Comparing Basic Knowledge in Critical Care Nursing Between Nurses From the United States and Nurses From Other Countries

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- **Background**: No previous research was found that compared basic knowledge in critical care nursing among nurses from different nations. Nurses from outside the United States were invited to participate during reliability testing of the Basic Knowledge Assessment Tool, Version 5.
- **Purpose**: To compare basic knowledge in critical care between nurses from the United States and nurses from other countries and to measure the reliability of the Basic Knowledge Assessment Tool, Version 5.
- **Sample**: Data were collected for 16 months from 682 critical care nurses: 528 from the United States and 154 from other countries.
- **Results**: The Basic Knowledge Assessment Tool, Version 5, was a reliable test for all nurses studied, regardless of country of origin. The level of knowledge of nurses from English-speaking countries other than the United States did not differ from that of nurses from the United States. Scores for nurses from non–English-speaking nations were lower than scores for nurses from the United States. The largest source of variance in scores among all subjects was the length of experience in critical care nursing.
- **Conclusions**: The Basic Knowledge Assessment Tool, Version 5, is a valid and reliable tool for assessing critical care nurses from the United States and the other countries studied. Critical care nurses from English-speaking countries scored higher than nurses from countries where the primary language is not English. (American Journal of Critical Care. 2003;12:41-46)

Basic knowledge in the practice of critical care nursing is a body of knowledge beyond that required for licensure as a registered nurse; critical care nurses use this knowledge to provide safe nursing care to patients in critical care units. Because safe practice is regarded as a moral and professional responsibility, basic knowledge is the minimum of information that is necessary for entry into critical care nursing and provides the foundation for job performance. Although basic knowledge does not guarantee safe practice, safe practice in critical care nursing cannot occur without basic knowledge.

A primary aim of orientation and in-service education in critical care nursing is to ensure that staff nurses have an understanding of this basic knowledge.

Because of ongoing research since 1979, publications related to the development of updated versions of the Basic Knowledge Assessment Tool (BKAT), and the national and international use of the BKAT in the past 18 years, the BKAT has become accepted as one standard for measuring basic knowledge in critical care nursing in the United States. Toth and Ritchey developed each version of the BKAT.

The Basic Knowledge Assessment Tool, Version 5

The BKAT, Version 5 (BKAT-5) that was used in this study was modified from the BKAT, Version 4. BKAT-5 is a 100-item paper-and-pencil test that measures knowledge in the following areas of critical care nursing practice: cardiovascular, monitoring lines, pulmonary, neurology, endocrine, renal, gastrointestinal/parenteral, and other. The category designated other includes such areas as infection control, hypo-
thermia, hemofiltration, and burns. Possible scores range from 0 to 100. The BKAT-5 has no subscales.

Validity

Content validity for each of the 5 versions of the BKAT was established through a review of the literature, clinical experience, and panels of experts in critical care nursing. Construct validity for the concept of basic knowledge has been supported through replication of research findings related to group differences and learning theory and through consistent statistically significant relationships between basic knowledge and both years of clinical experience and certification in critical care nursing.

Reliability

Internal consistency reliability was measured by using the Cronbach $\alpha$. For the first 4 versions of the BKAT, reliability ranged from an $\alpha$ of 0.73 to 0.88.

Research Questions

A review of the literature yielded no reports of studies comparing knowledge of critical care nursing between nurses from the United States and nurses from other countries. Also, no earlier version of the BKAT had been tested for reliability on nurses from countries other than the United States. For those reasons, the following research questions were used to guide the study:

- Is there a difference in basic knowledge of critical care nursing between nurses from the United States and nurses from other countries?
- What is the reliability of the BKAT-5 when used with both critical care nurses from the United States and nurses from other countries?

Purpose

The purpose of the study, therefore, was (1) to compare basic knowledge between critical care nurses from the United States and critical care nurses from other countries, and (2) to measure the reliability of the BKAT-5 when used with critical care nurses from the United States and from other countries.

Methods

Construct Validity of the BKAT-5

Data were collected during this study for the purpose of supporting the construct validity of the BKAT-5 by using the known group (or expected group) differences technique. BKAT-5 scores of 2 samples of American baccalaureate nursing students, groups known from learning theory and previous research to be different from experienced critical care nurses, were compared with the scores of critical care nurses practicing in the United States. The first group of 31 students was from a university in Delaware. Their mean score was 67.6 points (out of a possible 100 points), with a standard deviation (SD) of 9.7 points, as compared with the 528 critical care nurses from the United States, who had a mean score of 85.8 points (SD = 8.1 points). The reliability ($\alpha$) of the BKAT-5 when used with the Delaware students was 0.82. The second group of 27 student nurses was from a university in Indiana; their mean BKAT-5 score was 58.1 points (SD = 6.3 points). Both groups of students had scores that differed significantly from the mean score of critical care nurses from the United States ($P < .001$).

Sample

The sample of 528 nurses from the United States who were working in critical care was obtained from the District of Columbia and the following 24 states: California, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Michigan, Mississippi, Missouri, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, Washington, West Virginia, and Wyoming. The sample of 154 critical care nurses from other countries was obtained from the following 6 foreign countries: Australia, Brazil, Canada (Provinces of Alberta, Ontario, Saskatchewan, and Quebec), Grenada, Israel, and Thailand. All of the nurses from outside the United States spoke English. All subjects were tested with the BKAT in English.

The sampling technique was purposive because all subjects were graduate nurses or registered nurses working in a critical care unit at the time of the study. However, because all data were collected by nurse educators or managers who had requested a copy of the BKAT, the sample became self-selected. Data were collected for 16 months. Because earlier research had found no significant differences in scores when the BKAT was taken supervised versus unsupervised, tests were taken supervised or unsupervised so long as the nurses agreed to not look up the answers.
Ethics
Informed consent was obtained by the data collectors, except when the testing of nurses with the BKAT-5 was part of the required evaluation process where the nurses were employed. In the latter instance, testing was part of their job requirements.

Design
A quasi-experimental static-group comparison design was used. The independent variable was group (nurses from the United States vs from other countries). The dependent variable was the score on the BKAT-5.

Research Hypothesis
Because nurses from the United States would have the advantage over nurses from other countries whose first language was not English, the following nondirectional research hypothesis was developed to answer the first research question: There will be a difference in basic knowledge between critical care nurses from the United States and English-speaking critical care nurses from other countries. The second research question was answered directly by computing reliability coefficients (see “Findings”).

Findings
Demographic Characteristics of the Sample
The nurses from the United States came from locales that were fairly evenly scattered across the country. Table 1 shows the percentage of foreign nurses by country. More than half were from Canada; only a few were from Grenada and Israel.

Approximately 3.5 times as many nurses in the study were from the United States as from other countries (Table 2), but the mean number of years worked in a critical care unit was similar in the 2 groups. Highest nursing education completed was also similar for baccalaureate nurses in the 2 groups, but the nurses from the United States had more associate degrees and the nurses from other countries had more diplomas. The majority of all subjects were staff nurses. However, more nurses from outside the United States were in the job category designated other; these nurses were mainly faculty members in schools of nursing. This job category for nurses from the United States included head nurses, supervisors, clinical specialists, in-service educators, and faculty members in schools of nursing. Slightly more than three fourths of the nurses from other countries were associated with university hospitals, whereas the nurses from the United States were evenly divided between community/private and government hospitals.

Scores on the BKAT
Scores for the nurses from the United States ranged from 46 to 100 points, with a mean of 85.8 points (SD = 8.1 points). Scores for the nurses from other countries ranged from 35 to 98 points, with a mean of 81.7 points (SD = 11.2 points).

Ranking of the Nations
Not surprisingly, the highest ranking nations were those in which English was the first language (Table 3). Canada ranked first, higher than the United States, but the difference in scores on the BKAT-5 was not significant (t134.1 = 1.6, P > .05). Variability, however, was different, with the nurses from the United States having a larger SD (8.1 points) than the Canadian nurses (SD = 6.0 points). Consequently, the separate variance estimate was used.

Table 1 Countries outside the United States from which 154 subjects in the study originated

<table>
<thead>
<tr>
<th>Country</th>
<th>% of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>53.9</td>
</tr>
<tr>
<td>Australia</td>
<td>17.5</td>
</tr>
<tr>
<td>Brazil</td>
<td>13.6</td>
</tr>
<tr>
<td>Thailand</td>
<td>9.7</td>
</tr>
<tr>
<td>Grenada</td>
<td>3.9</td>
</tr>
<tr>
<td>Israel</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Table 2 Demographic characteristics of the sample (N=682)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Nurses from the United States</th>
<th>Nurses from other countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of subjects</td>
<td>528</td>
<td>154</td>
</tr>
<tr>
<td>Mean years in critical care</td>
<td>7.4</td>
<td>8.7</td>
</tr>
<tr>
<td>Highest nursing degree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate</td>
<td>37.7</td>
<td>0.9</td>
</tr>
<tr>
<td>Diploma</td>
<td>8.9</td>
<td>47.0</td>
</tr>
<tr>
<td>Baccalaureate</td>
<td>45.6</td>
<td>45.1</td>
</tr>
<tr>
<td>Master's</td>
<td>7.4</td>
<td>7.0</td>
</tr>
<tr>
<td>Doctorate</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Job</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff nurse</td>
<td>89.3</td>
<td>66.9</td>
</tr>
<tr>
<td>Other</td>
<td>10.7</td>
<td>33.1</td>
</tr>
<tr>
<td>Type of hospital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community/private</td>
<td>42.6</td>
<td>23.4</td>
</tr>
<tr>
<td>University</td>
<td>13.9</td>
<td>76.0</td>
</tr>
<tr>
<td>Government</td>
<td>42.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Other</td>
<td>0.9</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Numbers in table are percentages of subjects in the study unless indicated otherwise.
Reliability of the BKAT-5

In this study, internal consistency reliability (α) of the BKAT-5 was 0.84 for the nurses from the United States and 0.91 for the foreign nurses.

Hypothesis Testing

A 2-tailed null hypothesis was used to test the research hypothesis. Because previous research had consistently indicated that the number of years worked in a critical care unit was related to basic knowledge, an analysis of covariance was used to compare scores between nurses from the United States and nurses from other countries, with years of experience as the covariate.

Statistical Results. The probability level of .05 was set as the level for statistical significance. Years worked in critical care nursing (the covariate) accounted for a very large amount of differences in scores (variance) among nurses ($F_{1,6} = 72.9$, $P < .001$; the critical value of the F statistic for degrees of freedom 1,6 is 2.09). Interestingly, the differences in scores explained by years of experience in critical care nursing accounted for 36% of the explained variance, with group (nurses from the United States vs nurses from other countries) explaining the remainder (64%). Explained variance (years of experience and group) accounted for 26.8% of total variance (explained and not explained) in the analysis of covariance model.

Differences in scores between nurses from the United States and nurses from other countries also were significant ($F_{1,6} = 21.8$, $P < .001$). Therefore, the null hypothesis of no difference was rejected. After controlling for years of critical care nursing experience, a difference between nurses from the United States and English-speaking nurses from other countries was found.

Post Hoc Comparisons. Because the number of subjects from different nations was not equal and a conservative measurement was desired, the Scheffé procedure was used to make post hoc comparisons. These comparisons revealed that the scores of the nurses from Canada and the United States were significantly ($P < .01$) higher than the scores of nurses from Thailand and Brazil. The Australian nurses’ scores were higher than the scores for nurses from Brazil at the .05 level. The scores for the top 3 countries did not differ significantly (Table 3). The numbers of nurses in the study who were from Grenada and Israel were too small to make meaningful comparisons.

Discussion

Limitations

The limitations of this study were that (1) the understanding of technical English may have differed between subjects from the United States and subjects from other countries and (2) the results are applicable only to the sample studied and caution must be used when applying them to similar samples.

Reliability of the BKAT-5

Reliability of the BKAT-5 when used with English-speaking critical care nurses from outside the United States has not been reported before. The high reliability of the BKAT-5 when used with such subjects in this study is important to nurses outside the United States who administer the test, because they can be confident that the test consistently measures basic knowledge when used with subjects similar to those in this study. Before this research, it was not known whether the BKAT-5 could be recommended for use outside the United States. The reliability of the BKAT-5 with nurses from the United States is similar to the reliability found for earlier versions.

Differences in Basic Knowledge Among Nations Studied

Differences among nations in basic knowledge in critical care nursing have also not been reported before.

Table 3 Ranking of nations studied, by score on the Basic Knowledge Assessment Tool, Version 5

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>English as first language</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Canada</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>United States</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Australia</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Israel</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Thailand</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Brazil</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Grenada</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Scores from critical care nurses in the United States, Canada, and Australia were not different.

US nurses scored higher (85.8%) than nurses from other countries (81.7%), and not surprisingly, those in English-speaking countries did better than those in countries where English is not the first language.

The BKAT-5 is a valid and reliable tool for measuring basic knowledge among critical care nurses in the United States and in the nations studied.
The absence of a significant difference in basic knowledge among critical care nurses from Canada, the United States, and Australia supports the concept of basic knowledge. If knowledge is basic to safe practice, then basic knowledge should not differ from country to country. This concept was supported by earlier research findings related to no differences in basic knowledge and the following variables: type of hospital (community, university/teaching, government), type of critical care unit, job (staff nurses vs nonstaff nurses), age of the nurse, and size of the unit. That the countries of Brazil and Thailand ranked lower than the English-speaking countries studied was anticipated. However, it was not anticipated that they would do so well on a test that was not designed specifically for them and was not in their native language.

**Terminology Used in the BKAT**

Santiano et al administered the BKAT (version 4) to Australian critical care nurses. Although the Australian nurses had an overall score of 78% correct answers, problems with the terminology used in the United States may have caused the nurses to have low scores on some of the questions. This idea was supported by Boyle et al, who noted that the validity and reliability of the BKAT need to be determined in the Australian intensive care context. In this study, terminology used in the United States may also have led to lower scores in other subjects from countries outside the United States.

**Years of Experience as a Predictor of Basic Knowledge**

Previous research has consistently shown that years of experience in critical care nursing is one of the best predictors of basic knowledge in critical care. During times of serious shortage of critical care nurses, the number of years of experience is especially important for nurse educators to know when hiring nurses to work in critical care units. Because of these replicated findings, educators can “expect” that nurses coming to them with previous experience in critical care nursing should have higher basic knowledge than nurses without previous experience. BKAT scores, then, can be used to determine which nurses with previous experience need not attend orientation programs related to information that the nurses already know. Conversely, nurses with previous experience who score low on the BKAT should be given additional classes to assist them in attaining knowledge that all practitioners need. Findings from this study suggest that the number of years of experience in critical care nursing is also a predictor of basic knowledge among nurses in the countries outside the United States that were included in the study.

**Conclusions**

The following conclusions are made from the findings of this study:

- The BKAT-5 is a valid and reliable tool for measuring basic knowledge among critical care nurses in the United States and the other countries studied.
- A difference in basic knowledge in critical care nursing (as measured by a test in English) may exist between critical care nurses from the United States and critical care nurses from the countries studied where English is not the customary language.
- No difference in basic knowledge exists among the English-speaking countries of Canada, the United States, and Australia.
- The largest source of variance in scores among all the critical care nurses studied was from years of experience in critical care nursing; nurses with longer experience had higher scores.

**Recommendations**

Based on the findings of this study, the following recommendations can be made:

- This study should be replicated to include other samples of critical care nurses from outside the United States.
- A similar study should be done with the BKAT translated into the language of the nurses from outside the United States.
- Specific questions on the BKAT should be identified and modified by non–English-speaking critical care nurse educators for more accurate use in their countries.

**ACKNOWLEDGMENTS**

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