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U.S. Hospital Employment of Foreign-Educated Nurses and Patient Experience: A Cross-Sectional Study

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Abstract

Introduction—For over half a century, hospitals in the United States have actively recruited foreign-educated nurses (FENs) in response to nurse shortages in hospitals and nursing homes. Little attention has been paid to the quality of care in the United States related to employment of FENs.

Aims—The purpose of this retrospective study was to determine whether employment of FENs in U.S. hospitals is associated with patient care experience.

Method—This study used cross-sectional data from three sources in 425 hospitals in four large states to evaluate the relationship between patient perceptions of care and hospital employment of FENs. The study linked data from publicly reported patient experience of care surveys, nurse surveys, and administrative data using unique hospital identifiers common across the data sets.

Results—Patient-reported care experience was found to be more negative in hospitals employing more FENs, after controls for other possible explanations. Each 10% increase in FENs was associated with a decrease in the percentage of patients who would recommend their hospital and a decrease in the percentage of patients giving favorable reports on five nursing-specific aspects of patient experience.

Conclusions—The results of this study suggest that employment of substantial numbers of nurses educated outside the United States may have implications for quality of care. The findings suggest that research on the outcomes of transition programs for FENs would be useful to inform regulatory policies.

Keywords

Foreign-educated nurses; hospital staffing; patient care experience; patient satisfaction

The United States has long experienced cyclical shortages of registered nurses (RNs) which have prompted employers to recruit FENs (Aiken, 2007; Aiken, Buchan, Sochalski, Nichols, & Powell, 2004). The global shortage of nurses reached an apex in the mid-2000s, resulting in an international conference in Bellagio, Italy, of nurse labor force experts from nurse exporting (source) countries and nurse importing (host) countries. Published in a special issue of *Health Services Research* in 2007, the Bellagio conference concluded that major reliance on nurse recruitment abroad to solve nurse shortages in well-resourced countries could adversely affect population health without solving nursing shortages in host countries including the United States (Aiken, Pittman, & Buchan, 2007). Additionally, the Bellagio conference recommended that all countries, and especially the large importers of nurses such as the United States and the United Kingdom, invest in increased access to professional nursing education at home. The conference also suggested that by improving work environments, nurses' productivity and retention in the workforce could improve. Little evidence was available at the time of the report on potential quality implications for the host countries associated with importing nurses educated abroad.

Balancing Nurse Supply and Demand

The United States has substantially reduced its reliance on international nurse recruitment over the past 15 years by doubling nursing school graduates from 74,000 to over 150,000 (Auerbach, Buerhaus, & Staiger, 2015; Staiger, Auerbach, & Buerhaus, 2012). In parallel, the number of FENs taking the National Council Licensure Examination-Registered Nurse (NCLEX-RN) for the first time dropped to 8,641 in 2015, which is less than half of the number of FENs taking the U.S. RN licensure examination for the first time in 2005 (Kovner, Brewer, Fatehi, & Katigbak, 2014; U.S. Department of Health and Human Services Health Resources and Services Administration National Center for Health Workforce Analysis, 2014). These data reflect lower employer demand for FENs amidst a plentiful domestic nurse supply (Kovner, Brewer, Fatehi, & Katigbak, 2014; U.S. Department of Health and Human Services Health Resources and Services Administration National Center for Health Workforce Analysis, 2014). Although the increase in nurse supply was helped by the economic downturn and loss of jobs in other sectors of the economy, the rapid responsiveness of the U.S. nurse supply illustrates the potential of achieving better nurse supply and demand balance given access to nursing education and favorable employment opportunities (Staiger et al., 2012).

Even in the current context of relative nurse supply-demand balance in the U.S. market, individual hospitals still actively pursue international nurse recruitment (Reinwald, 2015; Sherwood & Shaffer, 2014). These hospitals may be responding to a different kind of shortage—one created by too few budgeted positions for nurses at the bedside and/or poor working conditions contributing to nurse recruitment and retention issues rather than an inadequate supply of nurses (DePillis, 2015; Robbins, 2015). Many studies demonstrate that nurse shortages at the bedside persist independent of the supply of nurses and can be addressed by improving working conditions and budgeting to ensure safe nurse staffing levels (Aiken et al., 2011; Aiken et al., 2014; Buchan & Aiken, 2008; Sermeus et al., 2011).

Quality of Care Concerns

Most of the literature on nurse migration has focused on rights and well-being of migrating nurses, the economic reliance of source countries on remittance income, and brain drain resulting in care deficits in source countries (Kingma, 2006; Pittman, 2013; Shaffer, Bahkhshi, & Kim, 2015). A few large-scale studies systematically examined quality of care differences in health care settings with respect to the proportion of employed FENs. The first such study of 665 U.S. hospitals found significantly higher risk-adjusted mortality and failure-to-rescue in hospitals that employ higher proportions of FENs, after controlling for potentially confounding factors (Neff, Cimiotti, Sloane, & Aiken, 2013). Patients cared for in hospitals with higher proportions of nurses trained abroad had significantly higher odds of dying after general surgery unless their hospitals had better-than-average nurse staffing. The fact that the impact of FENs on mortality is contingent upon nurse staffing levels may suggest that adverse quality outcomes occur when FENs are substituting for rather than supplementing U.S.-educated nurses (Neff et al., 2013).

Prior research has documented an association between nurse staffing levels and patient satisfaction (Jha, Orav, Zheng, & Epstein, 2008). The connection between employment of FENs and patient satisfaction has been studied previously in England (Germack et al., 2015), a country that continues to recruit nurses from abroad (Buchan, Seccombe, & O'May, 2013) and where concerns exist about the quality of nursing care (Aiken, Rafferty, & Sermeus, 2014). On the basis of data from England's National Health Service (NHS) National Inpatient Survey and surveys of hospital nurses, the 2015 English study revealed that patients cared for in NHS hospitals with a larger proportion of nurses trained abroad had lower patient satisfaction than patients cared for in hospitals employing fewer nurses trained abroad. The association between less favorable patient experiences and FEN employment was observed at every level of nurse staffing, unlike the association of FEN employment and mortality in the U.S. study (Neff et al., 2013). Also, the association between higher proportions of FENs and less favorable patient satisfaction in English hospitals persisted after controlling for the quality of the nurse work environment and other hospital characteristics, lending confidence to the possibility of a direct adverse effect of large proportions of FENs on less favorable patient satisfaction (Germack et al., 2015).

In this study, we seek to determine the extent to which patient ratings of care were associated with the employment of FENs in U.S. hospitals. The results could inform institutional efforts to improve hospital quality of care as well as national nurse workforce policies on nurse supply.

Methods

Study Design

This study used cross-sectional data from three sources in 425 hospitals in four large states to evaluate the relationship between patient perceptions of care and hospital employment of FENs. The study linked data from publicly reported patient experience of care surveys, nurse surveys, and administrative data using unique hospital identifiers common across the data sets. The three data sources included the 2007 Hospital Consumer Assessment of Healthcare

Providers and Systems (HCAHPS) publicly reported survey data; the 2006–2007 Penn Multi-State Nursing Care and Patient Safety Survey findings, and the 2007 American Hospital Association (AHA) Annual Survey findings. The full details of the data sources, how the data were merged, and the aggregation of all data to the hospital level have been previously published (Aiken et al., 2011).

The HCAHPS survey evaluates adult patients' experience with their short-term, acute care hospitalization. Patients are randomly surveyed following discharge, their responses are anonymous, and the results are collected quarterly and aggregated annually to the hospital-level to produce hospital-level percentages. Eighteen of the questions are used to create the 11 publicly available scores found on the *Hospital Compare* website (Centers for Medicare & Medicaid Services, 2015). In 2007, it included data from more than 118,400 patients in the four states included in this study.

The hospitals studied included virtually all hospitals in four large states (i.e., California, Florida, New Jersey, and Pennsylvania) that participated in the HCAHPS hospital patient experience survey in 2007. The survey was later mandated by Medicare for all U.S. hospitals (Centers for Medicare & Medicaid Services, 2015). In 2007, these four large states accounted for close to one-quarter of hospital discharges (Aiken et al., 2011). In 2008, three of the four (i.e., California, Florida, and New Jersey) were among the top five states in the country with the highest concentrations of nurses trained abroad (Cho, Masselink, Jones, & Mark, 2011). Hospitals in the four states are roughly comparable to the national profile of hospitals such as size, teaching status, and technology adoption, which increases the generalizability of this study's results (Aiken et al., 2011). The design of the present study was state-based because information on all RNs used to design the nurse survey is available only at the state level through boards of nursing.

The Penn Multi-State Nursing Care and Patient Safety Survey findings provided information from RNs not available from publicly reported resources. Large random samples of RNs working in hospitals in four states reported their personal characteristics (including country of education) and their workplace information (including the type of unit they worked on, their patient workloads, and their assessments of the work environment) (Aiken et al., 2011). Random samples of RNs were drawn from state licensure lists (50% of RNs in New Jersey, 40% of RNs in Pennsylvania and California, and 25% of RNs in Florida) and were sent a survey by mail to their homes. Nurses provided their employers' names, which allowed for aggregation of nurses by places of employment. This design allowed us to study the full population of hospitals in the four states that participated in the HCAHPS survey and virtually eliminated bias at the hospital level, a strength of the design for this study since hospitals could not opt out of the study over concerns about quality of care. Responses were obtained from 20,674 nurses in the 425 hospitals participating in the HCAHPS survey. The overall response rate to the survey from nurses in all employment settings and those not employed was 39% (Aiken et al., 2011). A second survey that achieved a response rate of over 90% was undertaken of nonrespondents to assess possible response bias. Nurses educated outside the United States were less likely to respond to the main survey than U.S.-educated nurses, but no differences in item responses between groups were found (Smith, 2008). Only data from the first survey were used for analysis.

Sample

The analysis focused on the 425 nonfederal general acute care hospitals in the four states participating in HCAHPS survey (Centers for Medicare & Medicaid Services, 2010). Data on characteristics of these 425 hospitals were obtained from the AHA Annual Hospital Survey, which is a source of general information for all hospitals in the US. Specific information on nurses and the presence of FENs was derived from respondents to the Penn Multi-State Survey.

Measures

Patient Care Experience—HCAHPS data are hospital-level measures comprising 11 risk-adjusted topics from a 32-question patient survey. Prior to public release of the data, HCAHPS data are risk-adjusted for patient mix adjustment variables (Centers for Medicare & Medicaid Services, 2008). Two single questions assess global experiences of care including, “Would you recommend the hospital to family or friends?” and “What number would you rate this hospital during your stay?” on a scale of 0–10, with higher numbers reflecting better ratings. Of the remaining nine measures, we studied the four that were most closely related to nursing care: “nurses always communicated well”, “patients always received help as soon as they wanted”, “staff always explained medications”, and “pain was always well controlled.” The HCAHPS percentages published for each question represent the percentage of patients from the hospital who gave the most favorable response.

Nurse Characteristics—The primary characteristic of interest here—percent of nurses educated abroad—was measured at the hospital level using data obtained from the nurse surveys. Foreign education was assessed by responses to one question about where nurses received their basic nursing education. They were considered U.S. educated if they reported being educated in Puerto Rico and U.S. territories. Hospital proportion of FENs was estimated by dividing the number of FENs in each hospital that responded to the survey by the total number of RNs that responded in each hospital (Neff et al., 2013).

Additional nursing characteristics included bachelor’s education in nursing (BSN), patient-to-nurse staffing ratios, and the nurse work environment. Educational composition is the percentage of nurses in each hospital whose degree was a bachelor’s degree in nursing or higher (Aiken, Clarke, Cheung, Sloane, & Silber, 2003). Staffing was calculated for staff nurses as the number of patients divided by the number of RNs and the mean was calculated for each hospital (Aiken et al., 2011). This measure has greater predictive validity and is superior to administratively reported nurse staffing from the AHA, which is missing as many as one-third of the hospitals, and often includes nurses without direct inpatient care assignments (Aiken et al., 2011; Aiken, Clarke, Sloane, Sochalski, & Silber, 2002). Staffing was categorized into four levels for descriptive statistics and the continuous variable was maintained for regression analysis.

Nurse work environment was derived from nurse responses to the Practice Environment Scale of the Nursing Work Index (PES-NWI) in the Penn Multi-State Nursing Care and Patient Safety Survey—an extensively validated and National Quality Forum-endorsed measure (Warshawsky & Havens, 2011; Lake, 2007; Aiken, Clarke, Sloane, Lake, &

Cheney, 2008; Friese, Lake, Aiken, Silber, & Sochalski, 2008). Four of the five subscales were used including: nursing foundations for quality; nurse manager ability, leadership and support; collegial nurse/physician relationships; and nurse participation in hospital affairs. Subscale measures were calculated for each hospital by averaging the values of all items on each of the four subscales for all nurses in the hospital (Aiken et al., 2011). For ease of interpretation in descriptive statistics only, work environments were presented as categorical variables—poor, mixed, or good. Hospitals with four subscales above the median were classified as “good,” hospitals with two or three subscales above the median were classified as “mixed,” and those with one or no subscales above the median were classified as “poor” (McHugh, Kutney-Lee, Cimiotti, Sloane, & Aiken, 2011).

Hospital Characteristics—Adjustments in our models were made for differences in patient experience associated with hospital size, teaching status, technology, ownership, population density, and state (Kutney-Lee et al., 2009; Lehrman et al., 2010). Hospital size was characterized as small, medium or large based on number of beds available (<100, 101–250, >250, respectively). The continuous variable of bed number was included in regression analysis. Teaching status was classified as none, minor and major, depending on trainee to bed ratio (0, <1:4, >1:4). Technology status was dichotomized by the availability of open-heart surgery or organ transplantation (Silber et al., 2007). Hospitals were classified by population density as defined by the census derived measure, Core Based Statistical Area and categorized into urban (more than 50,000 people) and rural (fewer than 49,999 people). State was categorical and represented the state in which the hospital was located—California, Florida, New Jersey and Pennsylvania. Ownership was dichotomized as nonprofit or for-profit.

Data Analysis

Descriptive statistics were calculated for nurse and hospital characteristics and patient care experience. Differences in characteristics of U.S.-educated nurses and FENs were compared, using *F* tests (for continuous variables) and chi-square tests (for categorical variables) to determine their significance. Hospitals were dichotomized based on their employment of above or below the mean percentage of FENs for descriptive comparison. Hospital characteristics between these two categories of hospitals were compared using chi-square tests. HCAHPS outcomes were compared between these two categories of hospitals using *F* tests. Using linear regression models, we estimated associations of a 10% increase in the proportion of FENs with patient care experience, before and after controlling for other nurse (staffing, work environment, and education) and hospital characteristics (teaching status, technology status, number of beds, rural/urban setting, and nonprofit ownership) and state. In sensitivity analysis, we included an interaction between FENs and nurse staffing (Table 1), which was shown to be significant in an earlier paper (Neff et al., 2013). All statistical analyses were conducted using the statistical analysis software, STATA, version 14.1 (StataCorp), and $p < .05$ was considered statistically significant.

Results

The final sample included data from 425 hospitals comprised of 118,400 patient respondents and 20,674 nurse respondents with an average of 49 nurse respondents (SD = 39; range 10 to 282) per hospital. Table 2 compares characteristics of the U.S.-educated nurses and FENs in the study hospitals. Of the 20,674 nurses in the sample, 2,643 (13%) reported being educated in a country outside of the United States. FENs were slightly older than U.S.-educated nurses (45.5 years old versus 44.4 years old; $p < .001$) and had more years of nursing experience (20.3 years vs. 16.3 years; $p < .001$). FENs were also somewhat more likely to be male than U.S.-educated nurses (7.9% vs. 6.6%; $p < .05$) and decidedly more likely to have baccalaureate degrees (69.0% vs. 37.3%; $p < .001$).

Across all hospitals, the mean proportion of FENs was 14.3%. The distribution of FENs was skewed, and slightly more than a third of hospitals employed more than the mean proportion of FENs ($n = 165$; 38.8%), while about 61% of hospitals employed less than the mean ($n = 260$; 61.2%) (Figure 1). Table 3 shows hospitals employing higher proportions of FENs were significantly more likely to have 250 or more beds (56.4% vs. 41.9%; $p < .001$); more likely to be in California (64.2% vs. 28.5%; $p < .001$); and less likely to be located in a rural area (1.2% vs. 12.7%; $p < .001$). Hospitals employing a higher proportion of FENs had fewer patients per nurse (52.7% of hospitals with 14.3% or more FENs had nurse staffing levels of four or fewer patients, while the same was true of only 34.2% of the hospitals with less than 14.3% FENs; $p < .01$). Profit status, technology, teaching status, and nurse work environment did not significantly differ between hospitals employing above and below average proportions of FENs.

Table 4 shows, across all six outcomes, patients in hospitals with fewer than 14.3% FENs were more likely than patients in hospitals with 14.3% or more FENs to give most favorable responses to the HCAHPS outcomes ($p < .01$). The biggest differences (involving roughly 5 percentage point differences between hospitals employing above and below average percentages of FENs) were seen in the percentages of patients reporting nurses always communicated well and that they always received help as soon as they wanted ($p < .001$).

Table 5 shows the regression coefficients indicating the effect of FENs—specifically the effects of a 10% increase in the hospital proportion of FENs—on six HCAHPS outcomes, as well as the 95% confidence intervals and probabilities associated with them. The unadjusted coefficients in the first column estimate the association between the hospital proportion of FENs and each of the six outcomes, when no other factors are controlled. The adjusted coefficients in the second column estimate those same effects after controlling for the state in which the hospital was located, the hospital work environments, staffing, proportion of BSN educated nurses, and other hospital characteristics described above and listed at the base of the table. Before and after adjusting for hospital characteristics, each 10% increase in the proportion of FENs is associated with lower percentages of patients giving the most favorable responses to each of the HCAHPS items. The most sizable effects in the fully adjusted models involve the effects of the two global measures of patient satisfaction: patients' willingness to recommend their hospital and to rate it highly (9 or 10 on a 10-point scale). Each 10% increase in FENs is associated with 2% decrease in the percentage of

patients definitely recommending the hospital ($p < .001$), and a 1.5% decrease in the percentage of patients rating their hospital as a 9 or 10. Likewise, in hospitals with an increased proportion of FENs, the other nurse-related measures of patient experience studied were all significantly lower including “nurses always communicated well,” “patients always received help as soon as they wanted,” “staff always explained medications,” and “pain was always well controlled.”

Discussion

We found an association between higher proportions of FENs in U.S. hospitals and less favorable care ratings by patients, after accounting for other characteristics of hospitals that might be responsible for less favorable patient ratings. These findings are consistent with a growing literature suggesting employment of substantial proportions of FENs in hospitals is associated with diminished quality of care for patients. Our previous study of U.S. hospitals using a similar design found an association between higher proportions of FENs and higher risk-adjusted surgical mortality, after controlling for other explanations (Neff et al., 2013).

Although the 1% to 2% differences associated with a 10% increase of FENs across these six outcomes may seem small, the implied difference between hospitals in our sample that have no FENs as opposed to 30% or 40% FENs would be three or four times as large, and involve differences ranging from 3% to 8%, which could influence a hospital’s qualification for a CMS value-based purchasing incentive.

Our findings are similar to the study we conducted in England, a country with a differently organized and financed health care system, and using a different measure of patient experience but an otherwise similar research protocol (Germack et al., 2015). Additionally, a newly published analysis reached a similar conclusion about lower patient satisfaction in U.S. hospitals using a more limited categorical measure of FEN employment from an AHA survey —“Did your facility hire more foreign-educated nurses to help fill RN vacancies in 2012 versus 2011” (Mazurenko & Menachemi, 2016).

Our study explored alternative reasons that might explain less favorable patient care experiences in hospitals that employed a greater proportion of FENs. These alternatives, including the quality of nurse work environments and nurse staffing levels have been shown to be associated with patient satisfaction in previous research (Kutney-Lee et al., 2009) but, in the present study, the FEN association persisted after controlling for these possible explanations. We tested for interactions between staffing and foreign education and found none (Table 1).

A limitation of our study is that participation in HCAHPS was still voluntary during the study period and not all hospitals were participating. However, the net effect, if any, on the relationship between proportion of employed FENs and patient experience ratings among the voluntary participants in the HCAHPS survey would be to underestimate the association that may be found in a fully representative national sample of hospitals. The data are from 2006 to 2008, but that was the height of FEN employment in U.S. hospitals associated with the last cyclical shortage of nurses and thus we believe is an appropriate period for studying

the primary research question. There are no data except ours, that we know of, that enable estimates to be made about the proportion of all nurses within large numbers of hospitals that are educated outside the United States. Our research design and data sources do not allow for the matching of a specific patient with a specific nurse. The HCAHPS survey does not ask patients whether their care was provided by an FEN. A measure limitation of the percent of FENs in each hospital is that the measure is based on nurse responses to our survey. We know from a rigorous nonrespondent survey that achieved over a 90% response rate that FENs were less likely to respond than U.S.-educated nurses, but their responses to survey items did not differ significantly from those of U.S. nurses (Smith, 2008). The net effect of underestimating the number of FENs would be to underestimate the association that might be found in a fully representative sample of respondents.

Although it might be possible that omitted variables explain the relationship between proportion of FENs and patient satisfaction, we believe that is unlikely. As shown in Table 5, we have controlled for a wide range of hospital characteristics that could explain less favorable patient satisfaction, including the quality of the nurse work environment, nurse staffing, percent of BSN nurses, location, bed size, technology, teaching status, and others. In a similarly designed study of the association between proportion of supplemental or temporary nurses and patient satisfaction, we found in unadjusted models that a higher proportion of temporary nurses was associated with less favorable patient satisfaction (Lasater, Sloane, & Aiken, 2015). However, in models like the ones used in this study, once the quality of the nurse work environment was accounted for, the association between proportion of temporary nurses and patient satisfaction was insignificant. Our interpretation of those findings was that hospitals employing more temporary nurses had deficient work environments and it was the deficient clinical environments that explained poor patient satisfaction and not the employment of temporary nurses. We conducted the same test here and did not find that work environment deficiencies or other characteristics of hospitals explained the less favorable patient satisfaction in hospitals that employed more FENs.

We were not able with our data to explore the reasons why patient satisfaction may be less favorable when a greater proportion of their nurses are educated outside of the United States. In related work in Europe, we found that FENs from developing countries were significantly more likely to spend their time on tasks that, in the developed host countries, were not responsibilities of RNs, thus potentially eroding FEN productivity and resulting in missed nursing care (Bruyneel et al., 2013). Another possible explanation we are unable to examine is subtle language differences and accents that could interfere with nurse-patient and nurse-physician communication that are important for good patient outcomes. Research also suggests the presence of workplace discrimination reported by foreign-educated health workers, which could have implications for quality of care (Chen et al., 2010). It is worth noting that all physician graduates of foreign medical schools are required to graduate from an accredited postgraduate residency program in the United States before becoming eligible to practice in the United States, which is not a requirement for nurses (Boulet, Norcini, Whelan, Hallock, & Seeling, 2006). Little is known about the outcomes of programs that do exist to orient FENs to U.S. health care. Evaluation of these programs would be useful to informing whether enhanced regulatory policies are needed regarding additional requirements or guidelines for onboarding FENs.

With patient experience with care, as measured by HCAHPS, contributing substantially to Medicare value-based payments to hospitals (QualityNet, 2016), there is motivation for U.S. hospital decision makers to consider the full range of potential approaches that address bedside care nursing shortages, including those associated with higher patient satisfaction. Alternative approaches to international recruitment to address nurse shortages in the United States include evidence-based strategies that help retain experienced nurses and result in higher patient satisfaction such as the American Nurses Credentialing Center's Magnet[®] Program (Kutney-Lee et al., 2015; Stimpfel, Sloane, McHugh, & Aiken, 2015), and policies standardizing nurse residencies or transition programs to safely onboard new nurse graduates who are in plentiful supply (Goode, Lynn, McElroy, Bednash, & Murray, 2013; Adeniran et al., 2008).

Conclusions

Our findings show a significant association between hospital employment of FENs and lower patient satisfaction with care. Research on the effectiveness of transition programs for FENs would inform regulatory policies governing FEN practice in the United States. With nursing as one of the most "in demand" occupations in the United States and plenty of good applicants to nursing schools, it is feasible to develop national and state workforce plans and public policies that ensure communities have sufficient U.S.-educated nurses to avert future nurse shortages.

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FIGURE 1. Distribution of Hospitals by Proportion of Foreign-Educated Nurses (FENs)
Note. Each bar represents one of the 425 hospitals included in the study sample. Mean = 14.3%, median = 10.5%, Range: 0%–86%.

TABLE 1

Effect of a 10% Increase in Proportion of Foreign-Educated Nurses on HCAHPS Outcomes with Interactions
(*N* = 425)

Outcome	Regression Coefficient	(95% CI) ^a	<i>p</i> Value
<i>Patients would definitely recommend the hospital.</i>			
10% increase in proportion of FENs	−4.11	(−6.50, −1.72)	.001
Staffing × FEN interaction	0.47	(−0.034, 0.98)	.068
<i>Patients gave a rating of 9 or 10 (high).</i>			
10% increase in proportion of FENs	−2.95	(−5.15, −0.76)	.008
Staffing × FEN interaction	0.34	−0.13, 0.81	.155
<i>Nurses always communicated well.</i>			
10% increase in proportion of FENs	−2.84	(−4.51, −1.17)	.001
Staffing × FEN interaction	0.33	(−0.21, −0.69)	.065
<i>Patients always received help as soon as they wanted.</i>			
10% increase in proportion of FENs	−1.84	(−3.81, 0.12)	.066
Staffing × FEN interaction	0.23	(−0.18, 0.65)	.273
<i>Staff always explained medications.</i>			
10% increase in proportion of FENs	−2.34	(−3.91, −0.77)	.004
Staffing × FEN interaction	0.25	(−0.81, 0.59)	.138
<i>Pain was always well controlled.</i>			
10% increase in proportion of FENs	−1.14	(−1.56, −0.73)	< .001
Staffing × FEN interaction	0.13	(−0.24, 0.50)	.481

Note. Fully adjusted models included controls for state (CA, NJ, PA, and FL), nurse work environment, nurse staffing, proportion of nurses with a bachelor of science in nursing, and additional hospital characteristics (i.e., core-based statistical area, bed size, ownership, teaching status, technology status, and proportion of medical-surgical nurses reporting from the hospital). CI = confidence interval; HCAHPS = Hospital Consumer Assessment of Healthcare Providers and Systems.

^aFully adjusted with staffing × FEN interaction.

TABLE 2

Characteristics of Foreign and U.S.-Educated Nurses

Nurse Characteristics	All Nurses (<i>N</i> = 20,674) ^a	Foreign-Educated Nurses (<i>n</i> = 2,643)	U.S.-Educated Nurses (<i>n</i> = 17,864)	<i>p</i> Value ^b
<i>Age, y, mean (SD)</i>	44.5 (10.6)	45.5 (10.0)	44.4 (10.6)	< .001
<i>Experience, y, mean (SD)</i>	16.8 (11.2)	20.3 (10.7)	16.3 (11.2)	< .001
<i>Male, No. (%)</i>	1,382 (6.8)	207 (7.9)	1175 (6.6)	< .05
<i>BSN educated, No. (%)</i>	8,486 (41.4)	1,822 (69.0)	6,664 (37.3)	< .001

Source: Penn Multi-State Nurse Survey Data, 2006–2008.

Note. Percentages cannot be exactly derived from the numbers given in the table because of small amounts of missing data for sex and education (<2%). BSN = bachelor of science in nursing; SD = standard deviation.

^aTotal of all nurses is greater than sum of Foreign-Educated and U.S.-Educated nurses because 167 nurses did not report their country of education.

^b*p* Values are based on *F* tests (for age and experience) and on chi-square tests (for sex and education).

TABLE 3

Hospital Characteristics by Percent of Foreign-Educated Nurses ($N = 425$)

Hospital Characteristic	Category	Foreign-Educated Nurses, %		<i>p</i> Value
		Less than 14.3% ($n = 260$) No. (%)	14.3% or More ($n = 165$) No. (%)	
<i>Profit status</i>	Not for profit	215 (82.7)	129 (78.2)	.249
	For profit	45 (17.3)	36 (21.8)	
<i>Technology</i>	Not high technology	134 (51.5)	83 (50.3)	.804
	High technology	126 (48.5)	82 (49.7)	
<i>Teaching status</i>	Nonteaching	143 (55.0)	76 (46.1)	.192
	Minor teaching	97 (37.3)	75 (45.5)	
	Major teaching	20 (7.7)	14 (8.5)	
<i>Bed size</i>	Small (<100)	32 (12.3)	4 (2.4)	< .001
	Medium (101–249)	119 (45.8)	68 (41.2)	
	Large (>250)	109 (41.9)	93 (56.4)	
<i>Location</i>	California	74 (28.5)	106 (64.2)	< .001
	Pennsylvania	95 (36.5)	1 (0.6)	
	Florida	72 (27.7)	37 (22.4)	
	New Jersey	19 (7.3)	21 (12.7)	
<i>Rural location^a</i>	Rural	33 (12.7)	2 (1.2)	< .001
	Urban, metropolitan	227 (87.3)	163 (98.9)	
<i>Nurse staffing</i>	4	89 (34.2)	87 (52.7)	< .01
	5	97 (37.3)	56 (33.9)	
	6	50 (19.2)	15 (9.1)	
	7	24 (9.3)	7 (4.3)	
<i>Nurse work environment^b</i>	Poor	77 (29.6)	35 (21.2)	.089
	Mixed	122 (46.9)	79 (47.9)	
	Good	61 (23.5)	51 (30.9)	

Note.

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^gRural hospitals group micropolitan and rural hospitals based on census-derived Core Based Statistical Area (American Hospital Association, 2017).

^hNurse work environment was classified using four of the five subscales of the Practice Environment Scale of the Nursing Work Index (excluding staffing-resource adequacy).

TABLE 4

Distribution of HCAHPS Outcomes by Percent of Foreign-Educated Nurses

HCAHPS Outcomes, % (SD)	Foreign-Educated Nurses, %				All Hospitals (N = 425)	p Value ^a	
	< 14.3% (n = 260)	14.3% (n = 165)	14.3% (n = 165)	14.3% (n = 165)			
Patients gave a rating of 9 or 10.	60.6	8.4	57.2	9.2	59.3	8.9	< .001
Patients would definitely recommend the hospital.	65.6	9.3	62.3	10.4	64.5	9.9	< .01
Nurses always communicated well.	70.6	6.0	65.5	7.0	68.6	6.9	< .001
Patients always received help as soon as they wanted.	57.0	7.3	51.8	7.1	55.0	7.7	< .001
Pain was always well controlled.	65.6	5.1	62.2	6.4	64.3	5.8	< .001
Staff always explained medications.	54.6	5.5	51.8	6.6	53.5	6.1	< .001

Source. From the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) (Centers for Medicare & Medicaid Services, 2017).

Note. HCAHPS estimates are adjusted for seven patient mix adjustment variables (self-reported health status, education, service line, age, emergency room admission source, response percentile, service line by age interaction, primary language other than English, and survey mode (mail only, telephone only, mail with telephone follow-up, and active interactive voice response) (Centers for Medicare & Medicaid Services, 2008). SD = standard deviation.

^aFtests were used for group comparisons.

TABLE 5

Effect of a 10% Increase in Proportion of Foreign-Educated Nurses on HCAHPS Outcomes ($N = 425$)

Outcome	Regression Coefficient (95% CI)	
	Unadjusted	Adjusted
Patients would definitely recommend the hospital.	-1.22 (-1.87, -0.58) **	-2.02 (-2.73, -1.31) **
Patients gave a rating of 9 or 10 (high).	-1.29 (-1.87, -0.72) **	-1.48 (-2.13, -0.84) **
Nurses always communicated well.	-1.93 (-2.35, -1.51) **	-1.37 (-1.87, -0.88) **
Patients always received help as soon as they wanted.	-1.96 (-2.44, -1.49) **	-0.84 (-1.42, -0.26) *
Staff always explained medications.	-1.19 (-1.58, -0.80) **	-1.18 (-1.65, -0.70) **
Pain was always well controlled.	-1.30 (-1.67, -0.93) **	-1.25 (-1.71, -0.79) **

Note. Adjusted models included controls for state (CA, NJ, PA, and FL), nurse work environment, nurse staffing, proportion of nurses with a bachelor of science in nursing, and additional hospital characteristics (i.e., core-based statistical area, bed size, ownership, teaching status, technology status, and proportion of medical-surgical nurses reporting from the hospital). CI = confidence interval; HCAHPS = Hospital Consumer Assessment of Healthcare Providers and Systems.

*
 $p < .01$

**
 $p < .001$.