillman et al., 2006). One study reported differences among BSN educated nurse distributions across urban (46.6%), large (35.3%), small (30.7%), and isolated (30.6%) locations (Skillman et al., 2006). Current research supports differences in rural compared to urban nursing characteristics, such as nurse staffing, education and experience, are associated with higher fall rates in rural hospitals (Baernholdt, 2018).

Limitations of rural-urban comparative nursing research might be lessened if there were more recent evidence to measure nursing resources variations across a multi-hospital sample with the hospital as the unit of analyses (Baernholdt, 2018). Hospital-level comparisons would be useful to administrators whose hospitals are funded through federal and state programs that reflect hospital-level operations. However, existing literature describes rural hospital nursing education, patient-to-nurse ratios, work environments, and skill mix at the individual (Baernholdt, 2018; Baernholdt & Mark, 2009; Bratt, Baernholdt, & Pruszynski, 2014) and unit-level (Baernholdt & Mark, 2009). One rural sub-sample included 22 U.S. hospitals with data collected in 2003 and 2004 (Baernholdt & Mark, 2009) that described nurse education and work environments at the unit-level.

More granular data about rural-urban resources might help inform health policies and interventions for rural hospitals (Hart et al., 2005). Rural classification is often dichotomous (Baernholdt, 2018; Bratt et al., 2014). Research suggests the need to use a non-dichotomous taxonomy to differentiate nursing factors and patient outcomes in remote locations

(Skillman et al., 2006). Rural areas should be classified using several metrics such as population density, census tract data, and commuting patterns to address acute care access challenges for underserved rural populations and to allocate limited healthcare dollars judiciously.

Rural areas within the U.S. are defined through geographic characteristics, settlement patterns, work commuting patterns, and economic factors (Hart et al., 2005). Multiple taxonomies exist to define rurality, including the Office of Management and Budget's (OMB) Core Based Statistical Areas (CBSA) (United States Census Bureau, 2017); Economic Research Service (ERS) Urban Influence Codes; and Rural-Urban Commuting Area (RUCA) codes (Hart et al., 2005). Rural-Urban Commuting Area codes are sensitive to demographic change and allow for several levels of generalization (Hart et al., 2005).

This study contributes to literature by providing a description of how nursing resources differ at the hospital-level using the RUCA coding scheme to measure variations by extent of rurality. This paper augments comparative rural-urban nursing resources evidence derived from data generated in the 1990s and early 2000s (Baernholdt & Mark, 2009).

## Research Question

The question was, "How do nursing resources differ according to the extent of the hospital's rurality as compared to urban location in the U.S.?" The four hospital nursing resources studied were: nurse education, patient-to-RN ratios, nursing skill mix, and nurse work environments.

## Method

### Design and Sample

The design was cross sectional, descriptive, and comparative. Multiple secondary sources were linked to determine differences between nursing resources across categories of rural hospitals and urban hospitals. The sample included nurses who worked in non-federal acute care hospitals in three U.S. States: California, Florida, and Pennsylvania. Hospitals were included if there were at least five nurse respondents to promote stability of aggregate measurements for the psychometric scale used to measure the nurse work environment. Institutional Review Board approval was obtained from the University of Pennsylvania for this study (#819470).

### Data Collection Methods and Sources

Secondary nurse survey data about nurse demographic characteristics, nurse education, nursing skill mix, patient-to-RN ratios, and work environments were obtained through the Multi-State Nursing Care and Patient Safety Study, which took place from 2005–2008 as funded by the National Institute of Nursing Research and National Institutes of Health (Aiken et al., 2011). Anonymous surveys were mailed to the homes of random samples of licensed nurses from state licensure lists (Aiken et al., 2011). Response rate was 39% (Aiken et al., 2011). No evidence was found to suggest response bias after analysis of a non-respondent follow-up survey. Consent to participate was implied through return of

completed nurse surveys. Although data are between 10–13 years old, these data are unique in providing valid hospital-level measures of nursing organizational characteristics recognized internationally. Such data are not otherwise available. Nurse survey data, based on random samples of licensed nurses in these four large states, offer answers to multiple research questions.

Nurse survey data were linked to American Hospital Association (AHA) Annual Hospital Survey data from 2005–2006 to describe hospital characteristics. Zip-code based Rural-Urban Commuting Area (RUCA) codes developed in 2004 by the University of Washington Rural Health Research Center and the ERS (Hart et al., 2005) were matched to the hospital sample to describe the extent of rurality. Health Resources and Services Administration (HRSA) data about the location of Health Care Provider Shortage (HCPS) areas were assessed for the rural hospital sample for sample description. The nurse sample was limited to nurses working in non-federal acute care hospitals.

## Measures

**Hospital sample selection.—**The minimum of five nurse respondents achieved satisfactory intraclass correlation coefficients (ICC [1, *k*]) reflecting stability of aggregate psychometric measures (i.e. nurse work environment) at the institution-level. The ICC (1, *k*) of .83 for urban and .69 for rural were considered acceptable because each exceeded .60, the conventional minimum criterion (Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005).

**Hospital classification.—**Hospitals were classified as urban if labeled “metropolitan” in AHA hospital data. For hospitals designated “rural” or “micropolitan” in AHA data, the hospital zip code was matched to RUCA codes. Rural-Urban Commuting Area classification uses the following categories: urban, large, small, and isolated (Rural Health Research Center, n.d.).

**Nurse education.—**Nurse education was measured as a hospital-level percentage of nurses with at least a baccalaureate degree. This information was obtained from a multiple-choice question asking a nurse’s highest level of education: hospital diploma, associate’s degree, baccalaureate degree, master’s degree, Doctor of Nursing Practice, Doctor of Philosophy in Nursing or other doctorate. For measurement, we created two categories: having at least a BSN or not having a BSN. Dichotomizing nurse education provides a single hospital-level nurse education percentage for communicating findings to policymakers, as BSN attainment is meaningful to policy recommendations (AACN, 2018; McHugh & Lake, 2010).

**Nursing skill mix.—**Nursing skill mix was measured as the hospital-level percentage of nursing personnel who were RNs among a work group of RNs, licensed practical nurses or licensed vocational nurses (LPNs or LVNs), and unlicensed assistive personnel (UAP). Information about nursing skill mix was obtained with a fill-in-the blank question, where nurses were asked to provide the number of RNs, LPNs or LVNs, or UAPs for the last shift worked.

**Patient-to-RN ratios.—**Patient-to-RN ratios were measured at the hospital-level as the average number of patients assigned to RNs. This was calculated as the mean of the number of patients-per-unit from the last shift divided by the number of RNs on the unit.

**Nurse work environment.—**The nurse work environment was measured with the National Quality Forum endorsed Practice Environment Scale of the Nurse Work Index (PES-NWI) (Lake, 2002). Subscales of the PES-NWI include nurse participation in hospital affairs, nursing foundations for quality care, nurse manager ability, leadership, and support of nurses, staffing and resource adequacy, and collegial nurse-physician relations (Lake, 2002). Nurse respondents answered items on a 4-point Likert-type scale ranging from "strongly disagree" (1) to "strongly agree" (4) (Lake, 2002). Mean PES-NWI scores were calculated for each nurse respondent and nurse respondent means were aggregated to the hospital-level. For interpretation, a mean of 2.5 is considered the neutral midpoint for the work environment score as neither favorable nor unfavorable (Lake, 2002).

**Demographic data.—**Data about hospital characteristics (teaching status, technology level, state, average beds, and average patients per unit) and nurse characteristics (age, sex, job status, and years of experience) were used to describe the sample.

## Analytic Strategy

Data for nursing resource variables were aggregated at the hospital-level for comparison. One-way ANOVA tests were used for analysis of major variables (Terrell, 2012). For ANOVA, normality of variables and non-parametric test alternatives were evaluated. The Shapiro-Wilk statistic was used to test for normality of the four key variables within each rurality and urban sub-sample (Shapiro & Wilk, 1965). Hospital and nurse characteristics were compared substantively in terms of relative differences with statistical significance indicated in parentheses from analyses using chi square or one-way ANOVA depending on variable level as either continuous or categorical (Terrell, 2012). Scheffe's test was used post-hoc after ANOVA to identify locations exhibiting significant differences (Kim, 2015). Stata v.15.1 was used.

Data were assessed for missing values before generating main variables (Enders, 2010). There were less than 0.5% missing data for nurse education and below 2% for the nurse work environment. For PES-NWI items, missing responses were replaced with row means when scores were aggregated to the hospital-level. Missing data for patients-per-unit at the hospital-level varied among urban (18%), large (14%), small (11%), and isolated (13%) hospitals. To ensure missing data for patients-per-unit did not drive results, we conducted sensitivity analyses to compare main results with all hospitals versus a sub-sample without hospitals with more than 25% missing data for patients-per-unit. There were no differences among major comparative results for the sub-sample tested and our final sample, which justified keeping all hospitals in our final sample.

Shapiro-Wilk statistic $W$ was adequate for all variables in all sub-samples, ranging from .88 to .99, except for the isolated sub-sample. However, the Shapiro-Wilk statistic for BSN nurses in isolated hospitals ($W$=.60) was non-normal. The non-parametric Kruskal-Wallis test was used as a sensitivity analysis. Results did not differ in terms of significance between

the non-parametric and parametric methods, confirming that the slight deviation in normality within the isolated sub-sample was not driving main results and that use of a parametric method (ANOVA) was acceptable.

## Results

In the final analytic sample, there were 566 urban, 49 rural, 18 rural, and nine isolated hospitals (Table 1). Rural hospitals were in California ($n$=23), Florida ($n$=11), and Pennsylvania ($n$=42) (Table 2). Urban hospitals were in California ($n$=275), Florida ($n$=165), and Pennsylvania ($n$=126). As expected, sample-sizes varied greatly among the rurality categories (large: 49; small: 18; isolated: nine). There was a relative difference among hospitals by rurality or urban location across states ($p$<.01) (Table 1). Between 44–57% of hospitals across all rural categories were located in Pennsylvania, whereas almost half (49%) of all urban hospitals were in California.

### Hospital Characteristics

Relative differences were between bed size categories of less than 100, 101–250, and over 250 beds within rural and urban hospitals ($p$<.01). Sixty-seven percent of isolated hospitals and one-hundred percent of small hospitals had fewer than 100 beds. Most urban and large hospitals were midsize (bed range 100–250) (46% and 55%, respectively). Hospital ownership type (non-federal, not-for-profit, and for-profit) varied substantively by location ($p$<.05) (Table 1). Isolated hospitals were most likely to be government-owned (33%) compared to urban (11%), large (4%), and small (11%) hospitals (Table 1), which were substantive variations. Over half of urban hospitals were teaching hospitals (53%), representing a substantive difference from rural hospitals, which ranged from 18% (large) to 0% (isolated) as having teaching status. There were fewer teaching hospitals as a location became more rural. On average, there were fewer patients-per-unit in isolated hospitals (15 patients-per-unit). Urban hospitals had more patients-per-unit (19 patients-per-unit) compared to rural hospitals ($p$<.01) (Table 1), representing a relative difference from rural hospitals whose patients-per-unit ranged from 12–16. Distribution of hospitals by RUCA classification differed substantively ($p$=.14) (Table 2). Although the p-value was .14, there was a largely disproportionate percentage of hospitals classified as large relative to small and isolated in Florida. For all rural hospitals, 33 of 76 (43%) were within HRSA designated HCPS areas for primary care, a substantive proportion of rural hospitals in areas without adequate primary care.

### Nurse Characteristics

The majority (64–69%) of nurses worked full-time across urban and all rural categories. Job status, however, varied significantly across urban and all rural hospitals. The two most remote rural categories had a disproportionate percentage of per-diem status nurses (15% and 17%) compared to less than 10% in urban and large rural. The average age of nurses in isolated hospitals was higher (mean = 49.4) compared to urban hospitals (mean = 44.5); a five-year difference ($p$ < 0.01) was observed (Table 3). Years of experience did not differ substantively across locations ($p$<.05) (Table 3), as all categories had an average nurse experience exceeding 15 years (Table 4). Distribution by sex across hospital location did not

differ substantively ($p$=.08) (Table 3), as all location categories featured over 90% female nurses.

### Nursing Resource Allocation

**Nurse education.—**Using ANOVA, mean hospital percentages for BSN nurses differed among urban (38%), large (28%), small (31%) and isolated (21%) hospitals ($p$<.01) (Table 5). More than a 10-point gap exists for the percentage of BSN nurses working at urban hospitals and the most isolated rural hospitals. Although not substantive, differences identified in the Scheffe's test were between urban hospitals and both large (p<.01) and isolated ($p$<.05) hospitals (Table 4).

**Patient-to-RN ratios.—**The mean number of patients assigned to RNs increased steadily as hospitals became more rural: urban (4.8 patients per RN), large (5.6), small (5.6), and isolated hospitals (7.3) ($p$<.01) (Table 5). Substantive differences were between large rural and urban ($p$<.01), isolated and urban ($p$<.01), and isolated and large hospitals ($p$<.05) (Table 4).

**Nursing skill mix.—**The proportion of RNs to RNs plus other nursing staff decreased on average as hospitals became more rural: urban (76%), large (73%), small (73%), and isolated (65%) hospitals (Table 5). More than a 10-point gap for the percentage of RNs to RNs plus other nursing staff working at existed between urban and isolated hospitals. Nursing skill mix within large ($p$<.05) and isolated hospitals ($p$<.01) differed relatively compared to urban (Table 4).

**Nurse work environment.—**The overall work environment composite score did not differ substantively by hospital location. Ratings for nursing foundations for quality of care were all between a range of 2.75–2.93 ($p$<.01) (Table 5). Non-substantive differences existed between urban (2.93) and large (2.83) hospitals ($p$<.05) (Table 4). Ratings of staffing and resource adequacy differed substantively across locations ($p$<.01), specifically between urban (2.50) and small hospitals (2.82) ($p$<.01) and between large (2.50) and small hospitals (2.82) ($p$<.01) (Table 4). As hospitals became more rural, nurses were more likely to rate nursing foundations for quality of care lower. Small and isolated hospitals had better staffing and resource adequacy compared to urban and large hospitals (Table 5).

## Discussion

Our focus was to compare nursing resources in urban, large, small and isolated hospitals. Results add to few published studies we identified about differences between rural and urban nurse education and work environments (Baernholdt & Mark, 2009; Skillman et al., 2006), and extends knowledge by describing how, as hospitals became more rural, there were fewer nurses with a BSN, fewer RNs, and higher patient-to-RN ratios. Fewer nursing resources in isolated hospitals represent another worrisome facet of rural population healthcare access given increasing U.S. rural hospitals closures (Kaufman et al., 2016; Warden, 2017). Results highlight the need for rural health policies to allocate nursing resources to under-resourced rural populations, who face greater chronic disease that contributes to poorer health compared to urban populations (AHRQ, 2014; NASEM, 2018).

Given the Institute of Medicine's (IOM) recommendation for 80% of nurses to obtain a BSN by 2020 (Insititute of Medicine, 2010), it is concerning that hospitals in remote locations had a substantively lower percentage of BSN educated nurses. Evidence suggests that a greater percentage of baccalaureate prepared nurses is associated with better patient outcomes (Aiken et al., 2011). Lower proportions of BSN educated nurses in rural settings is consistent with research that demonstrated a lower percentage of BSN-educated nurses in rural compared to urban hospital units (27.2% vs. 35.3%) (Baernholdt & Mark, 2009). Lower proportions of BSN educated nurses in rural hospitals might be due to barriers to higher education in rural communities such as time constraints, family obligations, and financial concerns (Gillespie & Langston, 2014; Landry, Orsolini-Hain, Renwanz-Boyle, Alameida, & Holpit, 2012). Rural hospitals might not be able to afford adequate salaries for BSN educated nurses due to financial forces accelerating U.S. rural hospital closures (Kaufman et al., 2016).

Nursing skill mix differed among hospitals based on extent of rurality, which expands upon findings from secondary data analyses about how the proportion of RNs to all other nurses was significantly lower in rural compared to urban hospital units (50.1% vs. 59.6%) in a national random sample of 194 units (Baernholdt & Mark, 2009). Similar to nurse education, as hospitals are located in more remote areas, nursing skill mix decreases. One large multi-country study found that each 10% reduction of RNs to all nursing staff was associated with an 11% increased odds of death (Aiken et al., 2017). Fewer RNs in isolated hospitals could be due to barriers for LPNs or LVNs to become RNs similar to financial constraints nurses face while pursuing a BSN (Gillespie & Langston, 2014).

Nursing foundations for quality of care were rated lower in large compared to urban hospitals. Nursing foundations for quality of care include the presence of continuing education opportunities, preceptor programs for new RNs, and quality assurance programs. This is consistent with reports about rural nurses having insufficient education to care for patient populations requiring specialized knowledge, such as the critically ill (Wolf & Delao, 2013). Conversely, small hospitals scored higher than urban hospitals, as well as large hospitals, for staffing and sufficient support to spend time with patients and discuss patient care problems with other nurses. Objectively, small hospital nurses had a higher patient load, but reported a more favorable view of staffing and resource adequacy. Perhaps this is because rural nurses are generally cross-trained to a variety of hospital settings to allow for flexible staffing (Winters, 2013). Rural nurses might view staffing and resource adequacy more favorably because of a "rural identity" that includes knowing all patients for whom they provide care (Winters, 2013).

Rural hospitals are subject to specific challenges that might require more nurses at unexpected times. Rural hospitals do not have a stable, continuous stream of high acuity patients compared to urban hospitals (Newhouse, 2005). One major challenge is that infrequent high-acuity trauma cases can occur, which means that there might be a sudden, unexpected need for more nurses than available (Newhouse, 2005). Policies should be created to sustain a well-prepared pool of available RNs to protect the most isolated residents.

One limitation is our cross-sectional design. Given the smallest subsample for isolated having nine hospitals, power to detect significant differences was limited. Missing data for patients-per-unit could have created bias; however, a sensitivity analysis supported that missing data did not drive results. Data are from 2005–2008; however, this is the most recent nurse survey data available with this many hospitals for comparison. Data were collected prior to the Affordable Care Act (ACA), however, the most frequently identified rural healthcare priority is healthcare access (Bolin et al., 2015), and rural residents still face challenges in achieving affordable healthcare due to limited Medicaid expansion (Foutz, 2017). Rural hospital closures leave rural residents without local acute care (NASEM, 2018). Findings provide bases to promote equitable nursing resource allocation for aging rural populations (NASEM, 2018). The sample frame included three states; however, states were in three of the four major U.S. regions.

Nursing resources across hospitals differ by rurality in multi-state data. Rural hospitals had fewer nursing resources such as fewer BSN educated nurses and less staffing and resource adequacy. Understanding nuanced differences among nursing resources between rural and urban hospitals is a step to informing more rural-relevant health policies to improve rural population health.

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## References

Agency for Healthcare Research and Quality. (2014). Chartbook on rural health care Rockville, MD: Agency for Healthcare Research and Quality.

Aiken LH (2014). Baccalaureate nurses and hospital outcomes: more evidence. Medical Care, 52(10), 861–863. doi:10.1097/mlr.0000000000000222 [PubMed: 25215645]

Aiken LH, Cimiotti JP, Sloane DM, Smith HL, Flynn L, & Neff DF (2011). Effects of nurse staffing and nurse education on patient deaths in hospitals with different nurse work environments. Medical Care, 49(12), 1047–1053. doi:10.1097/MLR.0b013e3182330b6e [PubMed: 21945978]

Aiken LH, & Fagin CM (2018). Evidence-based nurse staffing: ICN's new position statement. International Nursing Review, 65(4), 469–471. doi:10.1111/inr.12499 [PubMed: 30561798]

Aiken LH, Sloane D, Griffiths P, Rafferty AM, Bruyneel L, McHugh M, … Sermeus W (2017). Nursing skill mix in European hospitals: Cross-sectional study of the association with mortality, patient ratings, and quality of care. British Medical Journal of Quality and Safety, 26(7), 559–568. doi:10.1136/bmjqs-2016-005567

Aiken LH, Sloane DM, Bruyneel L, Van den Heede K, Griffiths P, Busse R, … Sermeus W (2014). Nurse staffing and education and hospital mortality in nine European countries: A retrospective observational study. Lancet, 383(9931), 1824–1830. doi:10.1016/s0140-6736(13)62631-8 [PubMed: 24581683]

American Association of Colleges of Nursing. (2008). The essentials of baccalaureate education for professional nursing practice Retrieved from https://www.aacnnursing.org/Portals/42/Publications/BaccEssentials08.pdf.

American Association of Colleges of Nursing. (2018). Academic progression in nursing: Moving together toward a highly educated nursing workforce Retrieved from https://www.aacnnursing.org/Portals/42/News/Position-Statements/Academic-Progression-PS.pdf

Anderson TJ, Saman DM, Lipsky MS, & Lutfiyya MN (2015). A cross-sectional study on health differences between rural and non-rural U.S. counties using the County Health Rankings. BMC Health Services Research, 15, 441. doi:10.1186/s12913-015-1053-3 [PubMed: 26423746]

Baernholdt M (2018). Fall rates in urban and rural nursing units: Does location matter? Journal of Nursing Care Quality, 33(4), 326–333. doi:10.1097/NCQ.0000000000000319 [PubMed: 29346186]

Baernholdt M, & Mark BA (2009). The nurse work environment, job satisfaction and turnover rates in rural and urban nursing units. Journal of Nursing Management, 17(8), 994–1001. doi:10.1111/j.1365-2834.2009.01027.x [PubMed: 19941573]

Bolin JN, Bellamy GR, Ferdinand AO, Vuong AM, Kash BA, Schulze A, & Helduser JW (2015). Rural healthy people 2020: New decade, same challenges. The Journal of Rural Health, 31(3), 326–333. doi:10.1111/jrh.12116 [PubMed: 25953431]

Bratt MM, Baernholdt M, & Pruszynski J (2014). Are rural and urban newly licensed nurses different? A longitudinal study of a nurse residency programme. Journal of Nursing Management, 22(6), 779–791. doi:10.1111/j.1365-2834.2012.01483.x [PubMed: 25208945]

Duffield C, Diers D, O'Brien-Pallas L, Aisbett C, Roche M, King M, & Aisbett K (2011). Nursing staffing, nursing workload, the work environment and patient outcomes. Applied Nursing Research, 24(4), 244–255. doi:10.1016/j.apnr.2009.12.004 [PubMed: 20974086]

Enders CK (2010). Applied missing data analysis New York: Guilford Press.

Estabrooks CA, Midodzi WK, Cummings GG, Ricker KL, & Giovannetti P (2005). The impact of hospital nursing characteristics on 30-day mortality. Journal of Nursing Research, 54(2), 74–84.

Foutz JAS, Garfield R (2017). The role of medicaid in rural America. The Henry J. Kaiser Family Foundation, Issue Brief Retrieved from http://files.kff.org/attachment/Issue-Brief-The-Role-of-Medicaid-in-Rural-America

Gillespie AB, & Langston N (2014). Inspiration for aspirations: Virginia nurse insights about BSN progression. Journal of Professional Nursing, 30(5), 418–425. doi:10.1016/j.profnurs.2014.01.001 [PubMed: 25223290]

Hart LG, Larson EH, & Lishner DM (2005). Rural definitions for health policy and research. American Journal of Public Health, 95(7), 1149–1155. doi:10.2105/AJPH.2004.042432 [PubMed: 15983270]

Hege A, Ball L, Christiana RW, Wallace C, Hubbard C, Truesdale D, … Fleming H (2018). Social determinants of health and the effects on quality of life and well-being in 2 rural Appalachia communities: The community members' perspective and implications for health disparities. Family and Community Health, 41(4), 244–254. [PubMed: 30134339]

Institute of Medicine. (2010, 10). Future of nursing: Focus on education Retrieved from http://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/2010/The-Future-of-Nursing/Nursing%20Education%202010%20Brief.pdf

Kaufman BG, Thomas SR, Randolph RK, Perry JR, Thompson KW, Holmes GM, & Pink GH (2016). The rising rate of rural hospital closures. The Journal of Rural Health, 32(1), 35–43. doi:10.1111/jrh.12128 [PubMed: 26171848]

Kim HY (2015). Statistical notes for clinical researchers: Post-hoc multiple comparisons. Restorative Dentistry & Endodonics, 40(2), 172–176. doi:10.5395/rde.2015.40.2.172

Lake ET (2002). Development of the practice environment scale of the nursing work index. Research in Nursing and Health, 25(3), 176–188. doi:10.1002/nur.10032 [PubMed: 12015780]

Landry LG, Orsolini-Hain L, Renwanz-Boyle A, Alameida M, & Holpit L (2012). The nursing educational highway in action: Results of a needs assessment and the formation of a collaborative workgroup. Nursing Education Perspectives, 33(4), 274–277. [PubMed: 22916635]

McCafferty KL, Ball SJ, & Cuddigan J (2017). Understanding the continuing education needs of rural midwestern nurses. The Journal of Continuing Education in Nursing, 48(6), 265–269. doi: 10.3928/00220124-20170517-07

McHugh MD, & Lake ET (2010). Understanding clinical expertise: Nurse education, experience, and the hospital context. Research in Nursing and Health, 33(4), 276–287. doi:10.1002/nur.20388 [PubMed: 20645420]

Meit M, Knudson A, Gilbert T, Yu AT-C, Tanenbaum E, Ormson E, & Popat M (2014). The 2014 update of the rural-urban chartbook. Rural Health Reform Policy Research Center Retrieved from https://ruralhealth.und.edu/projects/health-reform-policy-research-center/pdf/2014-rural-urban-chartbook-update.pdf

Newhouse RP (2005). Exploring nursing issues in rural hospitals. Journal of Nursing Administration, 35(7–8), 350–358. [PubMed: 16077277]

Newhouse RP, Morlock L, Pronovost P, & Sproat SB (2011). Rural hospital nursing: results of a national survey of nurse executives. Journal of Nursing Administration, 41(3), 129–137. doi: 10.1097/NNA.0b013e31820c7212 [PubMed: 21336041]

Office of Disease Prevention and Health Promotion. (2014). Social determinants of health Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health

Rural Health Research Center. (n.d.) Rural-urban commuting area codes University of Washington: Retrieved from http://depts.washington.edu/uwruca/index.php

Shapiro SS, & Wilk MB (1965). An Analysis of Variance Test for Normality (Complete Samples). Oxford University Press on behalf of Biometrika Trust, 52(3/4), 591–611. doi:10.2307/2333709

Skillman SM, Palazzo L, Keepnews D, & Hart LG (2006). Characteristics of registered nurses in rural versus urban areas: Implications for strategies to alleviate nursing shortages in the United States. The Journal of Rural Health, 22(2), 151–157. doi:10.1111/j.1748-0361.2006.00024.x [PubMed: 16606427]

Terrell SR (2012). Statistics translated: A step-by-step guide to analyzing and interpreting data New York, NY: The Guilford Press.

The National Academies of Sciences Engineering Medicine. (2018). Achieving rural health equity and well-being: Proceedings of a workshop (2018) Washington, D.C.: The National Academies Press Retrieved from http://nap.edu/24967

United States Census Bureau. (2017). Geographic terms and concepts - Core based statistical areas and related statistical areas: Retrieved from https://www.census.gov/geo/reference/gtc/gtc_cbsa.html

Warden DH, Probst JC (2017). The Role of the Nurse Executive in Rural Hospital Closure. The Journal of Nursing Administration, 47(1), 5–7. doi:10.1097/NNA.0000000000000429 [PubMed: 27893499]

Warshawsky NE, & Havens DS (2011). Global use of the practice environment scale of the nursing work index. Journal of Nursing Research, 60(1), 17–31. doi:10.1097/NNR.0b013e3181ffa79c

Winters CA (2013). Rural nursing: Concepts, theory, and practice (4th ed. ed.). New York, NY: Springer.

Wolf L, & Delao AM (2013). Identifying the educational needs of emergency nurses in rural and critical access hospitals. Journal of Continuing Education in Nursing, 44(9), 424–428. doi: 10.3928/00220124-20130816-38 [PubMed: 23964675]

World Health Organization. (2010). A conceptual framework for action on the social determinants of health Geneva, Switzerland: World Health Organization.

## Table 1

Hospital Characteristics: Rural Subtypes and Urban

| | Overall *n*=642[†] | Urban *n*=566[¶] | Large *n*=49[§] | Small *n*=18[‡] | Isolated *n*=9[††] | *P*[¶¶] |
|---|---|---|---|---|---|---|
| **Hospital Characteristics** | | | | | | |
| State (%)[§§] | | | | | | .00[**] |
| California | 46 | 49 | 23 | 44 | 44 | |
| Florida | 27 | 29 | 20 | 0 | 11 | |
| Pennsylvania | 26 | 22 | 57 | 56 | 44 | |
| Ownership Type (%)[§§] | | | | | | |
| Government, non-Federal | 11 | 11 | 4 | 11 | 33 | .01[*] |
| Not-for-Profit | 66 | 64 | 78 | 89 | 56 | |
| For- Profit | 23 | 25 | 18 | 0 | 11 | |
| Bed Size (%)[§§] | | | | | | .00[**] |
| <100 | 18 | 12 | 41 | 100 | 67 | |
| 101–250 | 46 | 46 | 55 | 0 | 33 | |
| >250 | 37 | 41 | 4 | 0 | 0 | |
| High Technology (%)[§§] | 42 | 48 | 6 | 0 | 0 | .00[**] |
| Teaching (%)[§§] | | | | | | .00[**] |
| Non-Teaching | 54 | 48 | 82 | 94 | 100 | |
| Minor Teaching | 38 | 43 | 13 | 6 | 0 | |
| Major Teaching | 9 | 10 | 5 | 0 | 0 | |
| Patients Per Unit, (mean) | 18 | 19 | 16 | 12 | 15 | .00[**] |

Notes.

[†]Number of overall hospitals vary from 373 –642 due to missing data

[¶]Number of urban hospitals vary from 317–566 due to missing data

[§]Number of large hospitals vary from 34–49 due to missing data

[‡]Number of small hospitals vary from 14–18 due to missing data

[††]Number of isolated hospitals vary from 8–9 due to missing data.

[¶¶]Statistical significance was determined with Chi Square tests for categorical variables and ANOVA was used to determine significance of the difference between patients-per-unit in hospital categories

[§§]Percentages might not add to 100 due to rounding

[*]p<0.05

[**]p<0.01

**Table 2**

Distribution of Rural Hospitals Classified Using Rural—Urban Commuting Area Categories (RUCA)

| | CA *n* = 23 [%] | FL *n* = 11 [%] | PA *n* = 42 [%] | *p-value* |
|---|---|---|---|---|
| ***RUCA Classifications*** | | | | .14 |
| Large (*n* = 49) | 48 | 91 | 67 | |
| Small (*n* = 18) | 35 | 0 | 24 | |
| Isolated (*n* = 9) | 17 | 9 | 10 | |

## Table 3

Nurse Characteristics: Rural Subtypes and Urban

| *Nurse Characteristics* | Overall *n*=22,215[†] | Urban *n*=20,880[¶] | Large *n*=1,065[§] | Small *n*=187[‡] | Isolated *n*=83[††] | *P*[¶¶] |
|---|---|---|---|---|---|---|
| Job Status (%) | | | | | | .00[**] |
| Full-Time | 64 | 64 | 69 | 64 | 64 | |
| Part-Time | 26 | 27 | 22 | 21 | 19 | |
| Per-diem | 9 | 9 | 8 | 15 | 17 | |
| Age, (mean) | 44.5 | 44.5 | 45.5 | 46.4 | 49.4 | .00[**] |
| Years of Experience, (mean) | 16.5 | 16.4 | 17.5 | 16.8 | 18.2 | .01[*] |
| Sex (%) | | | | | | .08 |
| Female | 93 | 93 | 94 | 95 | 92 | |
| Male | 7 | 7 | 6 | 5 | 8 | |

Notes.

[†] n's of overall nurses vary from 15,789–22,215 due to missing data

[¶] n's of urban nurses vary from 14,642–20,880 due to missing data

[§] n's of large rural nurses vary from 901–1,065 due to missing data

[‡] n's of small rural vary from 176–187 due to missing data

[††] n's of isolated rural vary from 70–83 due to missing data

[¶¶] *p* values generated from $\chi^2$ for categorical variables, and from *F*-test (analysis of variance) for the continuous variables.

[*] $p<0.05$

[**] $p<0.01$

## Table 4

Post-Hoc Analysis of Statistically Significant Differences (Scheffe's Test)

| RUCA Classification | Compared to | *p- value* |
|---|---|---|
| **Patients per Unit** | | |
| Urban | Large Rural | .00** |
| | Small Rural | .00** |
| | Isolated Remote Rural | .01* |
| Large Rural | Small Rural | .01* |
| | Isolated Remote Rural | .83 |
| Small Rural | Isolated Remote Rural | .56 |
| **Nurse Age** | | |
| Urban | Large Rural | .04* |
| | Small Rural | .13 |
| | Isolated Remote Rural | .00** |
| Large Rural | Small Rural | .78 |
| | Isolated Remote Rural | .02* |
| Small Rural | Isolated Remote Rural | .23 |
| **Years of Experience** | | |
| Urban | Large Rural | .02* |
| | Small Rural | .98 |
| | Isolated Remote Rural | .60 |
| Large Rural | Small Rural | .85 |
| | Isolated Remote Rural | .97 |
| Small Rural | Isolated Remote Rural | .83 |
| **BSN education** | | |
| Urban | Large Rural | .00** |
| | Small Rural | .25 |
| | Isolated Remote Rural | .01* |
| Large Rural | Small Rural | .92 |
| | Isolated Remote Rural | .66 |
| Small Rural | Isolated Remote Rural | .47 |
| **Patient-to-RNs Ratios** | | |
| Urban | Large Rural | .00* |
| | Small Rural | .12 |
| | Isolated Remote Rural | .00* |
| Large Rural | Small Rural | 1.0 |
| | Isolated Remote Rural | .02* |
| Small Rural | Isolated Remote Rural | .05 |

| RUCA Classification | Compared to | *p- value* |
|---|---|---|
| **Nurse Skill Mix** | | |
| Urban | Large Rural | .03 * |
| | Small Rural | .53 |
| | Isolated Remote Rural | .00 ** |
| Large Rural | Small Rural | .99 |
| | Isolated Remote Rural | .05 |
| Small Rural | Isolated Remote Rural | .06 |
| **Nursing Foundations for Quality Care** | | |
| Urban | Large Rural | .04 * |
| | Small Rural | .88 |
| | Isolated Remote Rural | .14 |
| Large Rural | Small Rural | .88 |
| | Isolated Remote Rural | .80 |
| Small Rural | Isolated Remote Rural | .55 |
| **Staffing and Resource Adequacy** | | |
| Urban | Large Rural | 1.0 |
| | Small Rural | .00 ** |
| | Isolated Remote Rural | .50 |
| Large Rural | Small Rural | .01 * |
| | Isolated Remote Rural | .55 |
| Small Rural | Isolated Remote Rural | .77 |

* p<0.05

** p<0.01

## Table 5

Organization of Nursing: Rural vs. Urban (hospital-level)

| | **Overall *n* = 642** | **Urban *n* = 566** | **Large *n* = 49** | **Small *n* = 18** | **Isolated *n* = 9** | ***p- value within & between groups*** |
|---|---|---|---|---|---|---|
| **BSN education** [%] | 37 | 38 | 28 | 31 | **21** | .00 ** |
| **Patient-to-RNs Ratios**, (means) | 5.0 | 4.8 | 5.6 | 5.6 | **7.3** | .00 ** |
| **Nurse Skill Mix** [%] | 76 | 76 | 73 | 73 | **65** | .00 ** |
| **Nurse Work Environment**, (means) | | | | | | |
| Participation in Hospital Affairs | 2.53 | 2.53 | 2.45 | 2.55 | **2.36** | .09 |
| Nursing Foundations for Quality Care | 2.92 | 2.93 | 2.83 | 2.89 | **2.75** | .00 ** |
| Nurse Manager Ability, Leadership, and Support of Nurses | 2.59 | 2.59 | **2.56** | 2.72 | 2.60 | .29 |
| Staffing and Resource Adequacy | 2.51 | **2.50** | **2.50** | 2.82 | 2.67 | .00 ** |
| Collegial Nurse-Physician Relations | 2.91 | 2.91 | 2.85 | 3.00 | **2.84** | .08 |
| Composite NWI Score | 2.69 | 2.69 | **2.64** | 2.80 | **2.64** | .10 |

Notes.

* p<0.05

** p<0.01

Bolded numbers indicate the lowest value compared across rurality