Comparing Medication Error Incidents Among Foreign-Educated Nurses and U.S.-Educated Nurses

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Despite a growing number of foreign-educated nurses (FENs) joining the health care workforce, scientifically based evidence comparing FENs to U.S.-educated nurses on quality of care, including medication errors, is lacking. Hypotheses tested were related to differences in frequencies and consequences of medication error incidents between FENs and U.S.-educated nurses. The case and control groups were randomly selected from 2006 and 2010 risk management files and medication files at five Southwestern hospitals. The sample included 2,178 observations. In 2006, there were comparable percentages of FENs in the case group (34.7%) and in the control group (31.2%). In 2010, the percentages were again comparable (30.7% of FENs in the case group and 28.6% in the control group). In 2006, FENs were less likely to make medication errors not reaching patients (4.5% for FENs and 13.3% for U.S.-educated nurses), but tended to make errors reaching patients without harm (85.8% for FENs and 75.1% for U.S.-educated nurses); however, the difference disappeared in 2010. The authors' comparison demonstrates that FENs provide quality of care comparable to that of U.S.-educated nurses with regard to medication errors, which may be attributed to the rigorous registered nurse licensure exam; FENs' relatively higher educational background; the hospital's recruitment, mentoring, and training programs; and the implementation of health information systems.

Recruiting foreign-educated nurses (FENs) has gained popularity in health care settings across the United States for many reasons, including the nursing shortage (Aiken, Buchan, Sochalski, Nichols, & Powell, 2004; Polsky, Ross, Brush, & Sochalski, 2007). Since the 1980s, the U.S. government has used immigration policy to address this shortage, issuing temporary work visas in the 1980s and 1990s and permanent work visas in the 2000s (Masselink & Jones, 2014). Consequently, FEN numbers in the United States have increased from 50,000 FENs in the mid-1970s to 165,000 in 2008 (Masselink & Jones, 2014). Between 2001 and 2008, the number of full-time registered nurses (RNs) increased by 476,000, with 155,000 or one-third being foreign born and the majority working in inpatient settings (Buerhaus, Auerbach, & Staiger, 2009). Typically, these FENs come from the Philippines, Canada, the United Kingdom, and India, respectively (Masselink & Jones, 2014).

With the increase of FENs employed in health care organizations, the impact on quality of care and patient safety has become a health policy and regulation interest. Aspects of concern include communication, cultural adjustment, integration into the American health care system, and most importantly, competency in care delivery. Prior studies consistently report that FENs encounter distinct and multifaceted challenges in their transition and adaptation into a new work environment in the United States (Davis & Nichols, 2002; Xu, Guitierrez, & Kim, 2008;

Yahes & Dunn, 1996). The transition to practice can pose many challenges, including the expectations of practice and language barriers (Tregunno, Peters, Campbell, & Gordon, 2009).

In their countries of origin, FENs may not be expected to make clinical decisions, exercise professional autonomy, or question physicians' orders. Therefore, they may follow medication orders without question. Language barriers include verbal and nonverbal communication, and FENs may not understand other providers, patients, and colleagues in their daily work. Existing studies observed that FENs have certain deficiencies in linguistic (Shen et al., 2012; Xu, Shen, Staples, & Bolstad, 2013; Xu, Bolstad, et al., 2010; Shen, Xu, Bolstad, Covelli, & Torpey, 2010) and nonverbal interpersonal communications (Xu, Staples, & Shen, 2012) when interacting with patients. These challenges pose potential threats to patient safety and quality of care. Nevertheless, only anecdotal cases based on perceptions about inferior quality of care provided by FENs may exist, and there is no scientific evidence supporting or rejecting the perception.

Medication errors, an important quality of care indicator, are defined as "any preventable event that may cause or lead to inappropriate medication use or harm to a patient" (U.S. Food and Drug Administration, 2009). Similarly, an *adverse drug event* (ADE) is defined as harm experienced by a patient as a result of exposure to a medication. The Agency for Healthcare Research and Quality (2012) estimates that ADEs affect up to 5% of hos-

pitalized patients. The Institute of Medicine (IOM, 2006) puts the number of ADEs in the United States at 1.5 million a year. An estimated 2,876 patient deaths resulted from medication errors in 1983; in 1993, the number rose to 7,391 deaths (Phillips, Christenfeld, & Glynn, 1998). Preventable ADEs are a serious concern in the United States not only because of the human cost but also because of the financial cost. According to the IOM (2000), preventable ADEs in hospitals result in an estimated cost of $2 billion annually. The IOM places the cost of hospital medication errors at $3.5 billion. Preventable ADEs among Medicare enrollees alone cost $887 million annually (IOM, 2006).

Despite the increasing number of FENs working in the American health care organizations and the staggering amount of attention paid to medication errors nationwide, little research focuses on the relationship between FENs and medication errors. Studies comparing the care quality of FENs with that of U.S.-educated nurses are almost nonexistent, although a few studies focus on the care of foreign-educated physicians and that of U.S.-educated physicians. Norcini and colleagues (2010) found that internationally educated non–U.S. citizen physicians had lower patient mortality rates when treating patients with heart failure or myocardial infarction in hospitals than domestically educated U.S.-citizen physicians (Norcini et al., 2010). Given the continuing growth of FENs in the U.S. nurse workforce and increasing national attention on patient safety and quality of care, the purpose of this study was to explore potential differences and related factors regarding medication errors, an important aspect of quality of care, between FENs and U.S.-educated nurses.

Study Design

This was a retrospective, quasi-case control design. In this design, a *case* was defined as an incident in which an RN made an error during medication administration, and a *control* was defined as an incident in which an RN administered a medication without error. RNs in the case group were randomly selected from the medication error case list. If the number of cases was not sufficient to conduct the random sampling at a hospital in a specific year, all cases in that year were selected. RNs in the control group were randomly selected from the medication administration data file in the pharmacy department. If an RN selected from the pharmacy department's list was already in the case group, he or she was excluded from the control group. One hospital was unable to provide the pharmacy list for the control group selection, and the human resource database was used to select the control group. The years of 2006 and 2010 were selected to investigate potential changes in RN-related medication errors. The study was approved by the Institutional Review Board of the University of Nevada, Las Vegas, and by the Western Institutional Review Board.

Data and Sample

Data were collected at five hospitals in the Southwest region of the United States. The ratio of sample size between the case group and the control group was 1:1. The minimum sample size was estimated as 816 per year (Fleiss, Levin, & Paik, 2003) and 1,632 for both years (2006 and 2010). The authors oversampled the 2010 case group for the purpose of investigating more severe but rare medication errors. As a result, the final sample after data clearing for data analysis consisted of 2,336 observations (1,276 medication error incidents and 1,060 control incidents). Medication error information was obtained from the risk management department, and information about RNs' demographics and educational background was obtained from the human resource department. Because the RN identification might be missed in some medication error cases, the related patient medical records were examined to identify the RNs who were involved in medication errors. The data collection was conducted from November 2011 to July 2014. Each hospital hired its own data collectors for data entry. To protect privacy, RN identifiers, such as name, Social Security number, and employee identification number, were removed at the data collection sites by the hospitals before data were given to the research team.

Measures and Analyses

The independent variable was whether an RN was an FEN (with a value of 1) or a U.S.-educated nurse (with a value of 0). The original definition of an FEN was a nurse who was born outside the United States and received his or her basic nursing education outside the United States. However, after the data collection, the authors found that human resource records for about 40% of the RNs did not indicate the country of birth. Therefore, the country where these RNs attended high school was used as a proxy for the country of birth, and the definition of an FEN was changed to a nurse who attended high school outside the United States and received his or her basic nursing education outside the United States. As a result, three RNs who attended high school in the United States and received basic nursing education in another country, 154 RNs who attended high school in another country but received basic nursing education in the United States, and one RN whose nursing education information was missing were excluded from the data analysis. The final number of observations for data analysis was 2,178, representing 1,190 in the case group and 989 in the control group. Because the first language of RNs from Canada is English, the authors included and excluded them from the sample for data analysis and did not find any differences in the results.

The authors compared percentages of FENs in the case and control groups in both 2006 and 2010, respectively. The authors also analyzed educational background, length of working experience, and most common drug classes involved in medication errors. Chi-square was used to compare FENs and U.S.-educated

TABLE 1

Nurses' Demographic, Educational, and Work Characteristics

	Case		Control	
Variable	**FEN** (*n* = 383)	**USEN** (*n* = 807)	**FEN** (*n* = 292)	**USEN** (*n* = 696)
Age, year, mean (SD)	42.1 (8.8)	40.6 (11.7)	43.2 (9.4)	40.9 (11.3)
Female	86.2%	89.1%	91.1%	85.5%
Basic nursing education*				
Associate degree	3.9%	47.7%	4.1%	50.0%
Licensed practiced nurse	1.0%	9.1%	0.3%	6.0%
Bachelor's degree in nursing	79.1%	39.0%	88.0%	40.5%
Diploma	5.5%	3.9%	6.5%	3.2%
With advanced degree	5.8%	2.4%	7.6%	1.9%
Type of employment				
Full-time hospital employee	84.3%	88.2%	82.4%	79.8%
Part-time hospital employee	4.5%	6.1%	9.3%	5.2%
On-call employee	1.3%	2.0%	4.1%	9.1%
Agency or travel nurse	3.1%	0.3%	0.0%	0.2%
Working at current hospital				
Less than 1 year	14.1%	12.9%	NS	NS
1–10 years	78.5%	77.6%	NS	NS
11–20 years	5.4%	7.1%	NS	NS
21 years or more	1.0%	2.4%	NS	NS

Note. FEN = foreign-educated nurse; USEN = U.S.-educated nurse; SD = standardized deviation.

NS: Results not shown because three hospitals did not collect this information for the control group.

*The first nursing education received before becoming a registered nurse.

TABLE 2

Location of Basic Nursing Education

	2006		2010	
Nursing Education	**Case** (*n* = 450)	**Control** (*n* = 359)	**Case** (*n* = 740)	**Control** (*n* = 630)
United States	65.3%	68.8%	69.3%	71.3%
Philippines	28.2%	24.8%	21.8%	24.6%
India	1.3%	1.7%	2.3%	2.2%
Canada	0.9%	1.7%	1.5%	0.8%
Other countries	10.1%	3.1%	5.1%	1.1%
Total	100.0%	100.0%	100.0%	100.0%

nurses in regard to medication error frequencies and consequences of the medication errors. The consequences were grouped into three categories, from the least severe to the most severe:

- Errors that did not reach patients
- Errors that reached patients but did no harm
- Errors that reached patients and caused harm.

No medication error caused the death of the patient in the sample.

Results

The demographic characteristics, education level, and working experience of the RNs are detailed in Table 1. On average, the age of the FENs (42.1 years old) was slightly higher than that of U.S.-educated nurses (40.6 years old) in the case and the control groups (43.2 years old versus 40.9 years old). Compared with U.S.-educated nurses, FENs had a much lower percentage of associate degrees (3.9% in the case group and 4.1% in the control group for FENs versus 47.7% in the case group and 50.0% in the control group for U.S.-educated nurses) but much higher percentages of bachelor's degrees (79.1% for FENs versus 39% for U.S.-educated nurses in the case group and 88% for FENs versus 40.5% for U.S.-educated nurses in the control group). The FENs also had a lower percentage of licensed practical nurse training as their basic nursing education before becoming an RN.

Table 2 lists the countries where the RNs received their basic nursing education. About two-thirds went to their first nursing school in the United States in the 2006 sample (65.3% in the case group and 68.8% in the control group). The figures went up slightly in the 2010 sample (69.3% in the case group and 71.3% in the control group). About one-quarter of the RNs in the control group in both 2006 and 2010 received basic nursing education in the Philippines and, in the case group, the number was higher (28.2%) in 2006 but lower (21.8%) in 2010. The next most common country of origin was India, followed by Canada.

Comparison of the number of FENs and U.S.-educated nurses in the case and the control groups are displayed in Table 3. In 2006, there were comparable percentages of FENs in the medication error case group (34.7%) and in the control group (31.2%) and no statistically significant difference was detected. A similar result was observed in 2010, when there were 30.7% of FENs in the case group and 28.6% in the control group.

Consequences of the medication error incidents in the case group are shown in Table 4. In 2006, as compared with U.S.-educated nurses, FENs were less likely to make medication errors that did not reach patients (4.5% for FENs and 13.3% for U.S.-educated nurses) and more likely to make errors that reached patients but did no harm (85.8% for FENs and 75.1% for U.S.-educated nurses). In 2006, FENs and U.S.-educated nurses had relatively similar percentages in terms of making medication errors that reached patients and caused harm (9.7% for FENs and 11.6% for U.S.-educated nurses). However, the difference seemed

to disappear in 2010, when there was no statistically significant difference ($p = 0.32$) in regard to the consequences of medication error incidents between FENs and U.S.-educated nurses.

Table 5 lists the five most common drug classes involved in medication errors for FENs and U.S.-educated nurses. In 2006, four drug classes were ranked among the five most common for both FENs and U.S.-educated nurses. The only difference was that neurologic drugs were ranked number four among FENs but were not in the five most common among U.S.-educated nurses, whereas analgesics were number five among U.S.-educated nurses but were not in the five most common among FENs.

Implications for Practice

Although discrepancies in language and interpersonal communication skills between FENs and U.S.-educated nurses have been reported in the literature (Shen et al., 2012; Shen et al., 2013; Xu et al., 2012; Xu, Bolstad, et al., 2010), the current study did not find a significant difference between FENs and U.S.-educated nurses regarding the frequency of medication errors. This absence of a difference may indicate that hospitals have been successful in recruiting competent FENs who provide a quality of care comparable to that of their U.S.-educated counterparts. Moreover, this lack of a difference may indicate that hospitals are able to offer effective training and education programs (e.g., new employee orientation and residencies, mentoring programs, continuing education programs, transition programs, and quality improvement programs) to standardize nursing care and reduce potential variations of care delivery by nurses with diverse sociocultural heritages, educational backgrounds, and other individual characteristics (Tregunno et al., 2009). The higher educational background of the FENs compared with that of U.S.-educated nurses may also be a factor that offsets their disadvantages in the areas of language and interpersonal communication.

The study further shows a change in the types of medication errors made by FENs and U.S.-educated nurses over time. In 2006, FENs were more likely to make errors that reached patients but did no harm, and U.S.-educated nurses were more likely to make errors that did not reach the patient. However, the differences between FENs and U.S.-educated nurses regarding all three types of errors disappeared in 2010. Several explanations may be possible. Some hospitals attributed the change to their implementation of computerized physician order entry (CPOE), bar-coding systems, and medication reconciliation, which reduces variation in medication administration. The literature suggesting that implementing predictive systems for medication errors and adopting electronic health records (EHR) that analyze medication orders supports this explanation (Gu, 2014).

The study found little variation between FENs and U.S.-educated nurses regarding the classes of medications involved in medication errors. Three of the five most common classes involved in medication errors in the current study—analgesic,

TABLE 3

Numbers and Percentages of FENs and USENs: Case Group Versus Control Group

	Case	Control	*p* Value
2006			
FEN	156 (34.7%)	112 (31.2%)	
USEN	294 (65.3%)	247 (68.8%)	
			> 0.10
2010			
FEN	227 (30.7%)	180 (28.6%)	
USEN	513 (69.3%)	450 (71.4%)	
			> 0.10

Note. FEN = foreign-educated nurse; USEN = U.S.-educated nurse.

TABLE 4

Consequences of Medication Errors: FENs Versus USENs

	FEN	USEN	*p* Value
2006 (*n* = 482)			< 0.01
Error not reaching patients	4.5%	13.3%	
Error reaching patients but no harm	85.8%	75.1%	
Error reaching patients with harm	9.7%	11.6%	
2010 (*n* = 777)			0.32
Error not reaching patients	16.6%	15.8%	
Error reaching patients but no harm	72.2%	76.3%	
Error reaching patients with harm	11.2%	7.9%	

Note. FEN = foreign-educated nurse; USEN = U.S.-educated nurse.

cardiovascular, and endocrine-metabolism medications—were also among the 10 most common classes involved in errors in a recent study on nursing home medication errors (Desai, Williams, & Greene, 2013). In a study investigating medication errors after initiating an EHR system, researchers found the most common medication classes involved in errors were similar to the findings of the current study. These classes include analgesics, antibiotics, cardiovascular (anticoagulant and antihypertensive) medications, and electrolyte/replacement solutions (Redley & Botti, 2013).

Implications for Policy

The lack of a significant difference between FENs and U.S.-educated nurses regarding the frequency of medication errors

TABLE 5

Five Most Common Drug Classes in Medication Errors: FENs Versus USENs

	Rank	
	FEN	**USEN**
2006		
Analgesics		5
Antimicrobials	2	1
Cardiovascular	1	2
Electrolytes/nutrition/minerals	3	3
Endocrine/metabolism	5	4
Neurologic	4	
Five most common as % of total medication error incidents	77.7%	77.7%
2010		
Analgesics	4	5
Antimicrobials	2	2
Cardiovascular	1	1
Electrolytes/nutrition/minerals	5	4
Endocrine/metabolism	3	3
Five most common as % of total medication error incidents	75.4%	72.8%

Note. FEN = foreign-educated nurse; USEN = U.S.-educated nurse.

may also indicate that state boards of nursing implement effective licensure processes that reduce potential variation of care delivery between FENs and U.S.-educated nurses related to clinical competencies. All FENs are required to pass the National Council Licensure Examination for Registered Nurses (NCLEX-RN®) to be licensed in the United States. Because each state is responsible for licensure in its jurisdiction, requirements for FENs may vary. The NCLEX-RN is a rigorous, standardized examination that ensures all RNs meet the competencies needed to perform safely and effectively, regardless of their country of training (National Council of State Boards of Nursing, 2014).

In 2006, the IOM published guidelines for preventing medication errors. Recommended system changes included CPOE systems, medication bar-coding systems, and medication reconciliation processes. These changes could have affected the decrease in medication errors for FENs and U.S.-educated nurses between 2006 and 2010 (IOM, 2006). The most evident factor noted during the study was the implementation of better technology by hospitals. This technology included a scanning system, updated medical equipment, and upgraded computer systems.

Observing the error rate by drug class can help direct efforts for nursing education at the facility, state, and national level. Currently, once an RN completes nursing school, continuing

pharmacologic education is limited to courses and educational opportunities that are determined either by the RN or the RN's employer. Medications that are safe at the beginning of an RN's practice may be determined to be harmful within just a few years because pharmaceutical changes move rapidly. Mandatory nursing pharmaceutical education on drug classes, new drugs within classes, drug interactions, drug indications, and pharmacokinetics may be warranted to reduce medication errors. The five most common drug classes involved in medication errors were similar among FENs and U.S.-educated nurses, and the areas with the highest-acuity patients use these most common medication classes.

Implications for Research

Given that the review of the literature revealed limited research, much of which is anecdotal and primarily qualitative, the current study provides a new and important piece of empirical and quantitative evidence comparing medication errors among FENs and U.S.-educated nurses. Nevertheless, research on FENs and this aspect of quality of care is still at an early stage. More research is merited to address the limitations of the study and fill the knowledge gap.

The current study was based on reported medication errors, and no information about unreported errors was available. Future research should investigate whether a difference exists between FENs and U.S.-educated nurses with respect to unreported medication errors. Because cultural differences between FENs and U.S.-educated nurses have been reported in ample studies (Xu, Shen, et al., 2010), it would be interesting to see whether the cultural differences affect unreported medication errors.

Although this study used a longitudinal design, the study was retrospective and did not yield significant differences in the frequency, type, and consequences of medication errors between FENs and U.S.-educated nurses. Even in this retrospective study, matching the case and control groups in terms of the nurses' demographics and working experience became unfeasible. Future research can use prospective or concurrent study designs to determine if similar results will be observed. Details on medication errors that are not in retrospective risk management or pharmacy records, such as workload at the time of the error, verbal miscommunications, and logistics of patient care, can be obtained from prospective studies. These factors may directly affect the occurrence of medication errors and potential patient outcomes. Time of the error was an important element to capture for the study; at one site, the records of the times of dose administration revealed that the majority of errors occurred in the 2 hours before and the 2 hours after shift change. In addition, concurrent data collection could provide opportunities to follow up with RN interviews and access to current human resource and risk management records. In fact, a concurrent study will become increasingly more practical as facilities move towards the national initiative of the meaningful

use compliance and institute electronic medical records (Office of the National Coordinator for Health Information Technology, 2013). Electronic medical records might reveal medication errors that would have been missed in written records; furthermore, they may have parameters that can be queried to obtain details on medication errors not available before the implementation of electronic medical records.

To further explain the lack of a significant difference between FENs and U.S.-educated nurses regarding the frequency of medication errors, future research also needs to examine the potential relationships of RNs' educational level and hospital characteristics with medication errors.

Of course, medication errors are only one type of medical error. The authors originally planned to examine other quality measures, such as the nursing-sensitive patient safety indicators (e.g., patient falls, decubitus/pressure ulcer formation). However, after discussing them with clinical staff, the authors realized the difficulty in allocating responsibility to individual RNs. In addition, even though medication error information is reasonably easy to obtain, ethnic background, place of birth, and citizenship are sensitive pieces of information. Sharing this type of information has legal implications for human resource departments as does documentation of performance matters regarding medication errors, and these implications may pose barriers to data collection.

Finally, caution is warranted regarding generalizing these findings because the study was conducted in a limited geographic area, some records were incomplete and had to be removed from the data at the data extraction and data analysis stages, and a large portion of the data extraction was performed manually rather than through queries of electronic records. Future research can target multiple geographic areas to verify the findings.

Conclusion

Although perceptions and questions about quality of care provided by FENs may exist because of deficiencies in language and interpersonal communication, no difference in making medication errors was found in this study. FENs provide a quality of care with respect to medication administration that is comparable to the quality of care provided by U.S.-educated nurses. Effective national regulations on nursing education and practice; FENs' relatively higher educational level compared with that of U.S.-educated nurses; health care organizations' workforce recruiting procedures and training, educational, and development programs; and health information technology may play important roles in reducing potential disparities in medication administration quality among RNs with diverse sociocultural backgrounds and educational experiences. Future prospective studies are needed to examine the quality of care delivery of FENs in broader geographic areas.

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