STUDY OF THE BASIC KNOWLEDGE LEVEL
OF CRITICAL CARE NURSES

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Suzanne Tovar
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APPROVAL OF THESIS PROPOSAL

Student  Suzanne Baird Tovar

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Approved by:

Mary C. Hansen, R.N., PhD. -- Advisor

Thomas S. Westbrook, PhD.

Deborah DeJong, R.N., M.S.

Dean, College of Pharmacy and Health Sciences
ABSTRACT

This retrospective data analysis was completed to determine if there is a relationship between the nurse's level of basic critical care nursing knowledge and the following variables: basic educational preparation, critical care nursing experience, cumulative nursing experience, specific critical care unit experience, and certification in critical care nursing. A convenience sampling technique was used at one midwestern hospital. The sample was comprised of 111 subjects who had completed the BKAT, a 100 question tool by Toth utilized to assess basic critical care knowledge. The sample was categorized by basic educational preparation, specific critical care unit, CCRN status, and years of nursing experience. Results indicated that nurses with more critical care experience had significantly higher BKAT scores than nurses with less critical care experience. Nurses with CCRN certification had significantly higher BKAT scores than nurses without certification. Nurses with more cumulative nursing experience also had significantly higher BKAT scores than nurses with less experience. When comparing basic educational preparation, nurses with a BSN had significantly higher BKAT scores when compared to nurses with a diploma or associate degree. However, when comparing each basic educational group separately, there was not a significant difference between the three educational groups. When comparing BKAT scores by specific critical care unit, a significant difference between the ICU and CSICU BKAT scores was found.
TABLE OF CONTENTS

ABSTRACT i
TABLE OF CONTENTS ii
LIST OF FIGURE AND TABLES iii
ACKNOWLEDGEMENTS iv

I. INTRODUCTION 1
   Overview of the problem 1
   Overview of the conceptual basis 3
   Purpose of the study 4
   Definition of terms 4
   Hypotheses 5
   Assumptions of study 6
   Significance of study to nursing 6

II. LITERATURE REVIEW 7
   Conceptual Framework 7
   Studies of critical care nursing competencies 9
   Summary of literature review 21

III. METHODOLOGY 23
   Subjects and Setting 23
   Procedure for Assessment of Learning Needs 24
   Protection of Human Subjects 25
   Instrumentation 25
   Data Analysis 27

IV. ANALYSIS 29
   Descriptive Statistics 29
   Inferential Statistics 34
   Additional Analyses 36

V. DISCUSSION AND RECOMMENDATIONS 39
   Discussion of findings 39
   Limitations of study 43
   Implications for nursing practice 45
   Recommendations for further research 46
   Conclusion 48

REFERENCES 49

APPENDICES 52
LIST OF FIGURE AND TABLES

Figure 1  Mean Years of Nursing Experience of All Subjects
Table 1  Educational Background of Subjects by Critical Care Unit
Table 2  CCRN Certification of Subjects in each Critical Care Unit
Table 3  Years of Nursing Experience by Unit
Table 4  BKAT Scores for Subjects Based on Education
Table 5  BKAT Scores Based on Critical Care Unit
Table 6  t-test Results for Critical Care Experience
Table 7  t-test Results for CCRN Status
Table 8  t-test Results for Cumulative Experience
Table 9  t-test Results for Education
Table 10 ANOVA Results for Education
Table 11 ANOVA Results for Specific Critical Care Unit
Table 12 Tukey-HSD Results for Critical Care Units
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CHAPTER 1
INTRODUCTION

Overview of the Problem

Over the past few decades, the nursing profession has been bombarded by an explosion of scientific discoveries and technological advances. With the advent of critical care units, a highly skilled and educated nursing staff is essential for the provision of quality care (Houser, 1977). To practice competently in critical care requires not only the mastery of technical skills but also the utilization of cognitive skills (Hughes, 1987).

In the midst of technological advances and budget constraints, institutions are faced with the challenges of preparing nurses to function effectively in critical care units and retaining experienced nurses in these units (Hamilton & Gregor, 1986). This need for a consistent level of clinical expertise, coupled with the variance in nurses' educational backgrounds and experience, requires institutions to assess the knowledge base of staff nurses. By doing this assessment, institutions would be aware of their staff's basic knowledge and learning needs and educational programs could be developed to meet these learning needs. Staff nurses would, therefore, be better prepared to provide high quality care for critically ill patients.

It is imperative for institutions to have a means of assessing knowledge levels of critical care nurses to ensure this quality care. Since resources are limited, institutions need to use their orientation and educational dollars wisely. With cost-effective orientation programs and programs designed to meet the learning needs of staff, the amount of dollars spent on recruitment could be decreased with a concomitant increase in retention and quality of care (Hamilton & Gregor, 1986).
Changes in health care delivery are leading to increased competition in providing cost-effective care and quality outcomes. Therefore, institutions need competent staff to provide this care. One tool that is being used to assess competency of critical care nursing staff is the Basic Knowledge Assessment Tool (BKAT) (Toth, 1984).

One aspect of competency is educational preparation. The issue of what basic educational preparation is needed for nursing has never been resolved. For an institution, the basic educational preparation has not been the issue. The issue has been what does the new staff nurse know. In this study, a comparison between basic educational preparation and knowledge levels could provide data regarding the relationship of educational preparation and the knowledge level of a staff nurse.

Another way to measure competency is the use of certification examinations. Nurses who have obtained Certification in Critical Care Nursing (CCRN) status have been promoted in several institutions as experts in providing critical care. The CCRN status is obtained by completion of a national certification examination, prepared by the American Association of Critical Care Nurses (AACN). Approximately 50,000 critical care nurses are certified in neonatal, pediatric, and adult critical care nursing by AACN (Niebuhr, 1993). Supporters of this certification believe it provides a means for recognizing those with specialized knowledge and experience while assuring the public that they are receiving care from nurses who have met a defined level of competence (Niebuhr, 1993). In this study, the knowledge levels of CCRNs will be compared to the knowledge level of staff not certified as CCRNs in an attempt to determine whether or not the CCRN status validates basic critical care knowledge.
Overview of the Conceptual Basis

According to Brookfield (1986), adults learn throughout their lives and use experience as a resource. When learning, adults prefer that the content and process have a perceived and meaningful relationship to past experiences. These life experiences have the potential to enhance or interfere with new learning. Therefore, if the adult learner experiences educational success early in life, learning is enhanced.

When adults are gathered in a classroom, learning may or may not be occurring (Brookfield, 1986). During formal educational preparation, the majority of teaching may be done in the classroom environment. Therefore, adults who complete the majority of their educational studies in the classroom environment may or may not have attained knowledge applicable to clinical practice.

Adults develop into critical thinkers by identifying and challenging assumptions as well as exploring alternative ways to complete tasks (Brookfield, 1987). Adults explore the feasibility of these alternatives and question ideas that claim to be the answer for all problems.

Adults must participate in learning voluntarily and be self-directed if meaningful learning is to occur (Brookfield, 1987). Identifying learning needs and encouraging adults to identify ways for these needs to be met assists in learning.

External sources and stimuli also play an important part in an adult's movement towards independence and self-directed learning (Brookfield, 1986). These extrinsic and intrinsic motives include patient care situations requiring knowledge the adult does not possess and/or internal realization of lack of knowledge.
Purpose of the Study

The purpose of this study was to determine if there is a relationship between the level of basic critical care nursing knowledge and the following variables: basic educational preparation, critical care nursing experience, cumulative nursing experience, specific critical care unit experience, and certification in critical care nursing.

Definition of Terms

Critical care nurse was operationally defined as a registered nurse in a critical care unit. The sample for this study consisted of critical care nurses in a selected private non-profit hospital.

Critical Care Unit was operationally defined as a nursing area with monitoring equipment where critically ill patients are admitted. The units, in this study, included the Coronary Care Unit, Intensive Care Unit, Surgical Intensive Care Unit, and Cardiac Surgical Intensive Care Unit.

Educational preparation was operationally defined as the highest level of nursing education completed. This included associate degree (AD), diploma, or baccalaureate (BSN). This was obtained by self-report.

Critical care nursing experience was operationally defined as the number of years spent working as a nurse, as a licensed practical nurse (LPN), and/or registered nurse (RN) in a critical care nursing area. This was obtained by self-report.

Cumulative nursing experience was operationally defined as the number of years spent working as a nurse, as a licensed practical nurse (LPN), and/or registered nurse (RN). This was obtained by self-report.
**Specific critical care unit experience** was operationally defined as the number of years spent working as a nurse, as a licensed practical nurse (LPN), and or registered nurse (RN) in the present critical care unit. This was obtained by self-report.

**Certification in critical care nursing** was operationally defined as having passed the American Association of Critical Care Nurses (AACN) certification examination and having maintained CCRN status at the time data was collected. This was obtained by self-report.

**Basic knowledge in critical care nursing** was theoretically defined as a body of knowledge that a critical care nurse applies in order to provide safe nursing care to the patient (Toth & Ritchey, 1984). Basic knowledge in critical care nursing was operationally defined as scores on the fourth version of the BKAT (Toth & Ritchey, 1984).

**Hypotheses**

The first research hypothesis for this study was: Nurses with more years of experience in critical care nursing will have higher BKAT scores than nurses with less years of experience. The null hypothesis stated: Nurses with more years of experience in critical care nursing will have the same or lower BKAT scores than nurses with less years of experience.

The second research hypothesis for this study was: Nurses with certification in critical care nursing will have higher BKAT scores than nurses without certification. The null hypothesis stated: Nurses with certification in critical care nursing will have the same or lower BKAT scores than nurses without certification.

The third research hypothesis for this study was: Nurses with more cumulative
nursing experience will have higher BKAT scores than nurses with less experience. The null hypothesis stated: Nurses with more cumulative nursing experience will have the same or lower BKAT scores than nurses with less experience.

The fourth research hypothesis for this study was: Nurses with a baccalaureate degree will have higher BKAT scores when compared to nurses with a diploma or associate degree. The null hypothesis stated: Nurses with a baccalaureate degree will have the same or lower BKAT scores when compared to nurses with a diploma or associate degree.

Assumption of Study

The main assumption of this study was that basic knowledge in critical care nursing is required for safe practice in critical care.

Significance of Study to Nursing

Health care is changing and the quality of care provided is being defined in terms of outcomes. Exploring the relationship between basic critical care nursing knowledge and selected demographics of critical care nurses can provide insight into the learning needs of these nurses. This information could be used by managers, educators, and professional organizations to examine the strategies needed to prepare nurses for the critical care role. In addition, individual learning needs could be identified and cost-effective education could be provided rather than giving the same education to all.
CHAPTER II
LITERATURE REVIEW

This literature review begins with a presentation of the conceptual framework for this study. This is followed by a discussion of individual studies related to critical care nursing competencies in regards to education, experience, and CCRN certification.

Conceptual Framework

Brookfield (1986) believes that when adults are in the classroom environment, learning may or may not occur. In formal educational programs, the majority of teaching is completed in the classroom environment. Many of these formal programs are organized in orderly sequences with predetermined educational objectives and activities. By focusing on attaining the predetermined objectives, incidental learning is discouraged and learning may not occur. This application has been frequently observed in nursing (Brookfield, 1991). The objectives are specified in terms of observable behavioral outcomes and are used in task-oriented instrumental learning. This type of learning does not encourage learners to develop critical thinking skills and find meaning within their experience. To build on this type of teaching, the facilitator should build on teachable moments (Brookfield, 1991).

Brookfield (1986) stresses that adult groups prefer to change directions and revise original purposes and plans of learning programs. By changing direction, unanticipated insights can occur. Therefore, this incidental learning and unplanned skill acquisition should not be regarded by the participants or facilitators as being of less value than the previously specified learning outcomes.
Teaching should be a transactional process (Brookfield, 1986). In an effective teaching-learning transaction, participants need to be self-directed for meaningful learning to occur. By encouraging adults to participate in their educational endeavours, learning is enhanced. Identifying individual learning needs and encouraging adults to identify ways for these needs to be met assists in learning. However, asking adults to take responsibility for their own learning and independence can be anxiety-producing. Therefore, these adults will need encouragement from their facilitators to participate in this process.

Adults are encouraged by their external sources and stimuli to become self-directed learners (Brookfield, 1986). The extrinsic and intrinsic motives may include patient care situations requiring knowledge the adult does not possess and an internal realization of lack of knowledge. Therefore, experience is a major motivator for learning.

Experience is an important resource for adults (Brookfield, 1986). Adults learn throughout their lives and their experiences have the potential to enhance or interfere with new learning. If the adult learner experiences educational success early in life, the potential for future learning to occur is enhanced. Also, the adult reflects on these experiences, gaining knowledge and insight on how to react in situations if they occur again. This incidental learning should be valued as highly as the learning that occurs in the classroom.

According to Brookfield (1986), the most fundamental flaw with educational programs developed with predetermined objectives is the tendency to focus on one form of adult learning. It does not take into account the most significant type of personal learning, which is the reflection on experiences. In this type of learning,
the adults reflect on their self-image, change their self-concepts, question their behavioral and moral norms, and develop a new perspective. By encouraging this type of learning, critical thinking is enhanced. Critical thinkers understand the importance of identifying and challenging assumptions, as well as, exploring alternative ways of thinking and acting (Brookfield, 1987).

When adults reflect on their experiences, they may identify learning needs and educational programs which would enhance their knowledge. Adults prefer that the content and process of the educational program has a perceived and meaningful relationship to past experiences (Brookfield, 1986). Therefore, educational programs need to be individualized to assist in the learning of all participants (Brookfield, 1990). No one can predict the range of learning outcomes that may result from this type of program development. In this process, the learners and facilitators negotiate objectives and methods of learning. Assumptions of this teaching practice are that the learners are the best judges of their own needs and the facilitator should meet these needs as requested. However, this may not always be the case. Therefore, facilitators and learners should discuss individual learning needs and develop programs based on input from both. Facilitators may be able to provide insight on individual learning needs that the learner does not identify (Brookfield, 1990).

Studies of critical care nursing competencies

Critical care nurses must make effective clinical decisions on a daily basis, therefore, clinical decision making is a highly desirable skill (del Bueno, 1983). To make these clinical decisions, critical care nurses must possess a well-developed critical care knowledge base (Oermann & Provenzano, 1992). The possession of
critical care knowledge does not guarantee effective clinical decision making, however, clinical decision making cannot occur without this knowledge (Toth & Ritchey, 1984).

Fagin and Lynaugh (1992) stated that the majority of critical care knowledge is obtained through nursing experts teaching novices the skills and rationale behind nursing cares. The theoretical knowledge, taught during educational preparation, is relevant only to the extent in which it is used in patient care activities (del Bueno, 1983). Students may have demonstrated skills as isolated tasks without emphasis on performance speed and with minimal environmental stressors (Hughes, 1987). Therefore, clinical experience combined with theoretical knowledge is essential for the development of clinical decision-making skills (Hughes, 1987).

Fagin and Lynaugh (1992) believe a common responsibility for all to share is how nurses are prepared for nursing. These authors state that nurses need to be prepared at the baccalaureate level to ensure quality patient care due to the need for in-depth arts and science education and clinical experience. According to these authors, only 22% of registered nurses complete their basic education in baccalaureate programs and less than a third possess a baccalaureate degree. To ensure safe patient care, these authors believe the proportion of nurses prepared at the baccalaureate level must exceed those prepared at the lower levels. They found that the basic educational nursing programs range from two to four years, with varying content and clinical experiences. To further complicate issues, associate degree program faculty rarely meet faculty in baccalaureate programs, creating minimal collaboration between the two faculty groups on educational decisions.

Jackle, Ceronsky, and Petersen (1977) sent questionnaires to elicit information
about students' critical care experience in school to a random sample of 104 applicants for the Minnesota State Board Examinations. The return rate was 89% and the sample consisted of 36% baccalaureate, 35% associate degree, and 29% diploma graduates, representing 32 schools of nursing. Approximately 75% of the students had experience in critical care, ranging from 6-320 hours with an average of 46 hours. The students reported caring for 1-6 acutely ill patients by observing, completing selected procedures, or helping a staff nurse provide cares. Of these students, 58% considered themselves unprepared to work in critical care with 37% citing the reason as not enough practice. Interestingly, the baccalaureate and diploma graduates were more likely to consider themselves capable of working in critical care.

Reynolds, Wood, and Gamero (1991) evaluated critical care educational preparation by sending questionnaires to 455 NLN accredited baccalaureate nursing programs. There was a 65.1% return rate, with 75% indicating their undergraduate curriculum incorporates critical care concepts. However, these concepts were incorporated in a variety of ways with two to twenty-one clinical days reported. In 39% of the programs, the critical care experience was limited to observation rather than direct patient care. The student-to-faculty ratio varied from 3-12 students per faculty person. The majority of programs used the adult critical care environment for these clinical experiences.

Oermann and Provenzano (1992) utilized the BKAT to study the effects of a critical care nursing course for nursing students. The sample consisted of 46 senior nursing students in a baccalaureate nursing program. The experimental group comprised of 31 students, six attended lecture while 25 attended lecture and clinical.
The control group consisted of 15 senior nursing students not participating in the critical care nursing course. Students enrolled in the lecture scored a mean of 66.7 on the BKAT at pretest and 72.2 at posttest. This was not statistically significant. The students enrolled in the lecture and clinical showed a statistically significant difference (p < .001) between pretest and posttest scores. When comparing BKAT posttest scores for lecture, lecture/clinical, and control groups, ANOVA revealed a significant difference (p = .007) across the groups. In this study, the hands-on experience made a difference. However, due to the disparity of group sizes, these findings have limited generalizability.

Schempe and Rompre (1986) reported that nurses from apprentice-type diploma programs, based in hospital settings, were better prepared for the real world. The majority of learning revolved around hands-on skill acquisition. By moving nursing education to the university setting and the focus on the theoretical component, the skill acquisition has been lost. This has left the college-based nursing graduate unprepared for the real world of nursing.

To deal with the disparity between education and the real world, a proliferation of nurse internship programs were developed over the years (Schempe & Rompre, 1986). These hospital internship programs were developed to bridge the gap between education and service. The programs were designed as an extended training period for new nurses. According to Gibbons and Lewison (1980), many of the nurse internship programs were required for the associate degree graduate. The diploma graduate was rarely required to participate in the program. However, due to restructuring in the hospital setting, these programs have lost popularity today. Nursing staffing patterns have changed and the cost-effectiveness of these
programs have not always been proven.

DeBack and Mentkowski (1986) studied nursing performance based on education and experience. These authors identified nursing competencies in three midwestern health care settings: acute care, long-term care, and a community agency. Eighty-three nurses were interviewed, using the Job Competence Assessment. Of these subjects, 38 were associate degree and diploma nurses while 45 possessed a baccalaureate or higher degree. Nurses with five or more years of experience ($n = 29$) were contrasted with nurses with less than five years of experience ($n = 54$). The findings showed that nurses with more education acted more independently, responsibly, or took an advocacy role for another ($p < .05$). This group also influenced others by attempting to change behaviors and coached to increase the responsibility of others ($p < .08$). Conceptualization was positively associated with experience ($p < .05$), showing that this group supported their actions with relationship between information. Interestingly, the more experienced nurses exhibited less helping skills, including less active listening, rapport, empathy, and provision of information ($p < .01$).

Most educators agree that the learning needs of experienced registered nurses differ from those of the novice nurse (Barrows, 1983). Education combined with experience influence what and how much nurses know, and that makes a difference in the health and well-being of patients (Fagin & Lynaugh, 1992). Oermann and Provenzano (1992) feel that prior experience in nursing is a significant factor in terms of job performance. This prior experience enables the nurse to acquire the knowledge and skills needed for data interpretation and interventions.

del Bueno (1983) believed the understanding of an actual nursing situation
occurs only through experience and analysis of similar and contrasting situations. This author completed a study where she provided experienced and inexperienced nurses with twelve video-simulated patient situations and asked nurses to choose appropriate actions. The simulations consisted of common physiological problems. In this study, the inexperienced nurse group consisted of 14 baccalaureate, 27 associate degree, and 3 diploma graduates. Experienced was defined as having seven months or more of nursing experience. The experienced group consisted of 15 baccalaureate nurses, 12 associate degree nurses, and 14 diploma nurses. The majority of the nurses worked with adult medical-surgical patients in critical care units or general units. The results showed that the experienced nurses made fewer decision errors in problem identification and subsequent action than those in the inexperienced group. Seventeen percent of the experienced group and nineteen percent of the inexperienced group labeled the problem incorrectly. Twenty-two percent of the experienced nurses and twenty-nine percent of the inexperienced nurses chose the wrong action. However, the experienced diploma nurses and inexperienced associate degree nurses made the most unacceptable decisions while the experienced baccalaureate nurses performed best. Forty-seven percent of the experienced baccalaureate nurses appropriately identified the problem and subsequent action.

McCloskey and McCain (1988) examined job performances of nurses in critical care units. The sample consisted of 320 nurses who joined a midwestern university in a 16-month period. The breakdown of the sample was 70 associate degree nurses, 51 diploma nurses, 188 baccalaureate nurses, and 10 master's degree nurses. Of this sample, 150 completed the study by completing self-reports at 1, 6,
and 12 month intervals. Additional data was collected from performance evaluations and the Six Dimension Scale of Nursing Performance. With regression analysis, years of RN experience was related significantly to critical care performance \((r = .24)\) and leadership skills \((r = .15)\). The years of total experience, including LPN and aide experience, was the best predictor of critical care skills \((r = .25)\). Continuing education was significantly related \((r = .18)\) to the Scale of Nursing Performance, however, formal education was not.

According to Barrows (1983), experienced nurses develop specialties in their area of practice and it is difficult to assess their basic knowledge level. These experienced nurses are regarded by others as knowledgeable and assessment of basic knowledge may not be considered. However, it is imperative that knowledge levels and lack of knowledge be recognized in all levels of critical care nursing practice.

Frandsen (1980) felt that periodic checking of competence was one way to assure competency and that this can be accomplished through examinations, performance evaluations, or other measurements. The use of examinations is a nonthreatening means of identifying a nurse's learning needs (Barrows, 1983). Whittaker and Henker (1987) agree that an examination may show that a nurse has adequate knowledge but it cannot always measure the ability to apply this knowledge in a clinical situation. However, the examinations may identify those nurses possessing the knowledge for safe practice and those without adequate knowledge levels. This type of assessment may be used to plan educational programs for staff or to identify the basic knowledge level of critical care nurses. The result can be increased competency level of staff and decreased potential of
malpractice claims against a hospital (Whittaker & Henker, 1987).

Houser (1977) studied 50 newly employed nurses in three critical care units and two post-acute units in a 1000 bed hospital. The purpose of the study was to identify the predictive factors of successful job performance, based on performance evaluations. She found a correlation between prior clinical experience, high post-orientation test scores, educational background, and job performance. The performance level of all associate degree graduates, at six months, was below the minimal expectations. The educational background of the nurse (with or without clinical experience) was not as significant a factor in test scores as it was in performance levels. The majority of the subjects took six months to adapt to the intensive care unit role. Prior clinical experience in any area was a significant predictor of successful job performance. Those with critical care experience scored higher on performance evaluations than those with other clinical experiences. However, lack of experience was not a significant predictor of low performance evaluations.

Toth (1984) administered the BKAT to a sample of 100 critical care nurses, including 18 new graduates with less than one month critical care experience. The sample included 61 baccalaureate nurses, 20 diploma nurses, 12 associate degree nurses, and 7 master's degree nurses. Scores ranged from 50 - 81, with an average of 75.5 and mean of 67.9. The length of critical care experience was found to be the best explanation and predictor of basic knowledge (p < 0.001). A statistically significant difference was found between the new graduates with less than one month of critical care experience and those nurses with greater than six months to greater than five years of critical care experience (p = 0.01). In addition,
a statistically significant difference was found between nurses certified in critical care nursing (CCRN) and those not certified \((p = 0.01)\). Neither the basic educational preparation or the type of critical care unit the nurse worked in was statistically related to the BKAT scores \((p = 0.24)\). Also, whether the test was taken on a supervised or unsupervised basis was not statistically related to the BKAT scores \((p = 0.77)\). Toth concluded that as the nurse gained critical care experience, basic knowledge increased.

Toth (1986) repeated the study by contacting 152 critical care nurses from among critical care nurses belonging to the American Association of Critical Care Nursing. Eighty-four nurses participated by completing the BKAT. The results showed that nurses with more experience in critical care nursing have more basic knowledge than do nurses with less experience \((p < .01)\). In addition, CCRNs had more basic knowledge than non-CCRN\(s\) \((p < .01)\). The length of experience in non-critical care nursing was not a significant predictor of basic knowledge \((p > .05)\). The results showed there was no significant difference in basic knowledge among nurses with an associate degree, a diploma, or a baccalaureate degree \((p > .05)\).

In studying utilization of the BKAT to assess knowledge levels, Toth and Dennis (1993) completed a study using a national sample of 93 nurses who requested copies of the BKAT over a period of 12 months. Of this sample, 58.1% completed and returned the questionnaire. Two-thirds of the sample used the BKAT during the orientation of nurses to the critical care unit. Other uses of the BKAT included placement of nurses with previous experience and evaluation of current staff. The BKAT scores were usually reviewed with the individual staff
nurse by the inservice educator. The nurses completing the study provided
information regarding their orientation programs and were using as many as five
written tests for orientation. These tests included the BKAT as well as EKG and
medication tests.

Toth (1994) completed another study using a purposive, stratified national
sample of 106 critical care nurses from seven midwestern and eastern states. The
dependent variable was basic knowledge. The independent variables were
experience in critical care nursing and CCRN certification. Other data collected
included years of experience in non-critical care nursing, educational preparation,
critical care unit, job status, type of hospital, and size of unit. Experience in critical
care ranged from new hire to 25 years. The results supported the theory that nurses
with more critical care nursing experience have more basic knowledge than nurses
with less experience. The findings also revealed that nurses with CCRN
certification have more basic knowledge than non-CCRNs. Variables that were
unrelated to basic knowledge included years worked in a non-critical care unit,
educational preparation, type of critical care unit, job status, type of hospital, and
size of critical care unit.

Ressler, Kruger, and Herb (1991) used the BKAT to evaluate new critical care
hires. They compared critical care nurse interns, experienced critical care nurses,
and medical-surgical nurses. The convenience sample consisted of 24 critical care
interns, 35 experienced critical care nurses, and 25 experienced medical-surgical
nurses. The intern group consisted of 18 baccalaureate graduates, 4 associate
degree graduates, and 2 diploma graduates. The experienced critical care group
consisted of 13 baccalaureate nurses, 10 associate degree nurses, and 12 diploma
nurses with years of experience in critical care ranging from 0.3 - 11 years (average 2.99 years). The 25 experienced medical-surgical group consisted of 12 baccalaureate nurses, 6 associate degree nurses, and 7 diploma nurses with medical-surgical experience ranging from 0.5 - 9 years (average 2.93 years). After 6 months of employment, there was a statistically significant difference between the groups' scores (p < .05). The interns had the highest BKAT mean score (88.25) while the medical-surgical group had the lowest. After one year, the interns maintained the highest mean but it was not significantly different from the other groups.

Hartshorn (1992) evaluated a critical care nursing internship program by administering the BKAT to critical care interns and preceptors. The 33 nurses in the intern group consisted of 19 baccalaureate graduates, 9 associate degree graduates, and 5 diploma graduates. The number of preceptors involved was not given. The average score was 83 for the preceptors while the average intern score was 75. For the intern group, the mean score on the BKAT prior to the internship program was 75, while the BKAT score after the internship program was 82. This was statistically significant. In five of the cases (33.3%), the interns scored higher on the BKAT than their preceptors. According to Hartshorn (1992), the preceptors' low scores may suggest that their knowledge of critical care nursing may be limited in some areas and a study should be developed to specifically assess the preceptors' knowledge base.

Henry and Waltmire (1992) used the BKAT, a Cardiovascular Self-Evaluation Tool, and four computerized clinical simulations to discriminate between nurses with varied levels of knowledge and experience. The convenience sample consisted
of 23 inexperienced (less than 1 year) critical care nurses and 119 experienced (1 or more years) critical care nurses. Of this sample, 53.5% were prepared at the baccalaureate level. The experienced critical care nurses had significantly higher (p < .001) BKAT scores than the less experienced nurses. Also, current and previous advanced cardiac life support (ACLS) certified nurses scored significantly higher (p < .001) on the BKAT than the nurses who had not been ACLS certified. The authors concluded that the BKAT discriminated between experienced/inexperienced nurses and ACLS-certified/non ACLS-certified critical care nurses.

To explore the relationship between the BKAT and computer-based clinical simulation performance, Henry and Holzheimer (1993) completed a study of 68 critical care nurses. The majority of the sample consisted of nurses educated at the baccalaureate level. The subjects completed the BKAT and four computer simulations of EKG interpretation and appropriate interventions. Two of the simulations significantly correlated (p = .001) with knowledge as measured by the BKAT. However, the other two computer simulations significantly correlated only with self-evaluation of expertise (p = .049) and not with BKAT scores.

Certification in critical care nursing (CCRN) has been promoted as a means of verifying competency. Therefore, it is postulated that nurses with CCRN certification have attained the basic knowledge required for critical care nursing practice. Supporters of certification believe it is a mechanism to assist practitioners in validating competence in practice while patients and families can be confident that a knowledgeable nurse is providing safe care (Dunbar, 1985; Johnson, 1985; Coleman et al, 1988). However, those against certification believe there are nurses
that are able to perform nursing skills and provide high-quality patient care but are unable to become certified due to poor test-taking skills (Johnson, 1988).

Therefore, the success on a written examination for certification documents the possession of a theory base, but does not document competent practice (Johnson, 1988). Also, it could be possible that an individual would continue to be certified by completing continuing education to obtain recertification but would be unable to pass the original test (del Bueno, 1988). Therefore, employers and consumers could have a false sense of security by thinking a recertified individual possessed the current basic knowledge relevant to the profession (del Bueno, 1988).

Walthall et al (1993) investigated CCRN status and knowledge with a sample of 212 nurses at five Detroit institutions. The participants were asked if digitalis should be withheld for a heart rate less than 60 beats/min and to provide the rationale for their answer. Forty percent of the respondents held a baccalaureate degree, 14 percent were CCRN certified, and over half of the respondents worked in a critical care unit. Eighty-one percent of the total respondents inappropriately withheld digitalis or administered it without appropriate rationale. CCRN nurses were three times more likely than non-CCRN nurses to respond correctly. After multivariate analysis, CCRN certification was the only statistically significant predictor of correct responses.

Summary

Based on the literature review, additional research is needed in this area. There is a need to examine this relationship at one institution, utilizing demographic variables similar to Toth's study. If research can show a correlation between critical care nursing knowledge and other variables, assumptions could be made and
expectations outlined when hiring and orienting critical care nursing staff, regarding the possession of basic critical care nursing knowledge.
CHAPTER III
METHODOLOGY

Subjects and Setting

This study was a retrospective data analysis, utilizing information previously collected by this investigator as part of the hospital's plan to identify the educational needs of critical care staff. A convenience sampling technique was used with critical care staff nurses at one midwestern hospital. The total population of critical care nurses in this hospital was 180 registered nurses. Subjects consisted of registered nurses working in the critical care units in this hospital who have taken the BKAT.

The setting for the study was a 550-bed private non-profit hospital. The critical care units where the sample was employed were the Cardiac Surgical Intensive Care Unit, Surgical Intensive Care Unit, Medical Intensive Care Unit, and Coronary Care Unit. The Cardiac Surgical Intensive Care Unit consisted of 14 beds with a patient population primarily consisting of pediatric and adult open heart surgical patients and heart transplant patients. The Surgical Intensive Care Unit consisted of eight beds with a patient population primarily consisting of adult general surgical patients, adult trauma patients, and kidney transplant patients. The Medical Intensive Care Unit consisted of 16 beds with a patient population primarily consisting of neurosurgical patients, neurotrauma patients, chronic obstructive pulmonary disease patients, and patients without surgical intervention. The Coronary Care Unit consisted of 33 beds with a patient population primarily consisting of acute myocardial infarction patients, coronary angioplasty patients, and cardiac arrest patients.
Procedure for Assessment of Learning Needs

The critical care nursing division identified the need to assess staff learning needs. Prior to the assessment, permission to collect demographic data and administer the BKAT to critical care registered nurses in the hospital was obtained from the critical care unit nursing directors and the administrative director of nursing for critical care (Appendix A). This assessment was done to assist the critical care educators in identifying learning needs and planning educational programs.

Critical care staff lists were obtained from each critical care unit nursing director. A memo explaining the BKAT, demographic data collection tool, and purpose of collecting this information was distributed to each critical care department for posting (Appendix B). The investigator, in her role as a clinical educator, met with the clinical educators from each critical care unit to discuss the process. The investigator attended individual unit meetings, as needed, for further clarification to staff. The staff were reminded that their participation and scores on the BKAT would remain confidential and would not affect their job status or performance appraisal. A time period of at least 45 minutes was set for completion of the BKAT. However, individual subjects were allowed more time for BKAT completion if needed.

The BKAT was initially distributed at unit department meetings, allowing subjects the time to complete the BKAT at the department meeting. After initial distribution, copies of the BKAT were distributed to unit educators to administer to the subjects who were not present at the department meeting. Completion of the BKAT was unsupervised. According to Toth (1984), the BKAT has been
administered in a supervised and unsupervised manner with no statistical difference. After completing the BKAT, the subject could return the BKAT to the unit educator or send it to the investigator through the hospital mail system. The official answers to the BKAT were kept by the investigator and all BKATs were scored by the investigator.

Protection of Human Subjects

Based on staff's input and to assure confidentiality, the last four digits of each staff nurse's social security number was used to code the answer sheet and demographic form. Anonymity was maintained during scoring by the investigator. The individual results and original answer sheet were returned to the staff nurse by the educator. In one critical care unit, the staff requested anonymity and this was assured by using random numbers to code answer sheets. Results were distributed by leaving answer sheets in the area and individual staff members retrieving their answer sheet.

Data was coded by the investigator, using the last four digits of the social security number or random numbers. The completed forms were stored in a locked box in the investigator's home. The data were reported in the aggregate form and individual results were not reported.

Instrumentation

A demographic form (Appendix C) was utilized to gather data on the following variables: critical care nursing experience, years in present critical care unit, cumulative nursing experience, basic nursing education, and CCRN status. The BKAT, Version 4, (Appendix D) was utilized to assess basic knowledge. Permission to use the BKAT in this study was obtained by the investigator.
This tool consisted of 100 multiple choice and fill-in-the-blank items. These items measured recall and application of basic knowledge in the following areas: cardiovascular, pulmonary, neurology, endocrine, renal, and gastrointestinal systems and invasive line monitoring. The possible score range was 0 - 100. For scoring purposes, there was a breakdown of items relating to each content area (Appendix F) and a score sheet developed to tally the scores in each area (Appendix G).

Content for the BKAT was determined through a literature review, interviews with head nurses and critical care nurses, and suggestions from two critical care physicians and a nine-member panel of experts in critical care nursing practice and education (Toth, 1984). Toth and Ritchey (1984) tested BKAT Version 1 on a sample of 100 critical care nurses, including 18 new graduate nurses with less than one month experience in critical care nursing. Reliability was established by Cronbach's coefficient alpha result of 0.86. Revisions of the tool were made using item analysis results. The original panel of experts and two additional nurse experts were consulted to ensure content validity for the revised tool (Version 2). Version 2 was evaluated on data from a sample of 38 baccalaureate nursing students and 92 critical care nurses who had not previously answered the BKAT (Toth, 1984). Cronbach's coefficient alpha result of Version 2 was 0.83 - 0.86. Item analysis was completed and the panel of experts were consulted to verify content validity for the revised tool (Version 3) (Toth, 1984). BKAT Version 3 was studied by Toth (1986) using a sample of 84 critical care nurses. Cronbach's coefficient alpha was 0.73 on Version 3. Version 3 was revised and Version 4 has shown Cronbach's coefficient alpha of 0.88 (Toth & Dennis, 1993).
Data Analysis

The demographic data included registered nursing experience, critical care nursing experience, years in specific critical care unit, cumulative nursing experience, basic nursing educational preparation, and CCRN status. Basic nursing educational preparation was categorized as 1) diploma 2) associate degree 3) baccalaureate degree in nursing. The breakdown of basic nursing educational preparation and CCRN status for nurses in each area were displayed in a table. Also, CCRN status was categorized as 1) yes 2) no and reported as percentages.

Descriptive statistics were used to summarize the data. The means and standard deviation for registered nursing experience, critical care nursing experience, cumulative nursing experience, and years in present unit were presented in a table and graph. The BKAT score was reported as a mean and standard deviation by basic nursing educational preparation and by specific critical care unit. In addition, the range of BKAT scores were reported in each critical care area. These results were presented in a table.

Inferential statistics were used to determine if there was a relationship between the study variables, as hypothesized by the researcher. One tailed t-test, with alpha level of .05, was used to test the hypotheses. To differentiate the nurses with more years of experience from the nurses with less years of experience, the subjects were divided based on the cumulative nursing experience median. To differentiate the nurses with more years of experience in critical care nursing from the nurses with less years of experience, the subjects were divided based on the critical care nursing experience median. To test the hypothesis based on education, the subjects were divided into two groups of baccalaureate prepared nurses and non-baccalaureate...
prepared nurses.

One-way ANOVA was used to test for a significant relationship between BKAT scores and the following variables: critical care nursing experience, cumulative nursing experience, specific critical care unit, and basic nursing educational preparation. Multifactor analysis was completed to test relationships between variables.
CHAPTER IV

ANALYSIS

Descriptive Statistics

The critical care nurse population at the time of data collection was 180 registered nurses. A total of 114 subjects completed the BKAT and demographic form. Three of the subjects returned incomplete demographic forms and their data was not included in the study. The return rate of usable data was 111 subjects (61%).

To analyze the data, the subjects were categorized by basic educational preparation, specific critical care unit, and years of nursing experience. The 111 subjects consisted of 47 diploma nurses, 28 associate degree nurses, and 36 baccalaureate nurses. The number of subjects for each area was: 23 subjects from the Medical Intensive Care Unit (ICU); 19 subjects from the Surgical Intensive Care Unit; 34 subjects from the Cardiac Surgical Intensive Care Unit (CSICU); and 35 subjects from the Coronary Care Unit (CCU).

Basic educational preparation for each of the critical care units varied by the individual area. As can be seen in Table 1, the majority of the ICU nurses were diploma prepared (52%). In the SICU area, the educational background was equally distributed among the subjects between all three educational programs. In the CSICU area, the majority of nurses were baccalaureate (44%) or diploma graduates (40%). In the CCU area, the majority of nurses were associate degree (34%) or diploma (40%) prepared.
Table 1

**Educational Background of Subjects by Critical Care Unit**

<table>
<thead>
<tr>
<th></th>
<th>ICU</th>
<th>SICU</th>
<th>CSICU</th>
<th>CCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma</td>
<td>12</td>
<td>7</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>ADN</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>BSN</td>
<td>6</td>
<td>6</td>
<td>15</td>
<td>9</td>
</tr>
</tbody>
</table>

Of the total sample, 13% of the nurses were CCRN certified. As can be seen in Table 2, the number of subjects with CCRN certification varied by areas. Of these CCRN certified nurses, 64% were from the CSICU area, 21% from the CCU area, 7% from the ICU area, and 7% from the SICU area.

Table 2

**CCRN Certification of Subjects in each Critical Care Unit**

<table>
<thead>
<tr>
<th></th>
<th>ICU</th>
<th>SICU</th>
<th>CSICU</th>
<th>CCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCRN</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

In analyzing years of nursing experience, 75% of the respondents had greater than two years of RN experience with 30% of the respondents having nine or more years RN experience. Cumulative experience was based on the total of RN and LPN experience reported for each individual. Seventy-six percent (n = 87) of the respondents reported no previous LPN experience. Of the nurses that reported
LPN experience, 93% reported one year or less of LPN experience. Therefore, there is a minimal difference between the cumulative years of experience and RN experience alone.

As can be seen in Figure 1, the highest mean nursing experience was cumulative experience. Critical care experience was differentiated from specific unit critical care experience with fifty percent of the respondents having more than three years of critical care experience. The total years of critical care experience ranged from new graduates to 27 years of critical care experience. Forty percent of the nurses had 2 - 6 years of critical care experience.

The years of nursing experience varied by the type of experience. Years of specific critical care unit experience ranged from new graduates to 27 years of experience in the specific unit. Fifty percent of the respondents had more than two years of experience in the specific unit. One-third of the nurses reported 2 - 6 years of experience in the specific unit. Based on self-report, one nurse had worked in critical care and the same unit during her entire RN experience (27 years).

![Figure 1](Image)

Figure 1. Mean years of nursing experience of all subjects.
As can be seen in Table 3, the years of nursing experience varied for subjects in each of the areas. In the ICU area, 50% of the subjects possessed two or less years of critical care experience. In the SICU area, 50% of the subjects possessed four or more years of critical care experience. In the CSICU area, 50% of the subjects possessed 6.5 or more years of critical care experience. In the CCU area, 50% of the subjects possessed two or less years of critical care nursing experience. The CSICU area maintained the highest mean years of nursing experience in each of the categories. For the total sample the mean years of critical care nursing experience was 5.21 years (Mdn = 5.1).

Table 3

Years of nursing experience by unit

<table>
<thead>
<tr>
<th></th>
<th>ICU</th>
<th>SICU</th>
<th>CSICU</th>
<th>CCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>5.61</td>
<td>6.40</td>
<td>9.58</td>
<td>7.43</td>
</tr>
<tr>
<td>SD</td>
<td>7.84</td>
<td>3.90</td>
<td>6.79</td>
<td>5.91</td>
</tr>
<tr>
<td>Cumulative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td>4.80</td>
<td>6.31</td>
<td>9.25</td>
<td>6.59</td>
</tr>
<tr>
<td>SD</td>
<td>7.09</td>
<td>4.00</td>
<td>6.83</td>
<td>5.63</td>
</tr>
<tr>
<td>Critical care</td>
<td>4.06</td>
<td>4.57</td>
<td>7.68</td>
<td>4.53</td>
</tr>
<tr>
<td>SD</td>
<td>5.87</td>
<td>3.91</td>
<td>5.50</td>
<td>4.40</td>
</tr>
<tr>
<td>Unit</td>
<td>3.79</td>
<td>3.76</td>
<td>5.55</td>
<td>2.80</td>
</tr>
<tr>
<td>SD</td>
<td>5.94</td>
<td>3.01</td>
<td>4.75</td>
<td>2.94</td>
</tr>
</tbody>
</table>
As can be seen in Table 4, scores on the BKAT varied by educational background with the BSN group scoring the highest mean. The overall mean BKAT score for all subjects was 82.1 (SD = 7.00).

Table 4

BKAT scores for subjects based on education

<table>
<thead>
<tr>
<th>Education</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADN</td>
<td>28</td>
<td>81.6</td>
<td>6.33</td>
</tr>
<tr>
<td>Diploma</td>
<td>47</td>
<td>81.7</td>
<td>7.56</td>
</tr>
<tr>
<td>BSN</td>
<td>36</td>
<td>84.3</td>
<td>6.56</td>
</tr>
</tbody>
</table>

The BKAT scores varied according to the critical care unit of employment (see Table 5). Subjects in the CSICU and CCU area scored the highest with a score of 94 points. In the ICU and CCU areas, 40% of the nurses scored greater than 85. In the SICU area, 40% of the nurses scored greater than 82. In the CSICU area, 40% scored greater than 86.

Table 5

BKAT Scores based on Critical Care Unit

<table>
<thead>
<tr>
<th>Unit</th>
<th>n</th>
<th>range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU</td>
<td>23</td>
<td>65 - 91</td>
<td>79.78</td>
<td>8.38</td>
</tr>
<tr>
<td>SICU</td>
<td>19</td>
<td>70 - 93</td>
<td>80.84</td>
<td>7.16</td>
</tr>
<tr>
<td>CSICU</td>
<td>34</td>
<td>73 - 94</td>
<td>85.03</td>
<td>5.40</td>
</tr>
<tr>
<td>CCU</td>
<td>35</td>
<td>70 - 94</td>
<td>82.80</td>
<td>6.68</td>
</tr>
</tbody>
</table>
Inferential Statistics

A t-test and alpha level of .05 was used to study the hypotheses. The first hypothesis tested was: Nurses with more years of experience in critical care nursing will have higher BKAT scores than nurses with less years of experience. The critical care nursing experience group was divided into two groups by those subjects above the median years of critical care experience (> 5.2) for one group and those subjects below the median years of critical care experience (≤ 5.2) for the second group. As can be seen in Table 6, the nurses with more critical care experience had significantly higher BKAT scores than nurses with less critical care experience.

Table 6

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>M</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>More CC exper.</td>
<td>37</td>
<td>86.59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less CC exper.</td>
<td>73</td>
<td>80.53</td>
<td>108</td>
<td>4.67</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

*** p < .001.

The second hypothesis tested was: Nurses with certification in critical care nursing will have higher BKAT scores than nurses without certification. As can be seen in Table 7, the nurses with certification in critical care nursing had significantly higher BKAT scores than nurses without certification.
The third hypothesis tested was: Nurses with more cumulative experience will have higher BKAT scores than nurses with less experience. The cumulative nursing experience group was divided into two groups by those subjects above the median years of cumulative experience (> 6.8) for one group and those subjects below the median years (≤ 6.8) for the other group. As can be seen in Table 8, the nurses with more cumulative experience had significantly higher BKAT scores than nurses with less cumulative experience.

Table 8

<table>
<thead>
<tr>
<th>t-test Results for Cumulative Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>More experience</td>
</tr>
<tr>
<td>Less experience</td>
</tr>
</tbody>
</table>

**p < .01.**
The fourth hypothesis tested was: Nurses with a baccalaureate degree will have higher BKAT scores when compared to nurses with a diploma or associate degree. As can be seen in Table 9, the nurses with a baccalaureate degree had significantly higher BKAT scores when compared to the group of nurses with a diploma or associate degree.

Table 9

_t-test Results for Education (BSN vs. non-BSN)_

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>M</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSN</td>
<td>36</td>
<td>84.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-BSN</td>
<td>75</td>
<td>81.67</td>
<td>109</td>
<td>1.88</td>
<td>0.031*</td>
</tr>
</tbody>
</table>

Note: Non-BSN group consisted of associate degree and diploma subjects.

*p < .05.

Additional Analyses

One-way ANOVA was completed to see if there was a difference between BKAT scores and each educational group: associate degree, diploma, and baccalaureate degree. As can be seen in Table 10, no statistically significant difference was seen.

Table 10

_ANOVA results for Education_

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>169.55</td>
<td>2</td>
<td>84.77</td>
<td>1.75</td>
<td>0.178</td>
</tr>
<tr>
<td>Within Groups</td>
<td>5222.15</td>
<td>108</td>
<td>48.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
One-way ANOVA was conducted to see if there was a difference in BKAT scores based on employment in specific critical care unit. As can be seen in Table 11, there was a statistically significant difference in the scores by critical care units.

Table 11
ANOVA Results for Specific Critical Care Units

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>442.68</td>
<td>3</td>
<td>147.56</td>
<td>3.19</td>
<td>.027*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>4949.01</td>
<td>107</td>
<td>46.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Analysis of Variance was completed to compare the 4 critical care units.

*\( p < .05 \).

A post-hoc test, the Tukey-HSD procedure, was completed to test the difference between individual units. As can be seen in Table 12, there was a statistically significant difference between the ICU BKAT scores and CSICU BKAT score. The mean ICU score was 79.78 while the CSICU mean score was 85.03.

Table 12
Tukey-HSD Results for Critical Care Units

<table>
<thead>
<tr>
<th>Group</th>
<th>Grp 1</th>
<th>Grp 2</th>
<th>Grp 4</th>
<th>Grp 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Group 1 = ICU; Group 2 = SICU; Group 3 = CSICU; Group 4 = CCU.
Multifactor analysis was completed to test for additional significant relationships. There was not a statistically significant interaction between basic education and area with regard to influence on BKAT score. There was not a statistically significant interaction between education and RN experience with regard to influence on BKAT score. No statistically significant interaction between education and CCRN certification with regard to influence on BKAT score was found. No statistically significant interaction was found between RN experience and CCRN certification with regard to influence on BKAT score.

In checking all variables, no statistically significant interaction was found between education, CCRN certification, and critical care area with regard to influence on BKAT score. No statistically significant interaction was found between RN experience, CCRN certification, and critical care area with regard to influence on BKAT score. No statistically significant interaction was found between basic education, CCRN certification, RN experience with regard to influence on BKAT score.
CHAPTER V
DISCUSSION AND RECOMMENDATIONS

This chapter begins with a discussion of this study's findings. An identification and discussion of limitations in this study as well as implications of this study for nursing practice is presented. Lastly, recommendations for further research are outlined.

Discussion of Findings

The purpose of this study was to examine variables that may affect the nurse's level of critical care nursing knowledge. When comparing nurses' BKAT scores between critical care units, there was a statistically significant difference found between the ICU nurses' scores and CSICU nurses' scores. This may be due to the difference between the groups in years of cumulative experience. The ICU subjects were the least experienced (5.6 years) while the CSICU subjects were the most experienced (9.6 years). The majority of CCRN subjects were from the CSICU area while only one subject was from the ICU area. Also, this researcher postulates that the difference between scores may be due to the type of questions on the BKAT and the patient care provided in these two units. This researcher has reviewed the types of patients, equipment, and critical care knowledge utilized in these specific units. The ICU is a medical unit caring for neurological patients, pulmonary patients, and patients without surgical intervention. In the ICU, there is a strong focus on pulmonary and neurological knowledge and equipment related to these systems. The ICU nurses have a limited exposure to pulmonary artery lines and hemodynamic monitoring. In the CSICU, the patient population consists of pediatric and adult open heart surgical patients and heart transplant patients. There
is a strong focus on cardiac and pulmonary knowledge and equipment related to these systems, including a strong knowledge level of hemodynamics. When reviewing the BKAT content, 31 questions are related to cardiovascular concepts and 11 questions are related to monitoring lines. These two areas would focus on knowledge the CSICU nurse would use frequently. For the ICU nurse, ten questions are related to pulmonary knowledge and ten questions related to neurology knowledge. Therefore, this researcher postulates that the CSICU nurses should have higher scores based on the BKAT content and experience level of the staff.

Based on Brookfield's conceptual framework, adults learn throughout their lives and they use experience as a resource (Brookfield, 1986). In this study, experience became an important factor in regard to the possession of basic critical care knowledge. Brookfield has also addressed formal education and the way adults learn, implying that learning may or may not occur in this milieu. In this study, the basic education was not a crucial factor in regards to the possession of basic critical care knowledge.

Several studies have been completed regarding critical care nursing competencies and the ways critical care knowledge is obtained (Reynolds, Wood, & Gamero, 1991; McCloskey & McCain, 1988). Educational preparation that includes critical care content and skill development has been encouraged, however, a standard educational program across all nursing schools has not been developed. Therefore, the amount of critical care knowledge obtained through formal education varies by the type of basic educational preparation (diploma, ADN, and BSN) and by the individual schools of nursing. Studies have linked more nursing education with
increased independency, responsibility, and coaching capabilities of the individual nurse (DeBack & Mentkowski, 1986). Generally, when comparing different educational programs, these studies showed that baccalaureate nurses performed better in actual nursing practice, simulations, and tests of basic critical care nursing knowledge. In this study, analysis showed there was a difference between the basic critical care knowledge of BSN nurses when compared to non-BSN nurses. When comparing each educational group (diploma, ADN, and BSN) individually, a significant difference was not found. However, the years of cumulative nursing experience for each educational group varied. The diploma group possessed the highest years of experience (8.4) followed by the baccalaureate group with 6.9 years, and the associate degree group with the least years of experience (4.7).

After completing basic educational preparation, there remains a disparity between education and practice. What is taught in nursing school does not equate to what is expected for performance as a critical care nurse. Further education in the practice area is required for the new graduate to function competently. In this study, those nurses who became CCRN certified possessed more basic critical care knowledge than those nurses without CCRN certification. Nurses prepare for the CCRN examination by completing coursework, attending seminars, and reviewing the literature. Therefore, additional education is completed to obtain this critical care knowledge.

Several studies have been done to identify whether basic educational preparation and/or nursing experience were valid predictors of critical care nursing knowledge the individual nurse possessed (Houser, 1977; del Bueno, 1983; Toth, 1986; McCloskey & McCain, 1988). Of these studies, nursing experience continued to
prove as a valid predictor of critical care nursing knowledge. As a nurse gained experience, critical care nursing knowledge was obtained. This was supported in this study by the significant difference in BKAT scores when comparing nurses with more critical care experience to those nurses with less critical care experience.

Toth completed several studies, utilizing the BKAT, to explore relationships between basic critical care nursing knowledge and the following: education, experience, and CCRN certification. The results of these studies demonstrated that CCRN certification and critical care nursing experience were significant predictors of basic critical care nursing knowledge. Educational preparation was not a significant predictor of basic critical care nursing knowledge. Other variables unrelated to basic knowledge attainment included years worked in a non-critical care unit, type of critical care unit, job status, type of hospital, and size of critical care unit.

The sample size of this study was 111 critical care nurses, similar to Toth's 1994 study consisting of 106 nurses. However, the sample of this study was obtained from one institution compared to Toth's sample from seven midwestern and eastern states. Also, there were four critical care units in this study compared to eleven types of units identified in Toth's study.

Regarding educational preparation in this study, 42% of the subjects were diploma prepared, 25% ADN prepared, and 32% BSN prepared. In Toth's study, 19% were diploma prepared, 18% ADN prepared, 58% BSN prepared, 2.9% master's prepared, and 1.9% doctorate prepared. However, CCRN certification was similar with 13% of the subjects CCRN certified in this study and 18.4% certified in Toth's study.
Critical care nursing experience was similar with zero (new to critical care) to 27 years of experience in this study while Toth's study included subjects with up to 25 years of critical care nursing experience. The average length of experience in this study was 5.21 years compared to Toth's average of 5.4 years.

BKAT score ranges also differed. In this study, scores ranged from 65 - 94 points, with an overall mean of 82.1. In Toth's study, the mean score was 80.2.

Based on analysis in this study, critical care experience significantly positively affected BKAT scores and CCRN certification significantly positively affected BKAT scores. These findings were congruent with Toth's findings.

General nursing experience correlated with significantly higher BKAT scores in this study. Toth's study showed that the years working in a non-critical care unit was unrelated to basic critical care knowledge.

In this study, nurses with a baccalaureate degree had significantly higher BKAT scores when compared to the diploma and associate degree group. This significance was found when comparing two educational groups: BSN nurses and non-BSN nurses. Toth's study does not support this finding. However, in this study, when the educational groups were analyzed separately, comparing BSN nurses, ADN nurses, and diploma nurses as three separate groups, a significant difference was not found.

Limitations of Study

Several limitations of this study can be identified. As mentioned previously, the generalization that cardiac-surgical intensive care nurses possess more basic critical care nursing knowledge than medical intensive care nurses cannot be made based on the different levels of experience and the BKAT content in relation to the
knowledge required by nurses in these areas. If the BKAT included more neurology and pulmonary questions, perhaps this significance would not have been obtained in this study. Also, if the experience level between the groups was equal, perhaps this significance would not have been found.

In this study, the initial orientation of the critical care nurses was assumed to be homogenous for the group. However, orientation time frames have varied at this institution since previously the institution utilized a critical care internship program for new graduates that is no longer offered. Therefore, orientation programs and times did vary.

In regard to collection of demographic information, the demographic data was collected by self-report. No attempt was made by this researcher to verify this data by reviewing individual personnel files.

For the subjects with baccalaureate preparation, no attempt was made to differentiate between the generic BSN graduates and graduates of BSN completion programs. This differentiation could possibly provide additional information. Also, demographic data on the subject’s age and nursing experience when completing basic educational preparation may have been helpful. According to Brookfield, adults use experience as a resource and those adults working while completing their basic educational program would have experience as a resource, assisting them with retention of the nursing information received.

For the CCRN certification, it was not identified when this certification was obtained. For the initial certification, the staff nurse must successfully complete a critical care certification examination. For recertification, AACN offers successful examination completion as an option but it is not required. The AACN does require


evidence of critical-care related continuing education, documentation of critical care nursing hours worked, and types of critical care experiences. It has been speculated that if a nurse was CCRN certified ten years ago, this might affect successful completion of the current critical care certification examination.

Implications for Nursing Practice

Several implications for nursing practice arise based on the results of this study. The BKAT has been used, by hospital educators, as an assessment tool of basic critical care knowledge. Critical care managers could also utilize this to assess the basic critical care knowledge of nurses hired into their department. After assessment, orientation and learning experiences could be planned based on this assessment. Orientation could then be focused on weak areas identified by this assessment and enable the manager or educator to plan a cost-effective orientation program for the individual nurse while ensuring quality care.

Second, critical care experience has been identified as a valid predictor of basic critical care knowledge. Critical care managers should administer the BKAT to all experienced nurses to assess their previous knowledge and verify competency of these nurses upon hire. With this assessment, orientation programs could be tailored to the experienced critical care nurses and educational money could be spent on advanced programs for these experienced nurses. Therefore, less funds would be used to assist nurses in obtaining basic critical care knowledge and more spent on advancing knowledge.

Third, regarding the CCRN certification as a valid predictor of basic critical care knowledge, institutions should regard this certification as an indicator of basic critical care knowledge. These nurses should be rewarded in some manner for
being motivated to obtain this certification. Rewards could be monetary but should be related to additional responsibilities given to these motivated nurses including additional decision-making responsibilities and involvement in the organization. Also, the institution could benefit by marketing that their patients are cared for by CCRN certified staff.

Fourth, basic educational preparation did not show a difference in possession of critical care nursing knowledge when each group was analyzed separately. The baccalaureate degree has been promoted as the professional degree. However, in this study, the baccalaureate degree did not make a significant difference in BKAT scores when compared to the ADN group and with the diploma group. There are a variety of curriculums in each of these basic educational programs. Uniformity of each of these programs would assist in identifying which program makes a difference in possession of critical care knowledge. If this is not done, should an educational program be developed at the basic preparation level specifically for critical care nursing? After obtaining a nursing license, should nurses interested in critical care nursing be required to complete an intensive critical care educational program prior to employment in critical care nursing?

Recommendations for Further Research

Further research should examine more homogenous groups when comparing CCRN certified nurses to non-CCRN certified nurses. This could be accomplished with a stratified random sampling. By contacting the AACN association, the researcher could obtain a list of CCRN certified nurses to create homogenous groups.

A longitudinal study, comparing educational background and experience with
retention of basic knowledge over time, could be completed to see if the basic knowledge scores are stable over time. This could be accomplished by administering the BKAT to the same subjects at different time intervals and testing for the significance of experience and educational background (BSN vs. non-BSN) over time.

A research study with a revised BKAT, including more equivalent numbers of questions in each of the content areas of cardiovascular, pulmonary, neurology, and renal, would assist in comparing nurses from different critical care units. This could be completed by analyzing content included on the CCRN certification examination and sampling different types of critical care units to examine what is required for the knowledge base in each of the critical care units.

No attempt was made by this researcher to identify the actual number of days the individual staff nurse worked (prn vs. part-time vs. full-time). If this information was collected, comparisons could be made between full-time staff and prn staff. An investigation of BKAT scores comparing full-time to part-time and prn status nurses would assist in verifying possession of basic critical care nursing knowledge and possibly assist in defining the competency of these nurses with varying work patterns.

Additional demographic data could be included to compare nurses working different shifts. Do night shift nurses, evening shift nurses, and day shift nurses possess the same amount of basic critical care nursing knowledge? This could be accomplished by utilizing a larger sample and including demographic data on shift work. Also, a stratified random sample could be completed by identifying nurses who work only one shift.
Demographic data could include the subjects' preceptor experience. Analysis could be completed to compare preceptors to non-preceptors in regards to basic knowledge levels.

Another area needing to be explored is the CCRN certification and if the possession of basic critical care nursing knowledge is related to CCRN certification over time. Does a nurse CCRN certified in 1986 have the same BKAT scores as a nurse CCRN certified in 1994? This could be accomplished by obtaining a list of nurses CCRN certified in 1986 and comparing the BKAT results to nurses certified in 1994. The researcher could contact the AACN association to verify how the previously certified nurses recertified (by examination or continuing education) or ask this question on the demographic data collected.

Conclusion

This study supported Toth's and others' previous studies showing previous critical care nursing experience does make a difference. Therefore, it is imperative that assessments are completed in the critical care units regarding possession of basic critical care knowledge. Competencies of the nurses in these critical care units must be assessed and verified. The BKAT is a cost-effective tool that could be utilized in this competency assessment to assure the quality of care provided to the patients in an institution. This study offers some initial data that serves to stimulate further inquiry into this important professional issue. For institutions to survive in today's changing health care environment, critical care managers must consider cost-effective options in verifying and reverifying the competency of the critical care staff to ensure the knowledge level of the staff and quality of care provided.
References


July 19, 1994

Human Subjects Research Review Committee
Drake University
25th and University Ave.
Des Moines, IA 50311

Dear Committee Members:

Suzanne Tovar has my permission to utilize data collected for the Study of Basic Knowledge Level of Critical Care Nurses. This data was collected to assess the knowledge level of critical care nurses at our institution, identify learning needs, and plan educational programs based on the data collected.

Suzanne does not need to obtain further approval from the Institutional Review Board.

Sincerely,

Sharon Meadowcroft, R.N.
Administrative Director of Nursing
Nursing Administration

: jyd
Appendix B

Memo explaining the BKAT

BASIC KNOWLEDGE ASSESSMENT TOOL (BKAT)

FOR CRITICAL CARE NURSING

The BKAT is a 100 item tool, which measures basic knowledge in critical care nursing in the following areas: cardiovascular, pulmonary, neurology, endocrine, renal and gastrointestinal systems and invasive line monitoring.

The BKAT takes approximately 30-45 minutes to complete. It contains multiple choice and fill-in-the-blank questions that measure the recall of basic information and application of basic knowledge in practice situations.

This tool will be administered at the unit department meeting. The following demographic data will also be collected: years of clinical experience as a RN; years of clinical experience as a LPN; years working in critical care; years working in present unit; basic nursing educational preparation; CCRN status.

After completion of the tool, it will be scored by Suzanne Tovar, RN, Clinical Educator, CSICU. Learning needs for each individual will be identified based on the results and given to the clinical educator in your area.

Your actual score on the BKAT will remain confidential. Suzanne Tovar will be available to discuss any questions you have about your results. You may contact her at Extension 4171.

This is not a test. There isn't a pass-fail score. The results of this tool will not be used for performance appraisals. This tool is being utilized to identify individual staff learning needs and identify content for inservice education.
Appendix C

DEMOGRAPHIC FORM FOR BKAT

ID Number _______________________

Clinical experience as a LPN __________ years

Clinical experience as a RN __________ years

Clinical experience in critical care ________ years

Years working in present unit ________ years

Basic nursing educational preparation _____AD _____Diploma _____ BSN

CCRN certified ______ yes ______ no
Appendix D

BASIC KNOWLEDGE ASSESSMENT TOOL (BKAT) IN CRITICAL CARE NURSING

Version Four

Directions: Circle the best answer or fill in the blank.

1. Initial measures for the treatment of angina pectoris include all of the following EXCEPT: (5)

1) rest
2) morphine
3) oxygen
4) nitroglycerine

2. The classical ECG change in myocardial infarction (MI) is a: (6)

1) normal Q wave
2) ST segment elevation
3) prolonged Q-T duration
4) prolonged P-R interval

3. Elevated cardiac iso-enzymes generally occur in all of the following EXCEPT: (7)

1) congestive heart failure
2) pericarditis
3) closed chest injury
4) cardiac surgery

4. The major therapeutic goal in the treatment of cardiogenic shock is to: (8)

1) increase afterload
2) lower the BUN
3) increase cardiac output
4) decrease extracellular fluid volume

5. Mr. Hart is two days post MI. During his first time getting out of bed his pulse increases from 86/min to 96/min. Based on this response the nurse should: (9)

1) ask him to slow his pace
2) allow him to continue
3) have him lie down immediately
4) check his vital signs

6. In dealing with a depressed patient during the first days post MI the most appropriate nursing action would be: (10)

1) encourage the patient to ventilate his concerns
2) restrict visits from the family members
3) provide for privacy by leaving the patient alone
4) provide a quiet environment for the patient
7. The following monitor pattern would indicate that the Swan Ganz catheter is in which position?

- [ ] right atrium
- [ ] right ventricle
- [ ] pulmonary artery
- [ ] pulmonary artery wedge

8. The use of an arterial line would be indicated for all of the following conditions EXCEPT:

- [ ] shock with blood pressure too low to be determined by cuff
- [ ] patients being treated with IV nitroprusside
- [ ] mechanical ventilation requiring frequent arterial blood gases
- [ ] for the administration of intravenous drugs

9. Which of the following wave patterns indicates ideal functioning of an arterial line?

- [ ]
- [ ]
- [ ]
- [ ]

10. After an arterial catheter is removed, direct pressure should generally be applied to the artery:

- [ ] for 2 full minutes
- [ ] for 5 to 10 minutes
- [ ] until the oozing of blood from the puncture site slows
- [ ] until a pressure dressing is applied

11. A central venous pressure (CVP) reading directly reflects pressure in the:

- [ ] left atrium
- [ ] right atrium
- [ ] left ventricle
- [ ] pulmonary artery
12. An elevated CVP reading may indicate:
   1) right heart failure
   2) a fall in hematocrit
   3) acute dehydration
   4) peripheral vasodilation

13. If the monitor shows a pulmonary capillary wedge pressure (PCWP) pattern, all of the following actions are appropriate **EXCEPT**:
   1) releasing air from the balloon
   2) repositioning the patient
   3) flushing the line
   4) keeping the patient immobile

14. The PCWP reflects pressure in the:
   1) right ventricle
   2) left ventricle
   3) right atrium
   4) vena cava

15. The normal pulmonary artery pressure is:
   1) 10-20 mean 5-10
   2) 21-30 mean 11-20
   3) 31-35 mean 21-30
   4) 36-45 mean 31-35

16. How many mm Hg is the normal PCWP?
   1) 1-3
   2) 4-12
   3) 15-20
   4) 21-26

17. An elevated PCWP may indicate:
   1) hypovolemia
   2) peripheral blood pooling
   3) systemic hypotension
   4) left ventricular failure

18. The wave in the cardiac cycle that represents atrial depolarization is the:
   1) P
   2) Q
   3) R
   4) T
19. A QRS complex wider than 0.12 seconds most likely indicates:  
1) normal ventricular conduction  
2) bundle branch block  
3) second degree heart block  
4) myocardial infarction  

20. How many seconds is the normal P-R interval?  
1) 0.04 - 0.10  
2) 0.12 - 0.20  
3) 0.22 - 0.26  
4) 0.28 - 0.32  

21. The following rhythm strip represents:  

22. The ventricular rate in question 21 is approximately how many beats per minute?  
1) 56  
2) 70  
3) 90  
4) 38  

23. The dysrhythmia in the following strip is:  

24. A strong ventricular stimulus is potentially dangerous in which period of the cardiac cycle?  
1) U wave  
2) P wave  
3) T wave  
4) QRS complex
25. The rhythm strip below shows:

26. The main purpose of enclosing a pacemaker generator in a rubber glove or similar apparatus is to prevent:

1) the pacemaker from getting dirty
2) moisture from corroding the pacemaker
3) accidental change in settings
4) electrical interference with the pacemaker

27. In the following rhythm strip the pacemaker is exhibiting:

1) failure to sense
2) failure to capture
3) normal function
4) demand function

28. The initial drug treatment for ventricular tachycardia is:

1) Isuprel 1.0 mg in 250 ml D5W drip
2) Epinephrine 1:10,000 1.0 mg IV bolus
3) Atropine 0.6 mg IV bolus
4) Lidocaine 50-100 mg IV bolus

29. The rhythm strip below shows:

30. The cardiac rhythm of atrial flutter is:

1) a benign condition in most people
2) normal following myocardial infarction
3) hazardous, as the ventricular rate may suddenly increase
4) hazardous, as it may progress to complete heart block
31. Upon recognizing ventricular fibrillation, the nurse should first:
   1) perform a precordial thump
   2) establish unresponsiveness
   3) give Lidocaine IV push
   4) check the ECG leads

32. One of the first drugs to be administered in the treatment of complete heart block would be:
   1) Atropine
   2) Lidocaine
   3) Quinidine
   4) Digoxin

33. Your patient has atrial flutter with a ventricular response of 150 beats per minute. Therapy for this rhythm includes:
   1) Digoxin, Verapamil, cardioversion
   2) Lidocaine, sodium bicarb, cardioversion
   3) Lidocaine, potassium chloride, pacemaker
   4) Isordil, Nitropaste, Pronestyl

34. The correct energy setting for defibrillation is how many watt/seconds?
   1) 25-30
   2) 50
   3) 100
   4) 200-300

35. Signs of cardiac tamponade may include all of the following EXCEPT:
   1) distended neck veins
   2) pulsus paradoxus
   3) decreased systolic pressure
   4) bradycardia

36. A patient becomes apneic and pulseless. The monitor shows asystole. The drug that would most likely be used initially is:
   1) Calcium Gluconate
   2) Atropine
   3) Epinephrine
   4) Lidocaine

37. The most important step in preventing central venous catheter related sepsis is:
   1) using an occlusive dressing
   2) thorough handwashing
   3) checking the patient's temperature q6h
   4) aseptic care of the catheter
38. An excessive amount of chest tube drainage in the first few hours following thoracic surgery is how many cc’s per hour? (42)

1) 150  
2) 75   
3) 50   
4) 30

39. A routine check of your patient's blood gas values show a pH of 7.40, $pO_2$ of 100 mm Hg, $pCO_2$ of 38 mm Hg, and $HCO_3$ of 25 mEq. These results reflect? (43)

1) metabolic acidosis  
2) metabolic alkalosis  
3) normal values  
4) respiratory alkalosis

40. Before suctioning a patient, you adjust the pressure so that it is: (44)

1) 120 mm Hg of vacuum  
2) as high as necessary  
3) 40 mm Hg of vacuum  
4) 10 mm Hg below the systolic blood pressure

41. Prior to starting chest physical therapy (PT) on a post-operative patient with a left anterior chest tube, you auscultate the lung fields bilaterally and note that you hear diminished breath sounds in the right posterior base. This would most likely be due to: (45)

1) pleuritis  
2) consolidation  
3) atelectasis  
4) the chest tube

42. Chest percussion would generally be contraindicated for which of the following conditions? (46)

1) atelectasis  
2) thick sputum  
3) pulmonary hemorrhage  
4) lobectomy

43. Your patient is on a ventilator. The low volume alarm sounds. This may be due to: (47)

1) pulmonary edema  
2) decreased secretions  
3) a disconnected tube  
4) biting the tube

44. To assess proper positioning of an endotracheal tube, the most appropriate nursing action would be to: (48)

1) listen for minimal leak of the cuff  
2) listen for bilateral breath sounds  
3) check for chest expansion  
4) check the tidal volume indicator on the ventilator
45. Mr. Gee has an endotracheal tube. While you are making rounds, you ask if his breathing is okay. In an audible tone, he says "yes". You should first:
1) ask the patient to cough
2) suction the patient
3) notify the physician
4) check the functioning of the cuff

46. The high pressure alarm on a volume respirator may be triggered by all of the following except:
1) biting on the tube
2) pulmonary edema
3) leaking cuff
4) decreased lung compliance

47. The most likely reason for a deviated trachea in an accident victim with closed chest trauma is:
1) edema from a fractured clavicle
2) a cervical dislocation
3) development of a tension pneumothorax
4) the presence of bronchial hemorrhage

48. Your trauma patient, who is 4 days post fracture of the right femur, suddenly develops shortness of breath. The most likely cause is:
1) fat embolus
2) atelectasis
3) pleural effusion
4) pulmonary edema

49. A severely burned patient is admitted to your unit. The most important treatment during the first 24 hours after injury is:
1) wound cultures
2) antibiotic prophylaxis
3) nutritional support
4) fluid replacement

50. A dangerous effect of re-warming a hypothermic patient is:
1) an increase in extravascular fluid
2) a decrease in cardiac output
3) a decrease in drug utilization
4) a sudden rise in blood pressure

51. Nursing care of a patient on a hypothermia blanket includes:
1) administering vasodilators to prevent shivering
2) avoiding moving the patient to provide maximum cooling
3) removing the hypothermia blanket q2h to prevent overcooling
4) making frequent observations of the skin to prevent tissue injury
52. The most important nursing measure for a patient admitted with the diagnosis of cervical spinal cord injury is:

1) keeping the patient flat
2) immobilizing the head
3) assessing the reflexes
4) monitoring for dysrhythmias

53. In a patient with cervical spine injury, the most important observations the nurse makes deal with which body system?

1) cardiovascular
2) respiratory
3) renal
4) gastrointestinal

54. The earliest sign of increased intracranial pressure generally involves changes in:

1) response to pain
2) level of consciousness
3) equality of pupillary reaction
4) respiratory rate

55. Increased intracranial pressure is characterized by all of the following EXCEPT:

1) decrease in briskness of pupillary reaction
2) increase in blood pressure
3) decrease in pulse pressure
4) decrease in level of consciousness

56. A drug used specifically to reduce increased intracranial pressure is:

1) Aldomet
2) Phenobarbital
3) Mannitol
4) Dilantin

57. A positive Babinski response in an adult:

1) indicates lower motor disease
2) is a normal finding
3) is an abnormal finding
4) is associated with flexion of the toes

58. The nursing care of a patient during the acute period after a stroke includes all of the following EXCEPT:

1) providing a quiet environment
2) control of secretions
3) preventing injury
4) increasing sensory input
59. All of the following are included in an hourly neuro check except:

1) motor strength
2) urinary output
3) response to stimulation
4) pupillary response to light

60. Signs and symptoms of diabetic ketoacidosis include:

1) dry, warm skin, fruity breath, deep and rapid breathing
2) vomiting, hyperactivity, diaphoresis
3) slow and shallow breathing, pallor, headache
4) dilated pupils, coma, flushed skin

61. Impending insulin shock should be suspected when the diabetic patient complains of or manifests:

1) decreased skin turgor, abdominal pain, fever
2) flushed skin, tachycardia, Kussmaul breathing
3) thirst, hypotension, fruity odor to the breath
4) weakness, headache, diaphoresis

62. Measures that would be taken to treat a patient in diabetic ketoacidotic coma would include all of the following except:

1) dextrose 50% IV infusion
2) insulin IV infusion
3) potassium replacement
4) sodium bicarbonate administration

63. A newly diagnosed diabetic patient who is on a sliding scale of Regular insulin complains of feeling very nervous and afraid that she is going to faint. Nursing actions might include all of the following except:

1) taking the blood pressure
2) administering the PRN order for Regular insulin
3) checking a blood sample for glucose
4) giving her a glass of juice to drink

64. Patients with diabetes mellitus who are acutely ill generally require:

1) higher dose of insulin
2) lower caloric intake
3) higher fat intake
4) lower dose of insulin

65. The psychophysiologic stress response of acute illness generally results in the following changes in heart rate (HR), blood pressure (BP), and urine output:

1) increased HR, increased BP, increased urine output
2) decreased HR, decreased BP, decreased urine output
3) increased HR, decreased BP, increased urine output
4) increased HR, increased BP, decreased urine output
66. Which of the following types of insulin when given sub-q will have a peak action within 2 to 4 hours?

1) Lente
2) NPH
3) Ultralente
4) Regular

67. If a patient receives his usual dose of sub-q NPH insulin at 7 AM but does not eat because he is placed on NPO, in how many hours might you expect an insulin reaction to occur?

1) 1-2
2) 4-6
3) 8-10
4) 12-14

68. Signs and symptoms of thyroid storm (crisis) include:

1) coma, hypothermia, respiratory acidosis
2) bradycardia, depression, respiratory failure
3) elevated temperature, tachycardia, delirium
4) hypotension, edema, low urine output

69. Mrs. Smith, who is a post-operative craniotomy patient has a fasting blood sugar of 100 mg, complains of extreme thirst, and has a urine specific gravity of 1.001. You should suspect:

1) diabetes mellitus
2) hyperthyroidism
3) acute adrenal insufficiency
4) diabetes insipidus

70. What does the following urine specific gravity reading indicate?

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.000</td>
<td>dilute urine</td>
</tr>
<tr>
<td>0.005</td>
<td>normal urine concentration</td>
</tr>
<tr>
<td>0.010</td>
<td>concentrated urine</td>
</tr>
<tr>
<td>0.015</td>
<td>glycosuria</td>
</tr>
</tbody>
</table>

71. A patient is admitted with a diagnosis of acute renal failure. The generally acceptable cc's of urine output per hour is:

1) 60
2) 45
3) 30
4) 10
72. The following lab tests are good indices of renal function EXCEPT:
1) catecholamines
2) electrolytes
3) creatinine
4) osmolality

73. Your patient has acute renal failure. Medications that are normally excreted through the kidneys will probably be:
1) decreased in dosage
2) administered as usual
3) increased in dosage
4) increased in frequency

74. Enteral feeding in acute renal failure commonly includes:
1) high protein, low potassium, low sodium
2) restricted protein, high potassium, low sodium
3) high protein, high potassium, high sodium
4) restricted protein, low potassium, low sodium

75. Sudden development of dyspnea, sinus tachycardia, and rales in an acute renal failure patient would most likely indicate which of the following?
1) fluid overload
2) infection
3) hyperkalemia
4) pericarditis

76. ECG changes commonly seen in hyperkalemia are:
1) narrow QRS, inverted T wave
2) narrow QRS, flattened P wave
3) wide QRS, inverted T wave
4) wide QRS, tall peaked T wave

77. Generally, peritoneal dialysis solutions do NOT contain:
1) chloride
2) glucose
3) creatinine
4) sodium

78. Complications of peritoneal dialysis include all of the following EXCEPT:
1) hypotension
2) respiratory distress
3) peritonitis
4) hyperkalemia
79. Following the first exchange of peritoneal dialysate solution, the outflow drainage return is brownish in color. Which of the following observations is correct?

1) commonly seen following the first exchange
2) characteristic finding in peritonitis
3) indicates possible bowel perforation
4) indicates possible abdominal bleeding

80. Nursing care measures for the patient receiving peritoneal dialysis include all of the following EXCEPT:

1) careful intake and output
2) warming the dialysis solution
3) maintaining sterility of the dialysate
4) maintaining immobility

81. When feeding a patient using continuous tube feedings, the most important intervention in preventing aspiration is to:

1) keep the head of the bed elevated
2) do frequent chest PT
3) check the position of the feeding tube q4h
4) aspirate stomach contents q4h

82. Hyperosmolar, non-ketotic dehydration and coma can be easily prevented in total parenteral nutrition therapy if detected early. A method of early detection is checking:

1) CPK, SGOT, LDH
2) the blood sugar
3) for abnormal pupillary response
4) for a decrease in urinary output

83. Ms. Phillips has a Blakemore tube in place for the control of active bleeding from her esophageal varices. The most important aspect of her acute nursing care is:

1) periodically releasing the pressure in the balloons
2) maintaining the pressure in the balloons
3) accurately checking intake and output
4) encouraging the patient to verbalize her feelings

84. Low intermittent suction of gastric contents is generally used in all of the following situations EXCEPT:

1) to reduce abdominal distention
2) to prevent aspiration
3) when bowel sounds are absent
4) to control bleeding
85. Acute gastrointestinal bleeding in critically ill patients may occur as a result of:

1) a decrease in catecholamines
2) the body's response to stressors
3) decreased gastric motility
4) alteration in eating patterns

86. Nursing activities for patients receiving gastric lavage to control acute gastrointestinal bleeding include all of the following EXCEPT:

1) observation for abdominal distention
2) accurate intake and output
3) using distilled water for the lavage
4) monitoring of hemoglobin and hematocrit

87. While caring for a cholecystectomy patient post-operatively, you notice "coffeeground" material coming from her nasogastric tube. You should:

1) know this is a normal finding
2) irrigate the tube
3) test the drainage for blood
4) listen for bowel sounds

88. Your patient, who is actively bleeding from the gastrointestinal tract and is receiving a blood transfusion, has a sudden increase in body temperature. Your first response is to:

1) notify the physician
2) chart the finding
3) check for a rash
4) stop the transfusion

89. Which of the following measures generally results in the earliest detection of gastric bleeding in patients who have gastric tubes?

1) testing the gastric contents for microscopic blood
2) observing the color of the gastric aspirate
3) noting the presence of abdominal distention
4) noticing a slow fall in blood pressure

90. Special care should be exercised when administering IV Dopamine because:

1) infiltration leads to tissue necrosis
2) high doses cause a bradycardia
3) precipitation can occur when used in a dextrose solution
4) low doses decrease renal perfusion
91. Dilantin will crystallize when given IV in all of the following solutions EXCEPT:
   1) dextrose in water
   2) dextrose in saline
   3) normal saline
   4) ringer's lactate

92. Precautions in using IV nitroprusside include all of the following EXCEPT:
   1) protection of the solution from light
   2) careful monitoring for a sudden increase in heart rate
   3) alertness to the development of hypertensive crisis
   4) use of a fresh mixture at appropriate intervals

93. The dosage of which drug must be tapered off slowly to prevent acute adrenal insufficiency?
   1) nitroprusside
   2) cortisone
   3) streptokinase
   4) pitressin

94. All of the following may be manifestations of digitalis toxicity EXCEPT:
   1) rapid A-V conduction
   2) premature ventricular contractions
   3) nausea
   4) yellow vision

95. The most common symptom of a toxic blood level of Lidocaine is:
   1) elevated blood pressure
   2) confusion
   3) abnormal clotting time
   4) metal taste

96. If the physician did not use Atropine for a bradycardia, which of the following could be used to increase the heart rate:
   1) Inderal
   2) Quabain
   3) Isuprel
   4) Verapamil

97. When administering Lidocaine to a patient, the proper functioning of which of the following body systems would be most useful to know to determine the correct dosage?
   1) hepatic
   2) gastrointestinal
   3) respiratory
   4) endocrine
98. How many micrograms are in one milligram? 

1) 10
2) 100
3) 1,000
4) 10,000

99. In caring for a patient in which the nurse would be exposed to body fluids, it is important to observe which of the following? 

1) respiratory precautions
2) reverse isolation
3) universal precautions
4) urine isolation

100. In caring for an intubated adult patient on 8 cm of PEEP who requires frequent suctioning, appropriate precautions would include the use of: 

1) gowns, gloves, and masks
2) gloves, and masks
3) gowns, eye coverings, and gloves
4) gloves, eye coverings, and masks.

* * * * THIS IS THE END OF THE TEST * * * *

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Kathleen A. Ritchey, R.N., M.S.N.
Veterans Administration Medical Center 
Washington, D.C. 20422

Jean C. Toth, R.N., D.N.Sc.
The Catholic University of America 
Washington, D.C. 20064

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June 30, 1992

Suzanne B. Tovar, BSN, CCRN
Unit Nursing Manager, CSICU
Mercy Hospital Medical Center
6th and University
Des Moines, Iowa 50314

Dear Ms. Tovar:

Replying to your recent letter, I am enclosing a copy of a letter of information regarding BKAT-4 together with an Agreement Form to be signed and returned to me.

I would be most interested in receiving a copy of your results.

Sincerely,

Jean C. Toth, R.N., D.N.Sc.
Associate Professor of
Cardiovascular Nursing
The Catholic University of America
Washington, D.C. 20064

JCT/vmc
### Appendix F

#### SCORE SHEET

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Questions</th>
<th>#</th>
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<tbody>
<tr>
<td><strong>1. Cardiovascular</strong></td>
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<tr>
<td>a. Myocardial ischemia</td>
<td>01, 03, 04, 05, 06</td>
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<tr>
<td>b. EKG interpretation</td>
<td>21, 22, 23, 24, 25, 27, 29, 30</td>
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<td>c. Electrical cardiac stimulation</td>
<td>26, 34</td>
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<tr>
<td>d. Emergency situations</td>
<td>21, 22, 23, 24, 25, 27, 29, 30</td>
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<tr>
<td>e. Drugs</td>
<td>28, 32, 33, 90, 92, 94, 95, 96, 97</td>
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<td><strong>2. Monitoring lines</strong></td>
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<tr>
<td>a. Intra-cardiac</td>
<td>07, 13, 14, 15, 16, 17</td>
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<td>b. Arterial-venous</td>
<td>08, 09, 10, 11, 12</td>
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<td><strong>3. Pulmonary</strong></td>
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<tr>
<td>a. Ventilators</td>
<td>43, 46</td>
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<td>b. Pulmonary assessment &amp; care</td>
<td>38, 39, 40, 41, 42, 44, 45, 47</td>
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<td><strong>4. Neurology</strong></td>
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<td>a. Assessment &amp; care</td>
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<td>c. Drugs</td>
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<td><strong>5. Endocrine</strong></td>
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<td>a. Diabetes Mellitus</td>
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<td>b. Thyroid</td>
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<td>d. Stress</td>
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<td><strong>6. Renal</strong></td>
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<td>a. Assessment &amp; care</td>
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<td>b. Peritoneal dialysis</td>
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<td><strong>7. Gastrointestinal/parenteral</strong></td>
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<td>a. Nutrition</td>
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<td><strong>8. Other</strong></td>
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<td>a. Blood transfusion</td>
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<tr>
<td>b. Burns</td>
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<td>c. Drug calculation</td>
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<td>d. Hypothermia</td>
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<tr>
<td>e. Infection control</td>
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<td>f. Trauma</td>
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### Appendix G

#### Score Sheet

<table>
<thead>
<tr>
<th>NAME</th>
<th>BKAT SCORE (Total possible 100)</th>
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</table>

1. Cardiovascular  
   a. MI (Total possible 31)  
   b. EKG interpretation (5)  
   c. Electrical cardiac stimulation (12)  
   d. Emergency situations (2)  
   e. Drugs (3)  

2. Monitoring Lines  
   a. Intra-cardiac (Total possible 11)  
   b. Arterial-venous (5)  

3. Pulmonary  
   a. Ventilators (Total possible 10)  
   b. Pulmonary care (8)  

4. Neurology  
   a. Assessment & care (Total possible 10)  
   b. CVA (7)  
   c. Drugs (1)  

5. Endocrine  
   a. Diabetes (Total possible 10)  
   b. Thyroid (5)  
   c. Drugs (1)  
   d. Stress (1)  

6. Renal  
   a. Assessment & care (Total possible 10)  
   b. Peritoneal Dialysis (6)  

7. GI/Parenteral  
   a. Nutrition (Total possible 9)  
   b. GI bleeding (6)  

8. Other  
   a. Blood transfusion (Total possible 9)  
   b. Burns (1)  
   c. Drug calculation (1)  
   d. Hypothermia (2)  
   e. Infection control (3)  
   f. Trauma (1)