COMPETENCE AND CERTIFICATION OF REGISTERED NURSES AND SAFETY OF PATIENTS IN INTENSIVE CARE UNITS

By Deborah Kendall-Gallagher, RN, JD, MS, PhD, and Mary A. Blegen, RN, PhD

Background Adverse events that place patients at risk for harm are common in intensive care units. Clinicians’ level of knowledge and judgment appear to play a role in the prevention, mitigation, and creation of adverse events. Research suggests a possible association between nurses’ specialty certification and clinical expertise. The relationship between specialty certification and clinical competence of registered nurses and safety of patients is a relatively new area of inquiry in nursing.

Objective To explore the relationship between the proportion of certified staff nurses in a unit and risk of harm to patients.

Methods Hierarchical linear modeling was used in a secondary data analysis of 48 intensive care units from a random sample of 29 hospitals to examine the relationships between unit certification rates, organizational nursing characteristics (magnet status, staffing, education, and experience), and rates of medication administration errors, falls, skin breakdown, and 3 types of nosocomial infections. Medicare case mix index was used to adjust for patient risk.

Results Unit proportion of certified staff registered nurses was inversely related to rate of falls, and total hours of nursing care was positively related to medication administration errors. The mean number of years of experience of registered nurses in the unit was inversely related to frequency of urinary tract infections; however, the small sample size requires that caution be exercised when interpreting results.

Conclusions Specialty certification and competence of registered nurses are related to patients’ safety. Further research on this relationship is needed. (American Journal of Critical Care. 2009;18:106-116)
Ensuring that critically ill patients receive safe, high-quality care in the complex environment of the intensive care unit (ICU) is an ongoing challenge. The combination of complicated medical regimens, multiple caregivers, and unpredictability creates a marked risk of harm for patients. ICU incidents involving harm of patients (adverse events) or risk of harm (near-misses) are relatively common, often preventable, and multidisciplinary. Analyses of ICU data derived from self-reports of multidisciplinary incidents indicate that human-related factors such as the knowledge and skill of the clinician often contribute to adverse events.

Understanding the role that a clinician’s knowledge and skill play in the prevention of adverse events is essential for developing effective strategies for reducing the risk of harm to patients. Specialty certification is one method of validating clinicians’ knowledge in a specific area of practice. In medicine, board certification “is designed to provide an overall assessment of physician competence . . . meant to indicate that a physician has the knowledge, experience, and skills for providing quality health care within a given specialty.”

In nursing, the link between specialty certification and competence has not yet been examined. The relationship between the competence and certification of caregivers and the safety of patients is a relatively new area of inquiry in nursing. The aim of this secondary data analysis was to explore, for the first time, the association between competence of registered nurses, measured by the proportion of staff nurses with specialty certification in the unit, and safety of patients, defined by rates of occurrence of 6 types of adverse events related to nursing care in the ICU.

**Background**

Adverse events are common in ICUs. Valentin et al, in a 24-hour observational, cross-sectional study of 205 ICUs in 29 countries, identified 584 adverse events (defined as 5 types of sentinel events) that affected 391 patients. In order of decreasing frequency, observed rates of adverse events per 100 patient days were 14.5 for indwelling lines, catheters, and drains; 10.5 for medications; 9.2 for equipment; 3.3 for airways; and 1.3 for alarms. Bracco et al reported that 777 critical incidents were detected in an observational study of 1024 patients admitted consecutively to an ICU during the course of a year; 2% of the incidents were attributed to technical failure, 67% to the patient’s disease, and 31% to human error. Of the 241 human errors, 75 were related to planning, 88 to execution, and 78 to surveillance.

Although rates of adverse events calculated from voluntary self-reported data are biased because of the difficulty in identifying specific populations at risk and the selective reporting (eg, underreporting), such data reflect the state of the science and provide valuable information for designing effective interventions to reduce the risk of harming patients. Analyses of self-reported data on adverse events from 2 different systems indicated that human-related factors such as clinicians’ knowledge, training, and use of protocols were categories often identified as contributing to harm of patients.

Beckmann et al found that human-related factors accounted for 66% of factors reported as contributing to 610 incidents; 42% were knowledge related (eg, error in problem recognition) and 30% were rule related (eg, failure to follow protocol). Pronovost et al, in an analysis of 2075 incidents from 23 adult and pediatric ICUs, found numerous important system and human factors associated with harm of patients. Frequent contributing factors included training and education (49%) and knowledge, skills, and competence (32%).

About the Authors

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Incidents involving patient harm or risk of harm (near-misses) are common but often preventable.

Certification validates clinician knowledge in a specific area of practice.
Evidence suggests that certified nurses demonstrate superior substantive knowledge compared to noncertified nurses.

As the percent of RN certification increased, patient falls decreased.

Recent research\textsuperscript{9,10} highlights that a similar, but nurse-specific, level of clinical competence is required to reduce risk of harming patients in the ICU. Hurley et al\textsuperscript{10} provide a qualitative description of how expert nurses in a coronary care unit identified, interrupted, and corrected potentially fatal near-misses. Hurley et al identified antecedents of nurse-initiated interventions to reduce imminent risk of patient harm: knowledge and expertise comprising clinical skills, ethical comportment, and self-efficacy.

One method for measuring level of knowledge is specialty certification. Although definitions of certification vary slightly, the underlying concept of certification is validation of cognitive knowledge.\textsuperscript{3,11} Certification in nursing, however, is not a unified construct. As of 2000, more than 410,000 nurses had been certified in the United States and Canada, representing 67 certifying organizations offering 95 different credentials across 134 specialty organizations.\textsuperscript{12} Certification programs may be accredited, but the process is voluntary and accreditation standards may vary.\textsuperscript{13,14} Certifying organizations may overlap in types of certifications offered but differ in standards, eligibility requirements, and examinations.\textsuperscript{11,13}

Passing a cognitive certification examination neither validates nor ensures competency at the bedside,\textsuperscript{3,11} but accumulating evidence suggests that certified nurses perform better than do noncertified nurses when tested on levels of substantive specialty knowledge. Hart et al,\textsuperscript{16} in a Web-based examination designed to test the reliability of the pressure ulcer measure of the National Database of Nursing Quality Indicators (NDNQI) and to assess 256 nurses' knowledge of pressure ulcers, found that registered nurses certified in wound, continence, and/or ostomy care scored significantly higher than did other nurses in staging of ulcers.

Zulkowski et al\textsuperscript{17} examined knowledge differences among a convenience sample of 3 groups of nurses: registered nurses certified in wound care, registered nurses certified in areas other than wound care, and registered nurses with no certification. Knowledge scores differed significantly (P<.001) between registered nurses certified in wound care and registered nurses with either another or no certification (89% vs 78% or 76.5%); knowledge scores did not differ with the nurses' education or experience. Henderson-Everhardus\textsuperscript{11} found that expert nurses with specialty certification demonstrated greater accuracy in palpitation of peripheral pulses and measurement of ankle-brachial pressures than did experienced but noncertified nurses.

The certification status of registered nurses is generally not tracked. Additionally, data that are collected may not differentiate among types of registered nurse certification, making it difficult to conceptually link cognitive knowledge validated on an examination with care at the bedside. However, detailed certification questions were included in the 2004 National Sample Survey of Registered Nurses; 70.1% of advanced practice nurses reported being certified; certifications other than advanced practice were collected but not reported.\textsuperscript{13} Unit certification data also are collected through voluntary programs such as the NDNQI project,\textsuperscript{20} with data being collected from self-report nurse surveys and nurse managers.\textsuperscript{15} In a 2007 NDNQI survey of registered nurses from participating hospitals, 21% of critical care nurses surveyed reported being certified.\textsuperscript{21}

Measuring the relationship between competence of individual registered nurses and safety of patients is methodologically difficult because nursing is practiced and characterized as a group; consequently, individual competency of registered nurses must be aggregated to the patient care unit level for purposes of study.\textsuperscript{22,24} The nursing work group comprises individual registered nurses and other personnel who have different professional competencies. The proportion of certified staff registered nurses in a unit, represented in this study as registered nurse work group competence, theoretically incorporates individual nurses' competence at the bedside within a group practice model.\textsuperscript{23}

In summary, risk of harm to patients as a result of adverse events in the ICU often involves clinically complex situations that demand a high level of competence among clinicians to identify and mitigate risk. Specialty certification has been associated with nursing expertise and presumably with competence. Although certification of registered nurses measures cognitive knowledge against preset principles and standards,\textsuperscript{10} it is unknown if the knowledge translates to better care at the bedside.

This study is the first we know of in which the relationship between the proportion of nurses certified on a care unit, conceptualized as competence, and the quality and safety of care on that unit were evaluated. The importance of the study is 2-fold: (1) it provides an essential conceptual foundation for understanding how level of clinical knowledge and judgment influences the risk of harming
patients at the point of care, and (2) it explores the methodological practicality of using the proportion of certified nurses in the unit as an indicator of the competence of registered nurses at the unit level.

Methods

Two primary research questions were proposed. The first concerned the relationship between the proportion of certified staff nurses in the unit and unit rates of occurrence of 6 adverse events (medication administration errors, total falls, skin breakdown, and 3 types of nosocomial infections). The second concerned the combination of organizational and nursing characteristics (magnet status, certification, education, experience, skill mix, and total hours of nursing care per patient day) associated with unit rates of adverse events. We hypothesized that an inverse relationship exists between the proportion of certified staff nurses in each unit and the rate of each type of adverse event in that unit. Medicare case mix index was used to adjust for risk. Independent variables and definitions of outcome measures are listed in Table 1.

Approval was obtained from the institutional review board before data analyses began. A correlational, cross-sectional, unit-level design was used to conduct secondary data analysis of 48 adult ICUs from a random sample of 29 hospitals. Study data were derived from a previous retrospective, cross-sectional study on the relationship between nurse staffing patterns and quality of care in 279 inpatient units from 47 community hospitals (NINR NR0104937).

Data from the parent study were collected quarterly during the year 2000 from unit nurse managers by using 2 questionnaires that addressed nurse staffing, rates of adverse events, and organizational nursing characteristics (ie, hospital magnet status, proportion of certified staff nurses in the unit, mean years of staff nurse experience in the unit, and proportion of staff nurses with a bachelor of science degree in nursing or a higher level of education). The study protocol required units to report rates of medication administration errors and falls along with rates of other adverse events, if data were available. Staffing data, excluding nurse managers and clinical specialists, were measured on the basis of hours of care reported for each provider type (registered nurse, licensed practical nurse, and certified nursing assistant) and standardized by dividing the hours by number of patient care days reported per quarter to produce total hours of nursing care per patient day. For purposes of analysis, quarterly staffing data were aggregated to a single annual value for each unit after repeated-measures analysis of variance and graphic displays showed no systematic differences in staffing from quarter to quarter. Similar statistical procedures were used to annualize unit rates of adverse events.

SPSS software26 was used for descriptive and bivariate analyses. Hierarchical linear modeling (HLM)27 was done to test the study model that a unit’s proportion of certified staff nurses affects patients’ safety. HLM accounts for bias in estimation of rates resulting from the interrelationship among units within each hospital.28

HLM improves statistical inference by better aligning theoretical models with natural data structures.29,30 By creating submodels for each level of data (unit and hospital), HLM allows researchers to (1) study associations at the lowest level of data (eg, units), (2) examine how variables from one level affect associations on another level (eg, hospitals and units), and (3) understand how variance attributed to components of the model is partitioned between the unit and hospital level.29 In this study, the primary focus of interest was the relationships between variables at the unit level.

Results

The secondary data sample consisted of 48 adult ICUs (31 medical-surgical, 17 cardiac) in 29

<table>
<thead>
<tr>
<th>Table 1 Study variables</th>
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<tbody>
<tr>
<td><strong>Type</strong></td>
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</table>
Table 2
Descriptive statistics for unit variables

<table>
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<tr>
<th>Variablea</th>
<th>No. of units</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN yrs work, y</td>
<td>42</td>
<td>12.4</td>
<td>4.0</td>
</tr>
<tr>
<td>RN BSN edu, %</td>
<td>48</td>
<td>44.3</td>
<td>21.5</td>
</tr>
<tr>
<td>RN cert, %</td>
<td>48</td>
<td>19.8</td>
<td>18.1</td>
</tr>
<tr>
<td>THPPD, h</td>
<td>46</td>
<td>15.8</td>
<td>3.1</td>
</tr>
<tr>
<td>RN skill mix, %</td>
<td>46</td>
<td>0.9</td>
<td>0.1</td>
</tr>
<tr>
<td>MAEb</td>
<td>47</td>
<td>4.9</td>
<td>4.6</td>
</tr>
<tr>
<td>Fallsb</td>
<td>47</td>
<td>1.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Skin brkb</td>
<td>21</td>
<td>4.7</td>
<td>3.5</td>
</tr>
<tr>
<td>CCIb</td>
<td>21</td>
<td>2.4</td>
<td>2.1</td>
</tr>
<tr>
<td>BSIb</td>
<td>19</td>
<td>1.7</td>
<td>2.4</td>
</tr>
<tr>
<td>UTIb</td>
<td>13</td>
<td>2.3</td>
<td>1.6</td>
</tr>
</tbody>
</table>

a Explanations: BSI, bloodstream infection rate in unit; CCI, central catheter infection rate in unit; MAE, medication administration error rate in unit; RN BSN edu, percentage of registered nurses in the unit with a bachelor of science in nursing or a higher degree; RN cert, percentage of staff registered nurses in unit who are certified; RN skill mix, percentage of nursing staff who are registered nurses; RN yrs work, mean years worked by staff registered nurses; Skin brk, skin breakdown rate in unit; THPPD, total hours of nursing care per patient day; UTI, urinary tract infection rate in unit.

b Annual rate per 1000 patient days.

hospitals. Most units were in hospitals with a mean of 338.2 (SD, 168) beds. The mean unit size was 14.7 (SD, 6.1) beds. Units were located in hospitals with populations of patients that were predominantly female (mean, 61%; SD, 6.6%), white (mean, 70%; SD, 21.6%), and insured (mean, 82%; SD, 8.5%). Most patients were 21 to 65 years old (mean, 52%; SD, 11.9%) or older (mean, 37.3%; SD, 12.2%). Of the 29 hospitals, 5 were designated as magnet facilities. The Medicare case mix index was between 1.18 and 2.01, with a mean of 1.46 (SD, 0.18).

Descriptive statistics for unit-level variables are outlined in Table 2. Denominators of independent variables varied slightly, with number of units ranging from 42 to 48. The proportion of certified staff nurses in the 48 units ranged from 0.07% to 97%. Adverse event rates for each unit were calculated as annual unit rates per 1000 patient days. A total of 47 units reported data on medication administration errors and fall rates. Because the remaining outcome measures had various denominators (numbers of units reporting data), each outcome measure was analyzed separately. HLM algorithms account for unbalanced group sizes that may result from missing data. Caution was required in interpreting study results for measures other than medication administration errors and falls.

Correlation matrices were constructed to assess potential multicollinearity between independent variables and to evaluate linear relationships between independent and dependent variables. Independent variables were not sufficiently correlated to pose a problem regarding multicollinearity. Evaluation of potential linear relationships between independent and dependent variables produced mixed results; unit proportion of certified staff nurses showed little correlation with outcome variables (Table 3). Nurse education was negatively related to skin breakdown, and nurse experience was positively related to medication administration errors. The total number of hours of nursing care per patient day was positively correlated with both central catheter infections and bloodstream infections. Nurse skill mix was correlated positively with medication administration errors and negatively with urinary tract infections.

Multivariate analyses revealed significant associations among outcomes and independent variables, with the associations varying by measure (Table 4). Bonferroni correction was used to adjust for possible inflation of type I error due to multiple comparisons, with unit proportion of certified staff nurses set at $\alpha = .05$ and all other covariates set at $\alpha = .01$. Proportion of certified staff nurses on the unit was inversely related to frequency of patient falls ($P = .04$). Other values of interest were those of urinary tract infections (inverse relationship; $P = .07$) and bloodstream infections (positive relationship; $P = .07$). For falls, the expected rate with no predictors was 1.1 per 1000 patient days, with fall rate decreasing by 0.04 for every 1 standard deviation change in the proportion of certified staff nurses in the unit. Urinary tract infection rate decreased by 0.19 and bloodstream infection rate increased by 0.04 for each 1 standard deviation change in proportion of certified staff nurses in the unit. The total number of hours of nursing care per patient day was positively related to medication administration errors ($P = .006$). Mean years worked by staff nurses was inversely related to urinary tract infections ($P = .01$). The expected rate of medication administration errors with no explanatory variables was 4.82 medication errors per 1000 patient days, with medication errors increasing by 0.39 for each 1 standard deviation change in total hours of nursing care per patient day. The expected rate of urinary tract infections with no predictors was 2.29 per 1000 patient days, decreasing by 0.86 with each 1 standard deviation change in mean years of experience of the staff nurses. No significant associations were found for magnet status, nurse education level, and nurse skill mix.

Discussion

Our results supported the hypotheses in part. Research question 1 examined zero-order correlations between the proportion of certified staff nurses in
the unit and rates of adverse events. Significant correlations were detected between (1) years of nursing experience and rate of medication administration errors, (2) skill mix and rates of both medication administration errors and urinary tract infections, (3) nurses’ education level and rate of skin breakdown, and (4) total hours of nursing care per patient day and rates of both central catheter and bloodstream infections. No significant correlations were found between certification and outcomes. Under HLM analyses, only rate of falls demonstrated a significant relationship with certification (inverse).

Research question 2 examined multivariate relationships between adverse event rates in the unit and organizational nursing characteristics, inclusive of certification. Outcome measures showed both univariate and bivariate associations, except for skin breakdown, which showed no association. Certification was not related to rates of medication administration errors, skin breakdown, or central catheter infections. Total hours of nursing care per patient day had a positive relationship with rate of medication administration errors, and nurses’ years of experience had an inverse relationship with rate of urinary tract infections. No significant relationships were found between central catheter infections and nurses’ years of experience (P = .05) and between bloodstream infections and certification (P = .07); larger samples are required to clarify relationships, if any, among these variables. In small samples, only large differences, if they exist, can be detected.

Study results for the 2 outcome variables with data from relatively large numbers of units, medication administration errors and patient falls, align with results reported in the patient safety literature. The relationship between medication administration errors and staffing indicators (eg, total hours of nursing care per patient day, skill mix) is unclear; no association was found between central catheter infections and nurses’ years of experience. The pattern of associations among outcomes, certification, and other covariates in our study suggests that assessment of the influence of registered nurse certification on risk of harming patients is complex and difficult. Assigning a value to registered nurse certification at the unit level is also difficult; outcome measures used frequently in nursing research to examine safety of patients in acute care hospitals may not reflect higher-level cognitive processes used by ICU nurses to avoid harming patients.

Types of registered nurse certifications in ICUs vary significantly. Schmelenberg and Kramer, in a study of nurses’ work environments in 4 types of ICUs (medical/surgical, medical, surgical, neonatal/pediatric) in magnet hospitals, found that 27% of 698 staff nurse participants were certified nationally. The types of certification varied: 60% were certified in adult critical care (CCRN) and 23% were certified as an RN, C (designates certification awarded...

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Correlation matrices*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intensive care unit independent variable correlation matrix</strong></td>
<td>CMI (risk adj)</td>
</tr>
<tr>
<td>CMI (risk adj)</td>
<td>1</td>
</tr>
<tr>
<td>Magnet hosp</td>
<td>0.51b</td>
</tr>
<tr>
<td>RN yrs work</td>
<td>-0.54b</td>
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<tr>
<td>RN BSN edu</td>
<td>0.34c</td>
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<tr>
<td>RN cert</td>
<td>-0.08</td>
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<tr>
<td>THPPD</td>
<td>0.01</td>
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<tr>
<td>RN skill mix</td>
<td>-0.07</td>
</tr>
<tr>
<td><strong>Independent-dependent variable correlations</strong></td>
<td>MAE</td>
</tr>
<tr>
<td>MAE</td>
<td>0.18</td>
</tr>
<tr>
<td>Fall</td>
<td>0.17</td>
</tr>
<tr>
<td>Skin brk</td>
<td>0.04</td>
</tr>
<tr>
<td>CCI</td>
<td>-0.20</td>
</tr>
<tr>
<td>BSI</td>
<td>0.07</td>
</tr>
<tr>
<td>UTI</td>
<td>0.31c</td>
</tr>
</tbody>
</table>

*Variables: BSI, bloodstream infection rate in unit; CCI, central catheter infection rate in unit; CMI (risk adj), Medicare case mix index, risk adjuster; MAE, medication administration error rate in unit; Magnet hosp, magnet hospital; RN BSN edu, percentage of registered nurses in the unit with a bachelor of science in nursing or a higher degree; RN cert, percentage of staff registered nurses in unit who are certified; RN skill mix, percentage of nursing staff who are registered nurses; RN yrs work, mean years worked by staff registered nurses; Skin brk, skin breakdown rate in unit; THPPD, total hours of nursing care per patient day; UTI, urinary tract infection rate in unit.

b Correlation is significant at the .01 level (2-tailed).

C Correlation is significant at the .05 level (2-tailed).
Significant relationships were identified, but they varied by outcome and direction of relationship.

The results provide a preliminary foundation for further research on the relationship between certification of registered nurses and safety of patients. Future studies would be strengthened by incorporating types of certification and by the development of outcome measures designed to reflect specific nursing actions at the bedside (e.g., care associated with patients receiving mechanical ventilation).3,36 The overall focus of this study was to increase understanding of the relationships between competence and certification of registered nurses and safety of patients. Evidence is accumulating that competency of ICU nurses is an important factor in both the prevention and creation of adverse events. Certification of registered nurses is associated with expertise in a specialized area of practice. Whether or not the percentage of certified nurses in a unit who are certified becomes a nursing unit characteristic that provides an “additive effect” in combination with nurse staffing, nurse education, and healthy work environments in delivering safe, high-quality care7 depends heavily on investment in nursing certification research and alignment of the nursing certification process.

Conclusion

The purpose of this secondary data analysis was to explore the relationship between the proportion of staff nurses in a unit who are certified and the safety of patients as measured by unit rates of adverse events. An inverse relationship between unit proportion of certified nurses and patients’ outcomes was hypothesized. Even though the sample was small, significant relationships were detected but varied by outcome and direction of relationship. This study was the first in which quantitative data were used to explore the link between nurses’ competence, as measured by certification status, and patients’ outcomes. Further exploration of an empirical link between the cognitive knowledge validated on certification examinations for registered nurses and the safety of patients is recommended.

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Table 4

Results of hierarchical linear model, unstandardized multivariate coefficientsa,b

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RN cert</th>
<th>RN yrs work</th>
<th>RN BSN edu</th>
<th>THPPD</th>
<th>RN skill mix</th>
<th>CMI</th>
<th>Magnet hosp</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAE (47)</td>
<td>-0.03</td>
<td>0.09</td>
<td>0.01</td>
<td>0.39c</td>
<td>-10.18</td>
<td>-2.88</td>
<td>-0.69</td>
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<tr>
<td>Falls (47)</td>
<td>-0.04d</td>
<td>-0.02</td>
<td>0.01</td>
<td>0.11</td>
<td>-7.9</td>
<td>-0.81</td>
<td>0.11</td>
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<tr>
<td>Skn brk (21)</td>
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<td>-1.2</td>
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<td>1.05</td>
<td>-2.94</td>
<td>-3.01</td>
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<tr>
<td>CCI (21)</td>
<td>0.23</td>
<td>1.69a</td>
<td>0.04</td>
<td>0.19</td>
<td>15.17</td>
<td>2.39</td>
<td>1.23</td>
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<tr>
<td>BSI (19)</td>
<td>0.04f</td>
<td>0.39</td>
<td>0.01</td>
<td>-0.07</td>
<td>1.85</td>
<td>3.8</td>
<td>-0.75</td>
</tr>
<tr>
<td>UTI (13)</td>
<td>-0.19g</td>
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<td>0.00</td>
<td>0.08</td>
<td>-27.05</td>
<td>4.83</td>
<td>0.57</td>
</tr>
</tbody>
</table>

a Hierarchical linear model algorithms account for unbalanced group size.
b Variables: BSI, bloodstream infection rate in unit; CCI, central catheter infection rate in unit; Magnet hosp, magnet hospital; RN BSN edu, percentage of registered nurses in the unit with a bachelor of science in nursing or a higher degree; RN cert, percentage of staff registered nurses in unit who are certified; RN skill mix, percentage of nursing staff who are registered nurses; RN yrs work, mean years worked by staff registered nurses; Skn brk, skin breakdown rate in unit; THPPD, total hours of nursing care per patient day; UTI, urinary tract infection rate in unit.
c P = .006.
d P = .04.
e P = .04.
f P = .05.
g P = .07.
h P = .01.
REFERENCES


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1. Which of the following statements is true regarding harm and risk of harm in the intensive care unit (ICU) patient population?
   a. Both adverse events and near-misses are relatively common in the ICU patient population.
   b. Adverse events are common, whereas near-misses are rare in the ICU patient population.
   c. Adverse events and near-misses are rarely preventable in the ICU patient population.
   d. Risk of harm identified as near-misses are rarely multidisciplinary in nature.

2. Which of the following human-related factors discussed by the authors often contribute to adverse events in ICU patients?
   a. Disease process and age of the patient
   b. Skill and knowledge of the clinician
   c. Number of physician specialists consulting on the patient
   d. Sex of patient and type of insurance coverage

3. Which of the following statements is true regarding the relationship of nursing specialty certification and competence?
   a. Board certification demonstrates that the nurse has knowledge and experience within a given specialty.
   b. Specialty certification is the only method of validating a clinician's knowledge.
   c. The link between nursing competence and specialty certification has not yet been established.
   d. A clear link between nursing specialty certification and competence has been well established.

4. In Valentin et al, which of the 5 representative categories of adverse events was observed most often?
   a. Medication errors
   b. Indwelling lines, catheters, and drains
   c. Airways
   d. Alarm failures

5. Which of the following may bias the rates of adverse events calculated from self-reporting data?
   a. Selective reporting and inability to identify populations at risk
   b. Demographic information on the patient
   c. Number of participants and years of experience in nursing
   d. Penalties associated with medication administration errors

6. After analyzing self-reported data from 2 systems, which of the following human-related categories was identified as frequently contributing to harm of the ICU patient?
   a. Clinicians’ knowledge and use of protocols
   b. Involvement of staff in bedside research
   c. Lack of predictability of course of illness
   d. Age and sex of clinician

7. Which of the following best describes the underlying concepts of the certification process?
   a. Validation of cognitive knowledge
   b. Demonstration of clinical performance
   c. Demonstration of clinical expertise
   d. None of the above is true

8. Which of the following were adverse events evaluated by the researchers in this study?
   a. Falls and medication administration errors
   b. Respiratory failure
   c. Wound and *Clostridium difficile* infections
   d. Equipment failure

9. Which of the following best describes the hypothesis of the researchers?
   a. A direct relationship exists between each type of adverse event and proportion of certified nurses in each unit.
   b. Certified nurses will exhibit fewer medication errors compared with uncertified nurses.
   c. An inverse relationship exists between the proportion of certified nurses and each type of adverse event in that unit.
   d. No relationship exists between adverse events and the number of certified nurses on the unit.

10. Which of the following best describes the characteristics of the ICUs from which the study data were collected?
    a. Combined 10-bed pediatric and adult ICU in a 200-bed hospital
    b. Adult 15-bed medical-surgical ICU in a 350-bed hospital
    c. Adult 25-bed trauma ICU in a 550-bed hospital
    d. Adult 6-bed coronary care unit in a 150-bed hospital

11. Which of the following patients is most indicative of the population of patients served by ICUs evaluated in this study?
    a. 18-year-old African American, uninsured male
    b. 52-year-old white, insured female
    c. 68-year-old white, insured male
    d. 25-year-old Hispanic, uninsured female

12. This study was the first to use quantitative data to explore which of the following?
    a. Nurses’ competence as measured by certification status and patients’ outcomes
    b. Clinical competence as measured by decreased number of adverse events
    c. Patient outcomes in the ICU
    d. Nurses’ competence as measured by years of ICU experience and adverse events

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Fee: AACN members, $0; nonmembers, $10  Passing score: 9 Correct (75%)  Category: 0 Synergy CERP A Test writers: Kim Baxter, RN, MSN, CS-FNP

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Evidence-Based Review and Discussion Points

By Ruth Kleinpell, RN, PhD

Evidence-Based Review (EBR) is the journal club feature in the American Journal of Critical Care. In a journal club, attendees review and critique published research articles: an important first step toward integrating evidence-based practice into patient care. General and specific questions such as those outlined in the “Discussion Points” box aid journal club participants in probing the quality of the research study, the appropriateness of the study design and methods, the validity of the conclusions, and the implications of the article for clinical practice. When critically appraising this issue’s EBR article, found on pp 106-114, consider the questions and discussion points outlined in the “Discussion Points” box. Visit www.ajconline.org to discuss the article online.

Certification is a recognized method of assessing competency, knowledge, and skills. Specialty certification in nursing has been linked to patient satisfaction, nurse staffing, and retention rates. This study examines the connection between certification and patient safety. Using data from a previous study, a secondary data analysis of 48 intensive care units (ICUs) from 29 hospitals examined the relationship between certification rates and rates of medication administration errors, falls, skin breakdown, central line infection rates, urinary tract infection, and bloodstream infection rates. The results revealed that the unit proportion of certified registered nurses was inversely related to falls—that means the higher the proportion of certified registered nurses, the lower the fall rate on a unit. The hours of nursing care were associated with more medication administration errors, and having more years of nursing experience was associated with lower urinary tract infection rates.

Not all sites reported infection rates, making the results difficult to generalize. “Other than reported rates of medication administration errors and falls, hospitals varied in types of adverse events reported, making it difficult to compare reporting patterns for any one type of outcome,” said Deborah Kendall-Gallagher, RN, MS, JD, PhD, lead author on this EBR article.

This secondary data analysis provides preliminary information that indicates a need for further study to explore the relationship between nursing specialty certification and patient safety outcomes.

Information From the Authors

Kendall-Gallagher reports that the study was conducted to further explore factors that...
impacts patient safety in the ICU related to nursing certification rates. She said, "Research indicates that patient harm results from an interaction among multiple system and human factors. In nursing, a large body of evidence exists regarding the impact of system factors, such as staffing levels, on patient safety; little is known about the human factors side of the equation. Specialty certification validates a specific level of cognitive knowledge. The ICU environment is ideal for exploring the relationship between certification and patient safety for 2 reasons: there is an expanding body of knowledge related to error causation in ICUs, and there is sufficient variability in the percentage of registered nurses with specialty certification in a unit."

Kendall-Gallagher explained that the secondary data analysis used information collected in a previous study conducted in 2000 that used a 2-stage sampling strategy to obtain a random, geographically representative, sample of hospitals with 200 or more beds (NINR NR0104937). In the first stage, geographic mapping software was used in conjunction with American Hospital Association data to produce geographically representative clusters of hospitals within the United States. In the second stage, a random sample of hospitals was selected from each cluster pending organizational approval of participation in the study.

**Implications for Practice**

Findings from the study suggest a link between the level of clinical nursing expertise at the bedside and the risk of patient harm. Although limited, the study results provide a clue as to how registered nurse specialty certification may function as a viable method for validating the specific level of cognitive knowledge required of ICU nurses. As recent evidence suggests, however, combining validated cognitive knowledge through specialty certification with demonstrated performance may enhance the value of specialty certification as the "gold standard" for clinicians.

Kendall-Gallagher concludes that AJCC’s readers can best use information from the study as initial evidence of the value of certification. Information from this study can best be used when considered in the context of what is known about the interrelationship among nurse staffing, work environment, and patient safety in ICUs. Based on research, we know that appropriate staffing and positive work environments impact quality of nursing care. We also know from emerging research on error occurrence in the ICU that clinicians’ knowledge and skill level play a role in preventing or creating risk of harm for patients.

“Registered nurse specialty certification is one approach for beginning the needed exploration of how ICU nurses’ level of clinical knowledge impacts quality at the point of care. Greater understanding of the interrelationship of these factors could maximize patient safety while reducing cost of care,” noted Kendall-Gallagher.

**REFERENCES**


**eLetters**

Now that you’ve read the EBR article and accompanying features, discuss them with colleagues. To begin an online discussion using eLetters, just visit www.ajcconline.org, select the article in its full-text or PDF form from the table of contents, and click "Respond to This Article" from the list on the right side of the screen. All eLetters must be approved by the journal’s coeditors prior to publication.

**Discussion Points**

A. Description of the Study

- What was the purpose of the research?
- Why is the problem significant to nursing?

B. Literature Evaluation

- What previous research on nursing certification has been conducted?
- What has prior research on the value of nursing certification shown?

C. Sample

- How were the data collection sites chosen for this secondary data analysis?

D. Methods and Design

- How often were data collected on the study variables in the original research study?
- What 6 types of adverse events related to nursing care in the ICU were explored in this secondary data analysis?

E. Results

- What study variables were related to unit nursing certification rates?
- What study variables were related to RN education?
- What study variables were related to RN experience?

F. Clinical Significance

- What are the clinical implications of this study?
- How does the study extend the evidence base on the value of nursing certification?