THE RELATIONSHIP BETWEEN PERCEIVED CLINICAL DECISION MAKING ABILITY AND MEDICATION DOSAGE CALCULATION ABILITY OF REGISTERED NURSES

by

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A DISSERTATION

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To be an effective registered nurse, one must be able to integrate clinical decision-making skills into the medication calculation process in order to provide safe and effective care. Medication errors have been associated with negative outcomes for both patients and registered nurses. The execution of clinical decision-making skills throughout the medication administration process is crucial; however, the literature has not revealed a linking of these 2 concepts.

The purpose of this study was to describe the relationship between registered nurses’ clinical decision-making skills and the accuracy of medication dosage calculation. Simon’s (1977) theory of decision making served as the conceptual framework for this study.

The sample was composed of 64 pediatric registered nurses who were participating in a nursing orientation program at a pediatric acute care institution. Each subject completed a demographic data instrument, the Clinical Decision Making in Nursing Scale (CDMNS) (Jenkins, 1983), and a Medication Calculation Test (MCT). The majority of the sample were female, employed full-time, and had earned a baccalaureate degree in nursing.
Statistical analyses using linear regression revealed that age, gender, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area did not serve as predictors of pediatric registered nurses’ medication-calculation skills and clinical decision-making abilities. A Pearson product-moment correlation coefficient did not identify a significant relationship between the MCT scores and the CDMNS overall scores, as well as the 4 CDMNS subscale scores.

The data suggested that subjects perceived themselves to possess strong clinical decision-making skills in Simon’s (1977) initial 2 decision-making phases of intelligence and design; however, subjects reported weaker clinical decision-making skills in the final 2 phases of Simon’s (1977) decision-making process, the choice and review phases.

Recommendations for further research included an analysis of the outcomes of clinical decisions that are made by registered nurses. Other recommendations include the psychometric development of an objective measure of clinical decision making and a study of the effect of medication dosage calculation remediation for registered nurses.
DEDICATION

This dissertation is dedicated in loving memory of my grandparents, John Hillgrove and Bertha Cook Hillgrove and Jack Stover and Ruth Sondecker Stover Griffin. You have each had a positive influence on my life. Thank you for giving me two very special gifts, my parents.
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CHAPTER 1

INTRODUCTION

Clinical decision making is "the process nurses use to gather patient information, evaluate the information, and make a judgment that results in the provision of patient care" (White, Nativio, Kobert, & Engberg, 1992, p. 154). Clinical decision making is a foundational process that guides nurses in making effective judgments regarding patient care. This important skill is a driving force for the practice of clinical nursing. Without applying this skill, a nurse cannot provide nursing interventions for a client or evaluate the effectiveness of nursing actions. A nurse who is not well-equipped with clinical decision-making skills can make poor decisions regarding patient care that can cause potentially harmful patient outcomes.

Decision making is recognized to be a fundamental skill for registered nurses (American Association of Colleges of Nursing, 1998; American Nurses Association, 1995; National League for Nursing, 1993). This skill has been described as "the key component of nursing practice, regardless of site" (Huffstuttlter, 1993, p. 1). Furthermore, the ability of nurses to formulate sound and logical clinical judgments has been classified as "crucial to today's health care environment" (Thiele, Holloway, Murphy, Pendarvis, & Stucky, 1991, p. 616). Registered nurses are faced with legal, professional, and educational problems that require the application of strong clinical decision-making skills (Jenkins, 1985). As the cost and quality of health care emerge as dominant issues for consumers, legislators, and administrators, registered nurses will continue to be challenged with
patient care situations involving the execution of clinical decision-making skills. Clearly, the registered nurse who understands the intricacies of decision making and who can successfully operationalize the decision making process will be a valuable asset for a patient as well as for an employer.

One specific facet of clinical practice that is critical for the registered nurse to apply decision-making skills is medication administration. This nursing intervention is not simply a psychomotor skill. Rather, it is a skill that combines the psychomotor actions of preparing and administering medications with the higher level cognitive actions of dosage calculation and also with communication with other health care professionals (Wakefield, Wakefield, Uden-Holman, & Blegen, 1998). The simultaneous application of clinical decision-making skills into the process of medication dosage calculation is obvious, as the registered nurse must consider many patient-related factors, such as body weight and pertinent laboratory values, before dosages can be calculated. When medication administration culminates in a dosage error, the nurse is subjected to making decisions regarding the evaluation of the severity of the error and how patient safety is impacted (Wolf, Ambrose, & Dreher, 1996). Thus, the registered nurse must be able to effectively integrate the skills of medication dosage calculation and clinical decision making to ensure positive patient outcomes.

Statement of the Problem

Medication errors have been referred to as the “skeleton in the closet of health care providers” (Fuqua & Stevens, 1988, p. 1). Medication error rates, including dosage calculation errors, have been utilized as a quality indicator for patient outcomes (Carey &
Teeters, 1995; McNeilly, 1987; van Leeuwen, 1994). The potential outcomes of medication dosage errors have serious implications for the patient, as well as for the registered nurse. A patient can suffer debilitating illness, injury, or even death as a result of a medication error (Fiesta, 1998; Fletcher, 1997). The registered nurse who is responsible for a medication error may experience guilt, shame, depression, anxiety, feelings of inadequacy, and lack of confidence (Arndt, 1994; Wolf, 1994). Furthermore, registered nurses continue to be named as defendants in medical malpractice lawsuits that are seeking huge monetary damages and even criminal charges for medication dosage errors (Farrell, 1993; Fiesta, 1998; Smetzer, 1998; Sweeney, 1991).

Medication dosage errors often culminate in extremely expensive outcomes. Beckman (1996) reviewed 747 malpractice lawsuits against nurses for medication administration negligence, including dosage errors, and reported an average settlement payment of $2,170,313. A patient who was given an overdose of coumadin that resulted in extensive tissue necrosis received a 2-million dollar verdict (Schakewitz, 1999). Another patient who sustained brain damage as a result of receiving an overdose of brevibloc was awarded a settlement of $840,000 (Anonymous, 1998). Although medication malpractice settlements are usually paid for by a registered nurse’s malpractice insurance provider or the employing institution, the ultimate cost of the settlements is covertly passed on to the health care consumer in the form of increased insurance premiums (Collard, 1994). Thus, it is evident that efforts must be aimed toward decreasing and eliminating medication dosage errors in order to provide safe nursing care.

Pediatric nurses incur a high risk for making a medication dosage calculation error with virtually each medication that is administered to a child. Due to stringent restrictions
that have been placed on the conduction of drug research trials with the pediatric population, there is a serious lack of published drug safety and efficiency information for pediatric medication dosages (Gutierrez, 1999). Registered nurses who calculate pediatric dosages must consider many factors prior to administering the medication, including patient’s age, organ system maturity, and current stage of growth and development (Lehne, 1998; Kuhn, 1998). Furthermore, the lack of many standardized pediatric dosage ranges for a wide variety of medications can create a dangerous environment for pediatric nurses who are seeking confirmation for a prescribed medication dose to be in a safe and effective range for the child. Clearly, many obstacles are present that could impact the accuracy of pediatric medication dosage calculations.

Registered nurses who practice in the subspecialty of pediatrics are routinely faced with the challenge of executing clinical decision making in the context of medication dosage calculation. There is strong support in the literature for using a sample of pediatric nurses in a study that examines the variables of clinical decision-making ability and medication dosage calculation ability. Pediatric nurses have an increased chance of making computational errors when calculating medication dosages for patients because there are not many standard pediatric dosages and most medications are packaged in adult dosage strengths (Wong, 1995). Saxton and O’Neill (1998) advised that small calculation errors for a pediatric medication dose can result in critical problems due to variances in a child’s “ability to absorb, distribute, metabolize, and excrete substances such as drugs” (p. 207). The use of standard formulas for calculating pediatric dosages is not recommended because “formulas do not take into consideration the physical condition of the child and the variety of responses and/or susceptibilities to the effects of drugs possible in individual
children" (Daniels & Smith, 1999, p. 218). Lastly, the nurse is the one who retains the ultimate responsibility for verifying that a doctor's order is appropriate for the individual child (Wilson & Shannon, 1997). These examples clearly illustrate that pediatric nurses do not perform the calculation of pediatric medication dosages in isolation; conversely, pediatric nurses must integrate the skill of medication dosage calculation with the intricate skill of clinical decision making.

Simon's (1977) theory of decision making (Figure 1) identifies four phases that one progresses through as decisions are made: (a) intelligence phase, (b) design phase, (c) choice phase, and (d) review phase. It is important to note that these phases are sequential; however, simultaneous interactions in other phases may be necessary in order to execute a sound clinical decision. This model can track the clinical decision-making process from the moment that a problem is identified and data gathering is initiated, through an identification of all possible options, to an analysis of options and selection of the best option, and concluding with the implementation and evaluation of the option. By participating in these four phases of decision making, a registered nurse can execute clinical decisions that are inherent in the process of pediatric medication dosage calculation.

Jenkins (1983, 1988) classified clinical decision making into four categories: (a) search for alternatives or options, (b) canvassing of objectives and values, (c) evaluation and reevaluation of consequences, and (d) search for information and unbiased assimilation of new information. These four clinical decision-making categories evolved from psychometric pilot testing that was performed to establish the Clinical Decision Making in Nursing Scale (CDMNS) (Jenkins, 1983). Each of Jenkins' four categories of clinical
decision making corresponds to one of Simon’s (1977) phases of decision making. The unique blending of Simon’s and Jenkins’ conceptual ideas regarding decision making results in a clear illustration of the role that clinical decision making assumes when a registered nurse is calculating medication dosages (Figure 2).

Figure 1. A conceptual framework for decision making (Simon, 1977).
Figure 2. A conceptual framework for decision making during the medication dosage calculation process based on the work of Simon (1977) and Jenkins (1985, 1988).

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Significance of the Study

The importance of accurate medication dosage calculation skills for the registered nurse is well documented in the literature. In addition, the combination of strong clinical decision-making skills with accurate dosage-calculation skills is essential for registered nurses who are practicing in today’s diverse and rapidly changing health care environment. The effective registered nurse needs to be able to integrate decision-making skills into the medication calculation process in order to provide safe and effective patient care.

Because nurse administrators do not typically spend a tremendous amount of time delivering direct patient care, this group often does not have a clear understanding of the complexities that are involved in medication administration. Nurse administrators might only acknowledge the negative outcomes that surround dosage calculation errors and give little attention to the environmental factors that could have contributed to the error (Wakefield et al., 1998). Almost 60 years ago, Faddis (1939) reported that nurse administrators have been accused of permitting conditions to exist that facilitate the occurrence of dosage calculation errors. Countless suggestions for nurse administrators to implement in order to reduce the incidence of medication errors have been documented in the literature; yet medication dosage errors continue to plague registered nurses (Day, Hindmarsh, Hojna, Roy, & Ventimiglia, 1994; Fletcher, 1997; Hazinski, 1986; Kennedy, 1996; Mohseni, 1998; Senders, 1995; van Leeuwen, 1994). Furthermore, the Institute of Medicine (2000) reported that most medical errors were not the fault of the individual; rather, these errors resulted “from basic flaws in the way the health system is organized” (p. 2). An analysis of the relationships that exist between medication dosage-calculation abilities and the four stages of clinical decision making provides data for nurse
administrators to utilize to identify, to isolate, and to ultimately reduce the incidence of medication dosage calculation errors. Once the decision-making phase that is challenging to a registered nurse is identified, nursing staff development specialists can target teaching and learning strategies that are designed to strengthen decision-making skills that are employed in specific phases of the decision-making process. Nurse administrators would benefit from this data by using it to justify the need and subsequent cost of including medication dosage-calculation content and clinical decision-making content in a nursing orientation syllabus.

The rapidly expanding and progressive health care system presents new and unique challenges to nurse educators. Because it is virtually impossible to convey all necessary knowledge to students while enrolled in a nursing program, it is imperative for nurse educators to communicate with institutions and agencies who employ registered nurses in order to identify critical core competency skills that are needed for safe and effective nursing practice (Manuel & Sorensen, 1995). Pediatric nurse educators are faced with the unique challenge of creating learning experiences in the midst of decreasing available pediatric clinical sites for clinical experiences, as well as shortened length of stays for pediatric inpatients, increased use of outpatient facilities for pediatric nursing care, and the closing or merging of pediatric units in adult-based institutions (Herrman, Saunders, & Selekman, 1998).

The cognitive skill of clinical decision making was identified as an important skill for pediatric nurses. Therefore, nurse educators were encouraged to emphasize the development of this skill in basic nursing students (American Nurses Association and Society of Pediatric Nurses, 1996). The data from this study may be useful to nurse
educators to gain an understanding of what clinical skills are needed in order for a graduate to be successful in the workforce. Furthermore, nurse educators can use the data to support the integration of new and innovative teaching and learning strategies for medication dosage and clinical decision-making content. Because professional nurses recognize the challenge to assume the role of lifelong learners, data from this study may also be useful to clinical nurse specialists in nursing staff development to gain a perspective of what clinical decision-making skills and medication-calculation skills are currently possessed by pediatric registered nurses. These data can also be used to plan effective orientation content in order to provide registered nurse orientees with a foundation for safe and effective nursing practice.

Litigation involving nurses who commit medication dosage errors is increasing at an alarming rate. Lesar, Briceland, and Delacoure (1990) reported that the most common medication error was the administration of an overdose. In a 1996 landmark decision, three nurses who were involved in the administration of a tenfold overdose of penicillin G benzathine were “indicted on charges of negligent homicide” (Smetzer, 1998, p. 48). An analysis of this deadly error was subsequently conducted and revealed over 50 system errors that contributed to the error. Smetzer stated that, if even one of those system errors had been detected, the likelihood of that error occurring would have drastically diminished. Clearly, the application of clinical decision-making skills during the process of medication-dosage calculation can have a positive impact on patient outcomes.

The possibility of negative patient outcomes and resulting litigation surrounding medication dosage errors supports the assessment of medication dosage calculation skills and clinical decision-making skills of registered nurses during nursing orientation.
programs. These two skills should also be assessed periodically throughout a nurse's
career. However, most nursing orientation programs focus heavily on the assessment of
dosage-calculation skills, yet clinical decision-making skills are not always assessed. The
data from this study are helpful for nursing staff development departments that are
debating the value of assessing clinical decision-making abilities of newly hired registered
nurses during orientation.

Definitions of Terms

The following terms were theoretically and operationally defined for utilization in
this study:

Clinical decision making—Theoretically, "a conscious, cognitive impression of how
one goes about making decisions" (Jenkins, 1985, p. 222); operationally, the ability of
registered nurses to make clinical decisions, as measured by the CDMNS (Jenkins, 1983).

Medication dosage calculation—Theoretically, performance of the mathematical
skill of calculating medication dosages for pediatric patients at a level of mastery
(Reynolds & Pontious, 1986); operationally, the ability of registered nurses to calculate
safe and accurate medication dosages, as measured by the Medication Calculation Test
(MCT) administered by the pediatric acute care institution during nursing orientation.

Registered nurses—Theoretically, one who has graduated from an accredited basic
nursing program and has passed an examination administered by a state board of nursing
(Potter & Perry, 1997); operationally, viewed similarly to the theoretical definition, but
extended to include new graduates of basic nursing programs who are practicing on
temporary permits as Nurse Graduates-Registered Nurse Program (NG-RNP). Addi-
tionally, the registered nurses in this study were all employed in the subspecialty of pediatrics.

**Purpose**

The purpose of this study was to describe the relationship between nurses' clinical decision-making skills and the accuracy of medication-dosage calculation. The aims of this study were to explore the application of clinical decision-making skills of pediatric nurses who are engaged in the process of medication-dosage calculation and to identify demographic variables that are related to a nurse's ability to make clinical decisions and to calculate medication dosages.

**Research Questions**

The following research questions were addressed in this study:

1. Is there a relationship between the overall and subscale scores on the CDMNS and age, gender, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area?

2. Is there a relationship between overall scores on the MCT and age, gender, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area?

3. Is there a relationship between overall and subscale scores on the CDMNS and overall scores on the MCT?
Conceptual Framework

This study was based upon Simon's (1977) theory of decision making. Simon's theory classifies the four consecutive, yet interactive, phases of decision-making activities as intelligence, design, choice, and review. These activities represent the behaviors that nurses engage in during the process of clinical decision making in the context of the clinical skill of medication dosage calculation as displayed in Figure 1.

Prior to 1945, very little information existed in the literature about decision making. After World War II, the phenomena of decision making became more widely investigated due to the technological growth and development of digital computers. Although the computers processed the information, humans programmed the computers and needed to understand and learn how to apply decision-making theory in order to accurately serve as the programmers of the technology. Simon initiated his work with human problem solving and decision making in the mid-1950s when he designed several computer programming languages (Newell & Simon, 1972). His problem-solving investigations also extended into cognitive applications and functions in humans (Klahr & Kotovsky, 1989; Simon, 1979). Simon's career focused on the study of decision making and decision analysis theory, and he is widely acknowledged as an expert on those topics (Klahr & Kotovsky).

Simon (1977) labeled the first phase of decision making as the intelligence phase. During this phase, one must identify a situation requiring the execution of decision-making skills. Emphasis is placed on reviewing environmental conditions to assess whether conditions exist that require decisions to be made.

Simon (1977) classified the second phase of decision making as the design phase. The expected behavior in this phase of decision making is the creation and analysis of all
viable options. During the design phase, all possible options are examined in order to
delineate the benefits and risks associated with each option.

The third phase of Simon's (1977) decision-making theory is called the choice
phase. During this phase of decision making, a careful and thorough analysis of the risks
and benefits of each viable option must first be performed in order to select the most
appropriate option. Then, the most appropriate decision for the situation can be formal­
ized.

The final phase of Simon's (1977) decision-making theory is the review phase,
which encompasses the implementation of the decision made in the choice phase and
involves subsequent evaluation of the activated decision's consequences. Careful attention
must be devoted to the analysis of the selected course of action, as that decision may
impact future decisions. Furthermore, Simon employs the use of an implied feedback loop
from the review phase of one decision-making process to the intelligence phase of a
related decision-making process. This feedback loop signifies the covert impact of
previous decisions upon decisions that are made in the future.

Simon (1977) acknowledged that there is a general sequence to his decision-
making process: intelligence, design, choice, and review. However, he admits that each of
the four phases of decision making "is itself a complex decision making process" (p. 43).
Therefore, decision-making activities that are contained within each phase can often be
interactive with activities contained in one of the other three phases of decision making.
This interactivity between the phases allows one to reconsider past information as new
information is encountered.
Simon (1977) stated that two major kinds of decisions existed, programmed and nonprogrammed, and that both types of decisions existed on a continuum. Decisions that are dependent upon established procedures are classified as programmed decisions. When a procedure has not been created for dealing with a particular situation and one must rely upon creative cognitive skills to make a decision, one is participating in a nonprogrammed decision. Furthermore, the approach that one uses to make a decision is dependent upon the type of decision that is being executed.

In this study, the relationship between clinical decision-making abilities and medication dosage-calculation abilities is being investigated. An assumption of this study was that registered nurses participate in clinical decision making when medication dosages are calculated. The points of articulation between the processes of clinical decision making and medication dosage calculation are highlighted in the following example. The registered nurse enters the design phase of decision making when a situation is identified in which a decision must be executed, such as when an ordered pediatric medication dosage appears to be out of the therapeutic range for a pediatric patient. The registered nurse should immediately identify this situation as one that is in urgent need of a clinical decision of whether or not to administer the ordered dose of medication. During the design phase, the registered nurse must analyze the possible courses of action that could be taken in the situation. In this example, some possible courses of action for the registered nurse would be to administer the medication as ordered and risk a patient reaction or to hold the medication while the dosage is confirmed through another source. There are many sources of information for validating a medication dosage, including recalculating the prescribed dose to check for mathematical errors, consulting with a
pharmacist, checking with various published references, or talking with the professional who ordered the medication.

During the choice phase of decision making, the nurse must analyze each viable option and select the best option to implement. The nurse in the example situation elected to recalculate the medication dose to check for a mathematical error that was made by the prescribing professional. The result was compared to the published therapeutic range for the medication, and a discrepancy was noted between the ordered dose and the newly calculated dose. The registered nurse had several resulting choices to make, including whether to notify the prescribing professional and which dose to administer. Theory dictates the obvious course of action of holding the medication and contacting the prescribing professional. However, clinical reality, coupled with the potential for human error, may have actually produced a different course of action.

Simon's (1977) fourth and final stage of decision making, the review phase, is the phase in which the nurse actually implements the decision and subsequently evaluates the impact of the action. The nurse in the example situation should have been prudent enough to notify the prescribing professional of a dosage error, discuss the newly calculated dose, and request another medication order for the correct dose. The implied feedback loop would be illustrated if the prescribing professional acts in a rude manner when the nurse shares the concern for the incorrect dose, and this may impact the nurse's willingness to implement the same decision if a similar situation is encountered in the future.

Medication calculation is a skill that involves both programmed and nonprogrammed decisions to be made by the registered nurse. Selecting the correct available concentration of a medication to administer, selecting the right size syringe to prepare an
accurate medication dosage, setting up the medication calculation in the correct format, using sliding scales in the dosage calculation set-up, and interpreting abbreviations that are contained in a medication order are examples of programmed decisions that a nurse routinely makes when calculating medication dosages. Distinguishing between an expected reaction and an allergy to a medication, determining whether to redose after a patient has emesis after swallowing an oral medication, and identifying appropriate situations to use topical numbing agents prior to administering an injection are examples of nonprogrammed decisions that a nurse who is calculating medication dosages may encounter.

In summary, registered nurses who are calculating medication dosages participate in clinical decision making and execute both programmed and nonprogrammed decisions. Because many factors must be considered in order to safely calculate medication dosages, registered nurses should view medication dosage calculation as both a cognitive process and a psychomotor skill. Applying Simon’s (1977) theory of decision making to this study allows for a clearer understanding of the unique mix of skills that results when the skills of medication dosage calculation and clinical decision making are executed simultaneously.

Assumptions

The following assumptions were made regarding this study:

1. Pediatric nurses engage in clinical decision making.

2. Pediatric nurses must perform medication dosage calculations.

3. Medication dosage calculation is both a cognitive and psychomotor skill that involves the simultaneous application of clinical decision making.
4. Clinical decision-making skills and medication-calculation skills must be executed with accuracy in order for a pediatric nurse to be safe and effective.

5. Clinical decision-making skills can be measured.

6. Medication-calculation skills can be measured.
CHAPTER 2
REVIEW OF LITERATURE

Research concerning the relationship between clinical decision-making skills and medication dosage calculation abilities of registered nurses is virtually nonexistent. This literature review examined the research reported on clinical decision making within the discipline of nursing. Then, medication dosage calculation errors in the nursing and medical literature were reviewed.

Clinical Decision Making in Nursing

Nursing Students

Jenkins (1983) investigated the self-perceived clinical decision-making skills of nursing students. Due to a lack of available standardized instruments to measure clinical decision making in nurses, the investigator developed the CDMNS as part of that study. The CDMNS was based upon Janis and Mann’s (1977) decision-making model, which proposes seven actions that aid one to be a successful decision maker. The convenience sample was composed of 111 nursing students who were enrolled in a baccalaureate nursing program in a large northeastern metropolitan area. The investigator conducted a pretest phase and a pilot study for psychometric development of the CDMNS. After the instrument was deemed to be psychometrically sound, with a Cronbach’s alpha value of 0.84, the instrument was used to collect data from the sample of nursing students. The CDMNS was administered near the culmination of a semester to nursing students who
were enrolled in clinical nursing courses. A one-way analysis of variance was conducted to examine the CDMNS overall and subscale scores among sophomore, junior, and senior nursing students. No statistically significant difference was found to exist among the three groups of nursing students ($F = 1.62, p = 0.5$). The investigator advocated for decision-making theory to be introduced early in a nursing curriculum and reinforced throughout the duration of a program of studies. The investigator also stated that students may not be able to perceive themselves as effective decision makers. Further research with the CDMNS was recommended in the following areas: correlating CDMNS scores with nursing performance measures, such as the correct administration of medications, and using registered nurse populations as subjects in an assessment of clinical decision making after some professional experience has been obtained.

Jenkins (1985) conducted a study to examine baccalaureate nursing students' self-perceptions of clinical decision-making skills in the formal testing phase of development of the CDMNS instrument. Decision making was defined as "a conscious, cognitive impression of how one goes about making decisions" (Jenkins, 1985, p. 222). Of the 111 subjects, 41 were seniors, 43 were juniors, and 27 were sophomores. Using analysis of variance, no statistically significant differences were found between the three groups, except on Subscale A: Search for Alternatives or Options ($F = 5.45, df = 2/108, p < 0.01$). On Subscale A, sophomores were not found to be significantly different from juniors and seniors in clinical decision-making skills; however, using a Scheffe procedure for Subscale A, juniors (mean = 37.21) were found to differ significantly from seniors (mean = 39.68). There are two explanations for this finding: (a) senior students have had more opportunities to participate in clinical decision making, and (b) juniors may doubt their
abilities more because they are at the midpoint of a nursing curriculum. This study provided a clear definition of clinical decision making and a conceptual model for clinical decision making.

Thiele et al. (1991) used a descriptive design to evaluate the perceived clinical decision-making skills of junior baccalaureate nursing students. Clinical decision making was defined as "the process of making judgments in clinical practice" (p. 620). There were 82 subjects in the convenience sample. During the last 3 weeks of a semester, the subjects completed the CDMNS (Jenkins, 1988); listened to a brief patient scenario; and were asked to identify relevant cues, the priority nursing diagnosis, and nursing interventions. Responses were solicited in multiple choice and short answer formats. Findings revealed that the students perceived their clinical decision-making skills to be weak (mean = 112.839) and that students were unable to distinguish relevant from irrelevant data to use as the basis for formulating clinical decisions. A limitation of the study was that students might have perceived a lack of incentive to perform well because a grade or reward was not attached to participation in the study. A second limitation is that entry-level nursing students may not be the best evaluators of their own decision-making capabilities. These limitations indicate that the CDMNS may not be a viable instrument for measuring perceived clinical decision-making abilities of entry-level nursing students.

Nurses

Del Bueno (1990) and White et al. (1992) used simulated patient care situations to evaluate the clinical decision-making skills of nurses. Del Bueno presented video vignettes of patient care situations to the subjects who were asked to identify the patient's priority
health problem and appropriate nursing interventions. White et al. asked subjects to participate in a video/computer simulation of a patient care situation and were instructed to record a list of diagnostic hypotheses throughout the simulation process. A design flaw in the study by White et al. was that there was no stated time limit to complete the simulation activity; therefore, subjects were being compared on a task for which more time to complete the task could result in a more accurate diagnosis. Furthermore, the simulation does not accurately mimic real-life situations, in which assessing a patient and formulating a diagnosis and treatment does not have an open-ended time limit.

Cruickshank, Mackay, Matsuno, and Williams (1994) assessed clinical decision making in an investigation of the clinical competence of registered nurses in an Australian hospital. The sample consisted of 607 registered nurses. The study focused on an assumption that clinical competence is associated with professional nursing preparation and experience. The CDMNS was used to measure perceived clinical decision-making abilities of nurses. The researchers obtained a Cronbach's alpha coefficient of 0.48, indicating a low internal consistency reliability. This value differed substantially from the Cronbach's alpha coefficient of 0.84 reported by the developer of the CDMNS. Results suggested that nurses with a baccalaureate degree displayed a higher level of critical thinking ability than nurses with a diploma degree in nursing. In this study, the researchers did not offer any conceptual or operational definitions of critical thinking; therefore, it was difficult to understand how critical thinking results were extrapolated from a clinical decision-making instrument. The concepts of critical thinking and clinical decision making are related, yet possess distinct differences (Adams, Whitlow, Stover, & Johnson, 1996).
It appears as though an inappropriate instrument, the CDMNS, was utilized to investigate critical thinking.

Grossman, Campbell, and Riley (1996) assessed the clinical decision-making skills of critical care nurses by using a self-developed instrument, the Clinical Decision Making Assessment (CDMA). This instrument was based on Lawrence's Health Restoration Model (Lawrence, 1992) and the conceptual framework of a hospital's nursing education division. Clinical decision making was defined as "the ability by which a clinician identifies, prioritizes, and establishes plans and evaluates data" (Grossman et al., 1996, p. 273). An unspecified reliability coefficient of 0.80 was obtained during pilot testing. Face validity was established by critical care nurse experts. A convenience sample of 71 nurse orientees, with different nursing degrees and a variety of years of clinical experience, was used. The CDMA was administered to subjects as a pretest and posttest surrounding a critical care orientation course. Demographic data were correlated with CDMA scores using multiple regression analysis. Analysis of variance and t tests were used to examine differences and relationships of the mean scores on the CDMA. Findings revealed no significant difference on the CDMA between experienced and nonexperienced nurses in critical care settings ($F = 1.38, p < 0.4361$). Age was found to be a significant predictor of success on the post-CDMA ($p < 0.01$). The researchers classified the design of the study as quasiexperimental; yet, it is unclear which elements of an experimental design are present and which are absent. Further reliability and validity testing of the CDMA with an increased number of subjects was recommended, thus supporting this study. Also, the conceptual models of the study focused on dimensions of nursing care and did not address the decision-making process. Another direction that was recommended for future resear-
Hughes and Dvorak (1997) evaluated clinical decisions that were made by critical care nurses to assess whether the decisions that were made correlated to decisions that were recommended by a decision analysis model. A nonexperimental ex post facto design was utilized. There were 82 randomly selected subjects who were critical care staff nurses with greater than 6 months of experience. Each subject completed an instrument, the Ethical Decision Analytic Model, which contained a routine clinical situation requiring an ethical decision that could be solely made by a staff nurse, without the input of other health professionals. A Cronbach's alpha value was not reported for this instrument. The majority of the subjects were in agreement concerning the best and worst decisions that could be made regarding the scenario about a chemically dependent colleague. When results were compared to the decision analysis model, agreement was noted between the nurses and the model regarding the worst decision; however, no agreement existed regarding the best alternative. Demographic data revealed that subjects reported "little or no education in decision making in their basic nursing education programs, regardless of the type of program" (Hughes & Dvorak, p. 247). Further research was recommended in the area of examination of the outcomes of exposure of nursing students and nurses to decision analytic models.

Lewis (1997) conducted a study to test a decision-making model. The proposed model was based on Newell and Simon's (1972) Information Processing Theory of Human Problem Solving. The purpose of the study was to assess the "relationships between decision-making task complexity in nursing and four content characteristics of the
Decision Making Task Model: (a) irrelevance, (b) ambiguity, (c) conflict, and (d) change" (p. 117). The 41 subjects were critical care nurses with at least 2 years of general critical care experience, who actually participated in weaning patients from mechanical ventilators. Multivariate analysis of variance revealed that situations involving conflict received higher mean scores on the complexity rating scale than situations involving irrelevance, ambiguity, and conflict. Further research was recommended in the following areas: using nurses with varying levels of clinical experience as content raters, conducting field observations with nurses to jointly identify and discuss stimuli that impact clinical decision making, and performing assessments of other types of decision-making tasks in order to further validate the Decision Making Task Complexity Model.

Summary

The nursing literature has an ample amount of published research concerning clinical decision-making assessment with descriptive designs; however, there are three elements present in the literature that weaken the research. First, there is an overwhelming lack of a use of a supportive conceptual framework, stated or implied. Thiele et al. (1991) and White et al. (1992) mentioned a theory but failed to show the points of articulation between the theory and the research being conducted. Next, there are abundant design flaws present in this body of literature, including inappropriate instrument selection (Cruickshank et al., 1994) and task comparison without a specified time limit (White et al.). Lastly, researchers have used the terminology of clinical decision making and critical thinking in an interchangeable manner. Even though these two terms are very similar in meaning, there are definite defining differences (Adams et al., 1996). In
order to fill these gaps in the literature, it is imperative that nurse researchers who are investigating clinical decision making use an appropriate conceptual framework to guide and strengthen the study.

The nursing literature revealed three primary instruments that were used to assess clinical decision making. The Medication Error Outcomes Scale (MEOS) (Wolf, McGoldrick, Flynn, & Warwick, 1996) measures a nurse's ability to make clinical inferences regarding medication error outcomes. Grossman et al. (1996) developed the CDMA to assess critical care nurse orientees' clinical decision-making abilities. The CDMNS (Jenkins, 1983) provides a measure of perceived clinical decision-making abilities. Strong Cronbach's alpha coefficients have been published for this instrument, as listed in the instrument subsection of this study, with only one exception.

The conceptualization of clinical decision making, as presented in the Definitions of Terms subsection of this document, is supported by the literature. Jenkins (1985) supported decision making being viewed as a cognitive process. Aspinall and Tanner (1981) viewed decision making as an integral part of the problem-solving process. The decision-making stages of problem identification, data gathering, validation, analysis, and evaluation closely parallel the components of the nursing process, a commonly used nursing problem-solving process. Kozier, Erb, Blais, and Wilkinson (1995) stated that decision making is often a simultaneous activity with problem solving.

Dosage Calculation Errors in Nursing

Bliss-Holtz (1994) conducted a study to examine two types of dosage calculation errors—mathematical concept errors and arithmetic operation errors—in order to identify
and classify errors so that remediation can be planned for nurses who make medication dosage calculation errors. The convenience sample was composed of 23 registered nurses and 28 new graduate nurses who were participating in a nursing orientation program. The instruments used in the study were two medication calculation tests containing 15 problems in short-answer format. Content validity was confirmed by nurse experts. Cronbach's alpha coefficients of 0.83 for Form I and 0.71 for Form II were reported. Subjects were given both test forms in a random order. The math was worked without the assistance of a calculator during the first administration of the test, but calculator assistance was permitted with the second test administration. The passing score for both forms of the test was 83%. Results indicated that 28 subjects passed both tests and 14 subjects failed both tests. There were 23 subjects who failed the test without a calculator, and, of that group, nine subjects were able to pass the exam with a calculator. This group of nine subjects made arithmetic operation errors. The results of this study indicated that nurses make two primary types of medication calculation errors: (a) arithmetic operation errors, and (b) mathematical concept errors.

Calliari (1995) conducted a study to examine the relationship between scores on a medication calculation test and subsequent medication errors made by registered nurses in order to evaluate whether the calculation test was related to actual medication errors. An assumption of this study was that the calculation test should be discontinued if it was not a strong indicator of dosage calculation performance on the nursing unit. This post hoc descriptive study had 274 subjects. Data were collected by obtaining the names of nurse orientees who had failed the orientation medication calculation test (n = 48) during a 3-year period of time and comparing those names to nursing medication error-related
incident reports for the same period of time. There were 617 nursing medication errors made. Of this number, 45 were dosage/calculation errors. A significant association was found to exist between making a medication error and performance on the medication calculation exam \( \chi^2 = 4.825, df = 1, p = 0.028 \). The findings of this study indicated that medication dosage calculation errors were prevalent, even though these errors may have been underreported. Furthermore, the strong association reported between medication dosage calculation errors and performance on the medication dosage calculation test administered during nursing orientation supports using a medication dosage calculation test in the proposed research. This study also supported assessing for the presence of extraneous variables that may influence one's cognitive abilities, such as level of stress or other uncontrollable life events, during the process of medication dosage calculation.

Wolf, McGoldrick, Flynn, and Warwick (1996) conducted a pilot study to examine elements related to nurses' perceptions of harmful outcomes following medication errors. The sample was composed of 117 registered nurses and licensed practical nurses. The subjects were asked to recall a medication error from their practice and complete the Medication Error Risk Profile (MERP), which assessed the events surrounding the error, the classification of the error, factors leading to the error, and a narrative description of the error. Cronbach's alpha for the MERP was reported as 0.776. Results suggested that dosage calculation was one of the top five factors implicated with the occurrence of medication errors. The researchers suggested implementing medication calculation assessments as a part of nursing annual performance reviews. Further research was recommended to examine issues and factors surrounding medication errors of nurses.
Thus, this study supports the investigation of nurses' medication calculation abilities as a precursor to medication errors, a potentially negative patient outcome.

Blegen, Goode, and Reed (1998) examined the effect of nurse staffing on several patient outcomes, including the outcome of medication errors. The data were analyzed in a post hoc manner using payroll, human resource, and quality assurance records from one institution during fiscal year 1993. Administered doses of medication were compared to medication error rates. A limitation of the study was a lack of generalizability due to a convenience sample from one hospital. Furthermore, the researchers questioned the rigor with which medication error incident reports were completed. The results of this study support associating medication errors with negative patient outcomes.

Summary

The issues surrounding nurses' medication errors are well-reported in the literature (Bindler & Bayne, 1991; Bliss-Holtz, 1994; Calliari, 1995; Wakefield et al., 1998). Blegen et al. (1998) reported a link between the use of a predominantly registered nurse workforce, in conjunction with the conservative use of licensed practical nurses and various nurse extenders, with decreased medication errors. Wolf, McGoldrick, Flynn, and Warwick (1996) reported that inaccurate dosage calculation was a factor associated with medication errors. Lester, Garafalo, and Kroll (1989) provided support for linking these two variables with the following statement: “the beliefs a person holds about his or her ability to do mathematics, about the nature of mathematics, and about problem solving are dominant forces in shaping that person’s behavior while engaged in work on a mathematics task” (p. 85).
Dosage Calculation Errors in Medicine

Ferner and Whittington (1994) performed a post hoc examination of coroners’ cases related to medication prescribing errors and adverse drug reactions during the period of 1986-1991. In the population of 1.9 million served by the coroners, 86,235 deaths occurred and 3,277 were referred for a coroners’ investigation. The coroners reported that medication errors were the cause of death in 10 cases, and adverse drug reactions precipitated death in 36 cases. This study documented actual outcomes of medication errors; however, further research is needed in the medical literature concerning the assessment of medication calculation abilities of physicians and the resulting impact of this on medication-prescribing activities. Because nurses are the last link in the medication administration chain and must utilize clinical decision-making skills to question physicians’ medication orders, a study linking medication dosage-calculation skills and clinical decision-making abilities is warranted.

Lesar, Briceland, and Stein (1997) examined factors associated with prescribing-related medication errors by physicians. Every third medication order with a detected error that was written or cosigned by a physician in a 631-bed teaching hospital from July 1, 1994, to June 30, 1995, was included in the sample. The number of physicians in the study was not reported. During the study, a period of 1 year, 2,103 prescribing-related medication errors were detected by pharmacists. Every third error equated to 701 errors, and, of these errors, 696 (99.6%) occurred in a situation that had the potential for an adverse patient outcome. Each documented prescribing error was reviewed by a team of three experts, consisting of one physician and two pharmacists, for analysis of adherence to the operational definition of a prescribing medication error. Of the top four common
medication errors, two classes of errors were reported that could have resulted from calculation errors: (a) overdoses (41.8%), and (b) underdoses (16.5%). Incorrect dosage calculation accounted for 77 errors (11.1%). This small percentage does not appear to be noteworthy at first glance; however, the occurrence of simply one prescribing-medication error can be lethal and can potentially cost the physician or nurse a license to practice, cause harm to a patient, or even result in a patient death. The findings in this study were consistent with previous studies (Baldwin, 1995; Koren & Haslam, 1994; Potts & Phelan, 1996; Rolfe & Harper, 1995), which reported a deficiency in the medication calculation abilities of physicians. Rowe, Koren, and Koren (1998) reported similar findings in a study that focused on medication errors in a population of pediatric residents. Baker and Napthene (1994) stated that a dosage error does not truly exist until the patient actually receives the medication. Therefore, this dissertation is important because it highlights the clinical decision-making skills of nurses that are related to medication dosage calculation, in order for nurses to confirm the accuracy of the physicians' medication orders.

Summary

The medical literature in this section pertaining to medication errors contained several major weaknesses. None of the studies utilized a theoretical framework to guide the study or provided definitions of the variables being investigated. With these two deficits, it is difficult to compare and contrast among studies in the absence of knowing the philosophical basis for the studies. Furthermore, medical researchers should devote more attention toward the identification and elimination of confounding variables in order to strengthen the validity of the selected design. The administration of medication to
patients is a cooperative effort between a physician and a nurse. Therefore this study can make a valuable contribution to the medical literature, as physicians and nurses should employ similar clinical decision-making skills when calculating medication dosages.
CHAPTER 3
METHODOLOGY

Design

The purpose of this study was to describe the relationship between nurses’ clinical decision-making skills and the accuracy of medication dosage calculation. A descriptive correlational design was used in this study. According to Bordens and Abbott (1996), the descriptive correlational design is appropriate to utilize when the variables of the study are in the early stages of examination. The variables of clinical decision-making skills and medication-calculation abilities have not been examined concurrently; therefore, this design choice is appropriate. The CDMNS (Jenkins, 1983) and the MCT, which was used during nursing orientation at the institution where the subjects were initiating employment, were employed to obtain data to answer the following research questions:

1. Is there a relationship between the overall and subscale scores on the CDMNS and age, gender, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area?

2. Is there a relationship between overall scores on the MCT and age, gender, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area?

3. Is there a relationship between overall and subscale scores on the CDMNS and overall scores on the MCT?
Instruments

Demographic Data Instrument

A demographic data instrument (see Appendix A) designed by the researcher was utilized to obtain background data about the subjects. This information included an assessment of age, gender, employment status, highest level of education completed, and years of nursing experience and identification of pediatric nursing subspecialty area. There was a qualitative, open-ended assessment of any extraneous variables that may have impacted the subjects' responses on the instrument. This assessment consisted of one question at the end of the demographic instrument. The quantitative items on this instrument are based on demographic questions that were elicited in prior research with the same variables (Calliari, 1995; Cruickshank et al., 1994; Glassman, Kravitz, Petersen, & Rolph, 1997; White et al., 1992; Wolf, McGoldrick, Flynn, & Warwick, 1996). These demographic data were vital to the proposed research to describe the sample accurately.

Clinical Decision Making in Nursing Scale (CDMNS)

The CDMNS (Jenkins, 1983) measures the subjects' self-perceptions of decision-making behaviors currently utilized when working with patients in the clinical setting (see Appendix B). This tool was selected because it is specific to situations encountered with actual patient care decisions and it has an acceptable Cronbach's alpha value, 0.83. Other available instruments, such as The Watson-Glaser Critical Thinking Appraisal (Watson & Glaser, 1980), The Ennis-Weir Critical Thinking Essay Test (Ennis & Weir, 1985), The Cornell Critical Thinking Test (Ennis, Millman, & Tomko, 1985), and The California Critical Thinking Skills Test (Facione, 1992), measure the broader concept of critical
thinking in a generic manner and do not contain situations specific to nursing. Thus, these instruments were not deemed to be useful to employ to answer the research questions that were posed in this study.

The CDMNS (Jenkins, 1983) is a 40-item, 5-point Likert-type scale instrument, containing the following subscales: Search for Alternatives or Options, Canvassing of Objectives and Values, Evaluation and Reevaluation of Consequences, and Search for Information and Unbiased Assimilation of New Information. Each of these subscales is composed of 10 items which are scored on a scale ranging from 1 (never) to 5 (always). Scores are reported for each subscale, as well as an overall CDMNS score. Overall scores on the CDMNS can range from 40, indicating a low perception of clinical decision-making ability, to 200, indicating a strong perception of clinical decision-making ability. Scores on each of the four subscales can range from 10 to 50, indicating the perceived skill level that is assessed by a particular subscale.

The CDMNS is supported by the conceptual framework of this study and is illustrated in Figure 2. In Subscale 1, Search for Alternatives or Options, the nurse who is presented with a clinical situation requiring medication calculation must identify the client’s corresponding clinical problem to ascertain the appropriateness of the medication for the client and must gather data that are needed in order to set up the problem. This first subscale corresponds to Simon’s (1977) intelligence phase. Subscale 2, Canvassing of Objectives or Values, measures a nurse’s ability to validate variables that may impact the medication dosage calculation, such as liver and kidney functions, as well as assessing for medications that might be contraindicated if administered simultaneously in order to avoid polypharmacy side effects. Subscale 2 corresponds to Simon’s design phase.
The third subscale of the CDMNS, Evaluation and Reevaluation of Consequences, measures a nurse’s ability to integrate the facts surrounding medication administration that were uncovered in the Intelligence and Design phases and, subsequently, make a decision about the appropriateness of the ordered dose. For example, a nurse who receives an order for 1,500 mg of Zantac (Ranitidine)/kg of body weight might first consult a drug reference text to check the seemingly excessive dose and then consult the physician who wrote the order to question the large dose and obtain a lower dose. The third subscale is related to Simon’s (1977) choice phase of decision making.

In the fourth subscale, Search for Information and Unbiased Assimilation of New Information, the nurse’s ability to synthesize all aspects of medication administration into a correct medication calculation is assessed. Not only is the dosage calculated in this phase, but the nurse must also question the appropriateness of the answer that is obtained, as some set-up or mathematical error might have occurred. The fourth subscale corresponds to Simon’s (1977) review phase of decision making.

Content validity of the CDMNS was established by Jenkins (1983) based on related concepts present in the literature, as well as pretesting an early form of the instrument with 32 junior nursing students; soliciting comments on the congruity and clarity of the items from experts; and asking nurse educators to examine the items for construction, appropriateness, and separateness from other items. A specification matrix was used to examine the content validity of each item. The items that did not meet an overall 70% to 76% agreement score were not retained. No other type of validity was assessed during the psychometric development of the CDMNS (Jenkins, 1983). Furthermore, no subse-
quent studies that used the CDMNS (Corder, 1992; Cruickshank et al., 1994; Thiele et al., 1991) have reported any type of validity estimate beyond the data that Jenkins obtained.

Using principal factor methods, two factor analyses were performed during the psychometric development of the CDMNS to assess the grouping of items into factors or subtests. The first factor analysis yielded 14 factors, and the outcome of the second factor analysis was four factors. These four factors or subtests were subsequently transformed into the four subscales of the CDMNS (Jenkins, 1983). Next, the items contained within each of the four subscales were assessed for congruence with a single construct. The subscales were not found to be representative of a single construct. Therefore, “less credence can be given to the results of the subtests” (Jenkins, p. 64).

Cronbach’s alpha was utilized to assess the internal consistency reliability of the CDMNS. This statistical test was applied to examine the degree to which the CDMNS items measure perceived clinical decision-making skills. A Cronbach’s alpha coefficient of 0.8-0.9 reflects an instrument that is capable of making discriminations among the levels of the construct (Burns & Grove, 1997). Jenkins (1985) obtained a Cronbach’s alpha coefficient of 0.83. Of the three published studies that utilized the CDMNS, one did not report an estimated Cronbach’s alpha specific to the study (Thiele et al., 1991); the second study (Cruickshank et al., 1994) reported a coefficient of 0.48, considerably lower than the 0.83 as reported by Jenkins (1985); and the third study (Corder, 1992) reported a coefficient of 0.84.

The low alpha value obtained by Cruickshank et al. (1994) is not addressed directly by the authors, who concluded, “The difference is hard to explain” (p. 225). A conceptual design flaw present in this study is that the authors used an instrument to
measure clinical judgment; however, the results were reported under a heading of critical thinking. According to Adams et al. (1996), there are conceptual differences between critical thinking and clinical judgment. Thus, a difference in the conceptualization of clinical judgment may account for the low alpha value.

Critical thinking is a cognitive ability that has many interrelated and supportive skills, including clinical decision making. Radwin (1995) stated that decision-making research is supported conceptually by decision-analysis theory. Conversely, the bulk of published studies (Haffner & Raingruber, 1998; May, Edell, Butell, Doughty, & Langford, 1999; Washburn, 1991) in the critical thinking literature lack a theoretical framework. However, the critical thinking research that does utilize a supportive framework is guided by a framework reflective of educational theory (Colucciello, 1998; Corder, 1992). Clearly, the conceptual difference between critical thinking and clinical decision making originates in the body of theoretical support for the two distinct concepts.

Medication Calculation Test (MCT)

The MCT (see Appendix C) that was utilized in the study is a 20-item test that was developed by pediatric nurse experts in the Department of Nursing Education at the pediatric acute-care institution where data were collected. Items on this test reflect the variety of calculations that are encountered by pediatric nurses in the institution and are based on actual client situations. Employment decisions have been made based on the results of this instrument for over 10 years (D. Knight, personal communication, April 28, 1999). Items include pediatric patient medication calculation situations, which involve reconstitution of powders, intravenous flow rates, dosage based on body weight and body
surface area, injectable medications, oral tablets, and oral elixirs. These items reflect the high degree of accuracy of medication-calculation abilities that are necessary in the area of pediatric nursing. In addition to the actual dosage calculation problems, the MCT contains short-answer questions in which the nurse is asked to make clinical decisions regarding medication administration. There are clinical decision-making questions on the MCT that correspond to each subscale on the CDMNS and each phase of Simon’s (1977) theory of decision making.

**Protection of Human Subjects**

In order to protect the rights of the subjects in this study, an application was submitted to the Institutional Review Board (IRB) of the University of Alabama at Birmingham. Expedited status for the study was requested and approved (see Appendix D). An application for internal review of this research was submitted to the Nursing Research Board of the pediatric acute care institution where data were collected. This application to conduct research at the institution was approved (see Appendix E).

Informed consent was provided to the subjects by presenting a written introduction letter explaining the study to each subject. This was followed by a brief discussion of the study, allowing time for questions from the subjects. The completion of the Demographic Data Instrument and the CDMNS indicated the subject's consent to participate in the study. The instruments were coded to provide a basis for matching the MCT to the CDMNS and the Demographic Data Instrument. The code key was destroyed upon culmination of the data collection process.
Subject Recruitment/Procedure

During a scheduled nursing orientation session, the researcher presented each nurse orientee with a letter describing the purpose of the study (see Appendix F). A brief verbal explanation of the study was given to the group of subjects, and an opportunity for subjects to pose questions regarding the study was offered. Those who agreed to participate were given a period of 45 min to complete the Demographic Data Instrument and the CDMNS. The MCT that was utilized is the same test that is used routinely during nursing orientation for all nurses who are new to the institution. These instruments were numerically coded in order to match the subject's MCT results with data obtained during the scheduled session and to preserve the anonymity of the subject's responses. A staff member in the Department of Nursing Education and Research used the code sheet to match the code numbers on the Demographic Data Instrument and the CDMNS to the MCT results. The staff member then forwarded completed MCTs labeled with code numbers (without subject names) to the researcher. Therefore, the investigator remained blind as to the actual dosage-calculation abilities of the individual subjects and could only identify subjects by code numbers, not by individual names.

Validity Issues

There were four primary threats to the internal validity of this study: (a) the use of a convenience sample; (b) the possible presence of extraneous variables that may have affected the subjects' responses on the instruments; (c) the use of an instrument that relied on a self-report by subjects that may have resulted in the subjects documenting responses that reflect positively on themselves; and (d) the use of an instrument that did not repre-
sent a single construct and that had no published data regarding criterion, face, and construct validity.

A convenience sample of pediatric nurses in a nursing orientation program was utilized. This type of a sample was necessary for two reasons: (a) medication errors are more likely to occur during the first year of employment at a health care facility (Baker & Napthene, 1994); and (b) pediatric nurses are a population of nurses who work in a specialty area and engage in clinical decision making for a vulnerable population, children. The collection of data from subjects in the setting of a nursing orientation class allowed for the same testing conditions for all subjects, including the actual room setting, the optional use of calculators, and adherence to the specified time limits. Providing similar testing conditions for all subjects was essential to eliminate any extraneous variables that were present in an uncontrolled testing situation. Another method that was utilized to assess for any deleterious extraneous variables was to ask the subjects to identify the presence of any professional or personal issues that may impact their responses on the instruments. Furthermore, subjects had the option of briefly identifying any factors that might have interfered with their responses. Finally, the use of a self-report to measure the concept of clinical decision making was necessary because this cognitive process inside the human brain cannot be directly observed, because only the end product or action resulting from clinical decision making can be directly observed. Finally, the use of the CDMNS for data collection was necessitated due to the dearth of acceptable instruments to measure the concept of clinical decision making in nursing. Content validity was established by Jenkins (1983); however, further psychometric testing is warranted in order to assess
criterion, face, and construct validity of the CDMNS, as well as to perform a subsequent factor analysis.

Sample

A power analysis is a statistical method for ascertaining the appropriate sample size (Burns & Grove, 1997). Using the convenience sample of 64 subjects and an alpha value of 0.05, the design provided for a power of 0.97, with a medium to large effect size (Statistical Product and Service Solutions [SPSS], 1997). A power of 0.80 for behavioral science research is acceptable (Burns & Grove; Keppel, 1991).

The sample was composed of pediatric nurses in a nursing orientation program at an acute-care pediatric institution in the southeast United States. In order to be included in the study, subjects had to be a registered nurse or new graduate from a registered nurse program practicing on a temporary permit. Subjects were asked to participate in the study during a scheduled nursing orientation class session.

Statistical Analyses

Descriptive statistics were employed to report the demographic data. Frequencies and percentages were calculated for age, gender, employment status, highest level of education completed, years of nursing experience, pediatric specialty area, and the presence of any extraneous variables that might impact each subject's performance on the instruments. Arithmetic mean scores were computed for the overall and subscale scores on the CDMNS and overall MCT scores. Frequencies were calculated for the type of dosage calculation problem that subjects missed on the MCT. Linear regression analysis
and ANOVA (analysis of variance) were used to analyze relationships among the variables. Cronbach's alpha coefficients were computed for the CDMNS and MCT as an estimate of internal consistency reliability.

**Limitations**

This study had several limitations:

1. A lack of generalizability beyond the subjects in the sample exists when using a convenience sample.

2. Subjects in a nursing orientation class session may be predisposed to sensory overload and fatigue and may not respond accurately on the instruments.

3. Because the CDMNS scores do not have an impact on the subjects’ employment at the institution, there may not be a strong incentive for subjects to respond in an accurate manner.

4. The results only described a relationship and do not predict causality among the variables.

5. The creator of the CDMNS addressed content validity but did not address criterion, face, and construct validity during psychometric development of the instrument.

6. Although the CDMNS has been used in other studies (Corder, 1992; Cruickshank et al., 1994; Thiele et al., 1991), factor analysis revealed that the subscales were not representative of a single concept.
CHAPTER 4

FINDINGS

The purpose of this study was to describe the relationship between nurses’ clinical decision-making skills and the accuracy of medication dosage calculation. This chapter presents the statistical analyses that were employed to address the purpose of the study and to answer the three research questions that were posed in this study. This chapter also addresses the demographic findings from the sample, an overall summary of scores on the CDMNS and the MCT, qualitative findings from a question on the demographic data form, the findings from the three research questions, and a summary of the findings.

Sample

The sample was composed of 64 pediatric registered nurses who were participating in a nursing orientation program at an acute care pediatric institution in the southeast United States. Tables 1-3 depict detailed demographic characteristics of the sample. The sample was primarily female (96.9%), and the two male subjects comprised 3.1% of the sample. The subjects ranged in age from 21 to 57 years. The mean age of the subjects was 29.23 years (SD = 9.57) (see Table 1). The sample had been employed as registered nurses for an average of 3.67 years, with a range from 0 to 30 years (SD = 6.80) (Table 2). Forty-one (64.1%) of the subjects were employed full time at the study institution, and 22 were part-time employees (34.4%). The highest level of education of the sample was as follows: (a) 3 (4.7%) held diplomas in nursing, (b) 22 (34.4%) had...
earned an associate’s degree in nursing, (e) 1 (1.6%) possessed a nonnursing baccalaureate degree, (d) 36 (56.3%) had received a baccalaureate degree in nursing, (e) 1 (1.6%) had earned a nonnursing Master’s degree, and (f) 1 (1.6%) had received a Master’s degree in nursing (Table 1). A total of 17 pediatric subspecialty areas was identified by the subjects. Table 3 displays the pediatric subspecialty area in the institution where the subjects were hired to work upon completion of the nursing orientation program.

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
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<td></td>
</tr>
<tr>
<td>Male</td>
<td>2</td>
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<tr>
<td>Female</td>
<td>62</td>
<td>96.9</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-25</td>
<td>34</td>
<td>53.1</td>
</tr>
<tr>
<td>26-30</td>
<td>13</td>
<td>20.3</td>
</tr>
<tr>
<td>31-57</td>
<td>17</td>
<td>26.6</td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>41</td>
<td>64.1</td>
</tr>
<tr>
<td>Part time</td>
<td>22</td>
<td>34.4</td>
</tr>
<tr>
<td>(Missing data)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td>Highest level of education</td>
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<td></td>
</tr>
<tr>
<td>Diploma</td>
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</tr>
<tr>
<td>Associate degree</td>
<td>22</td>
<td>34.4</td>
</tr>
<tr>
<td>Baccalaureate (nursing)</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Baccalaureate (nursing)</td>
<td>36</td>
<td>56.3</td>
</tr>
<tr>
<td>Master's (nursing)</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Master's (nursing)</td>
<td>1</td>
<td>1.6</td>
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</table>
### Table 2

**Nursing Experience**

<table>
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<th>Years of nursing experience</th>
<th>Frequency</th>
<th>Percentage</th>
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<tr>
<td>0</td>
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<td>43.8</td>
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<td>0.5</td>
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<td>1.5</td>
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<td>1.6</td>
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<td>2</td>
<td>9</td>
<td>14.1</td>
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<td>1.6</td>
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<td>16</td>
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<tr>
<td>18</td>
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<td>27</td>
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<td>1.6</td>
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<tr>
<td>28</td>
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<td>1.6</td>
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<tr>
<td>30</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>(Missing data)</td>
<td>(2)</td>
<td>(3.1)</td>
</tr>
</tbody>
</table>

### Table 3

**Pediatric Nursing Subspecialty**

<table>
<thead>
<tr>
<th>Subspecialty area</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical-surgical</td>
<td>10</td>
<td>15.6</td>
</tr>
<tr>
<td>*Emergency department</td>
<td>9</td>
<td>14.1</td>
</tr>
</tbody>
</table>

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Table 3 (Continued)

<table>
<thead>
<tr>
<th>Subspecialty Area</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric intensive care</td>
<td>7</td>
<td>10.9</td>
</tr>
<tr>
<td>Adolescent/young adult</td>
<td>7</td>
<td>10.9</td>
</tr>
<tr>
<td>Community pediatrics</td>
<td>6</td>
<td>9.4</td>
</tr>
<tr>
<td>Hematology/oncology</td>
<td>5</td>
<td>7.8</td>
</tr>
<tr>
<td>Specialty clinics</td>
<td>4</td>
<td>6.3</td>
</tr>
<tr>
<td>*Intensive care step-down</td>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>Infant-toddler</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>*Burn center</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>Surgical</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>*Post-anesthesia care (recovery)</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>IV therapist</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>*Neonatal intensive care</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

* = classified as intensive care (areas not identified with an * are considered to be nonintensive care areas).

Instrument Findings

The mean score on the MCT was 95.125%, with scores ranging from 84 to 100% (SD = 4.475). Of the 20 questions on the MCT, there were primarily three questions that presented challenges for the subjects. One question required the computation of how much medication to add to a bag of intravenous fluid. There were 13 different answers that were recorded for this question, and 73.5% of the subjects responded correctly, while 26.5% responded incorrectly. In another question, the subjects were given a formula for
computing an emergency medication intravenous drip rate and were then asked to compute the answer. A total of 87.5% of the subjects responded correctly, while 12.5% of the subjects responded incorrectly. A third problem involved the computation of the reconstitution of a powdered drug. A total of six different answers was recorded for this question, and 87.5% of the subjects offered correct responses, while 12.5% of the subjects did not answer this question correctly.

There were several questions on the MCT that 100% of the subjects responded to correctly. Subjects were able to accurately compute dosages based on body weight, medications that were drawn up from a vial or ampule, and oral medications that were in a liquid form.

In addition to mathematical computation questions, the MCT contains some short-answer questions regarding clinical decisions that must be made in the context of medication administration. Every subject (100%) was able to select the appropriate equipment for medication administration and to make the correct decision in a clinical scenario regarding monitoring an intravenous flow rate. Subjects were able to identify a total of 10 different resources to utilize to obtain medication information. In a question that asked subjects to identify clinical indicators for administering a particular medication, a total of 22 different clinical indications were identified for the administration of the medication, yet there were only three true clinical indicators for the medication to be administered.

A Cronbach's alpha value of 0.1365 was obtained for the MCT. There were no other previous reliability estimates available for comparison to the reliability coefficient obtained in this study. A Spearman-Brown coefficient was computed, as the instrument
contained only 25 items. When the number of items was increased to 50, the reliability coefficient increased to 0.2, and with 100 items, the reliability coefficient increased to 0.35. The practicality of administering a medication calculation test that consists of over 100 items is simply not feasible or practical. Most schools of nursing and staff development departments administer medication calculation tests that contain between 20 and 30 problems that are representative of the problems that a nurse will encounter in practice and that do not contain multiple problems that cover the same content area. One factor that might have interfered with the calculation of an accurate reliability estimate for the MCT is the fact that there are several items on the instrument that have a wide range of correct responses.

The mean score for the CDMNS was 127.75 (SD = 7.1536). Mean scores and ranges for each CDMNS subscale are presented in Table 4. A detailed description of CDMNS can be found in Chapter 3. As previously mentioned in the discussion of the CDMNS in Chapter 3, a wide range of Cronbach’s alpha values, 0.48-0.84, were obtained by other researchers for this instrument. The Cronbach’s alpha value for the CDMNS for this study was 0.43. Because the CDMNS contains only 40 items, the calculation of Cronbach’s alpha value for this study may have been adversely affected. Therefore, a Spearman-Brown reliability was calculated for the CDMNS. When the number of items increased to 80, the reliability coefficient increased to 0.6, and with 160 items, the reliability coefficient increased to 0.75. Furthermore, the nature of reliability testing is so sensitive that an addition of simply five more subjects to this sample may have been sufficient enough to increase the reliability coefficient to a higher value (A. Bartolucci, personal communication, January 26, 2000). However, the power analysis that was
conducted before data collection was begun indicated that only 60 subjects were needed to obtain a power of 0.97. It should be noted that the sample contained 64 subjects.

Table 4

Clinical Decision Making in Nursing Scale (CDMNS) Subscale Scores (n = 62)

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Mean</th>
<th>Range</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A—Search for alternatives or options</td>
<td>35.0856</td>
<td>30-42</td>
<td>2.4684</td>
</tr>
<tr>
<td>B—Canvassing of objectives or values</td>
<td>34.8548</td>
<td>29-42</td>
<td>2.7630</td>
</tr>
<tr>
<td>C—Evaluation and reevaluation of consequences</td>
<td>30.0806</td>
<td>19-37</td>
<td>2.8127</td>
</tr>
<tr>
<td>D—Search for information and unbiased assimilation of new information</td>
<td>27.5161</td>
<td>22-40</td>
<td>2.9350</td>
</tr>
</tbody>
</table>

Qualitative Data

The qualitative data that were collected in this study were follow-up responses to an answer to the following question on the demographic data form: Is there anything in your professional or personal life that may affect your perceptions of your clinical decision-making skills or your medication calculation abilities? A total of 61 subjects (95.3%) responded "no" to this question, while 2 subjects (3.1%) responded "yes" and provided narrative responses, and 1 subject (1.6%) did not respond at all to this question. A 30-year-old registered nurse with 2 years of nursing experience responded that "personal experience as a patient" would affect her clinical decision-making skills or medication-calculation abilities. A 22-year-old new graduate with no nursing experience offered the following perspective regarding what might impact her clinical decision-making skills and medication calculation abilities:
I am a Christian and sometimes the "increased morphine pump" or feeding a comatose patient glucose and water only disturbs me. These are generally more in the elderly population, but it seems to take things in your own hands when one is increasing the morphine to rid pain knowing they will stop breathing or starving a comatose patient because they cannot speak up. I realize that we do not have the right to prolong a poor quality of life that would normally pass on just like we can't take it. Our technology has advanced that we are making some decisions that are up to God, not us.

Research Question 1

The first research question asked, "Is there a relationship between the overall and subscale scores on the CDMNS and age, gender, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area?" A linear regression analysis was computed to assess the association between the independent variables of age, gender, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area and the dependent variable, clinical decision-making ability. Because the sample was composed of 96.9% females and only 3.1% males (n = 2), the linear analysis was computed without gender as an independent variable. The variable of pediatric nursing subspecialty was collapsed into two categories (see Table 3), intensive care and nonintensive care, in order to meet the assumptions of the regression model. There was no statistically significant association between the five demographic variables and CDMNS overall scores at the 0.05 level of significance, as presented in Table 5. There was no statistically significant association between the five demographic variables and the CDMNS's four subscale scores at the 0.05 level of significance, as presented in Tables 6 through 9.
Table 5

Predictors of Clinical Decision Making in Nursing Scale (CDMNS) Overall Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standardized beta</th>
<th>t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-.146</td>
<td>-.445</td>
<td>.660</td>
</tr>
<tr>
<td>Employment status</td>
<td>-.026</td>
<td>-.125</td>
<td>.901</td>
</tr>
<tr>
<td>Years of nursing experience</td>
<td>.334</td>
<td>1.178</td>
<td>.249</td>
</tr>
<tr>
<td>Pediatric nursing subspecialty area</td>
<td>0.54</td>
<td>2.82</td>
<td>.780</td>
</tr>
<tr>
<td>Level of nursing education</td>
<td>-.103</td>
<td>-.472</td>
<td>.641</td>
</tr>
</tbody>
</table>

*Note.* Model summary $r^2 = .080$.

Table 6

Predictors of Scores on the Clinical Decision Making in Nursing Scale (CDMNS) Subscale A. Search for Alternatives or Options

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standardized beta</th>
<th>t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.64</td>
<td>.196</td>
<td>.846</td>
</tr>
<tr>
<td>Employment status</td>
<td>-.115</td>
<td>-.557</td>
<td>.582</td>
</tr>
<tr>
<td>Years of nursing experience</td>
<td>.211</td>
<td>.747</td>
<td>.462</td>
</tr>
<tr>
<td>Pediatric nursing subspecialty area</td>
<td>.089</td>
<td>.468</td>
<td>.643</td>
</tr>
<tr>
<td>Level of nursing education</td>
<td>-.060</td>
<td>-.276</td>
<td>.785</td>
</tr>
</tbody>
</table>

*Note.* Model summary $r^2 = .089$.

Table 7

Predictors of Scores on the Clinical Decision Making in Nursing Scale (CDMNS) Subscale B. Canvassing of Objectives or Values

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standardized beta</th>
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<th>Significance level</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>.090</td>
<td>.276</td>
<td>.792</td>
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<tr>
<td>Employment status</td>
<td>-.031</td>
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<td>.884</td>
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<tr>
<td>Years of nursing experience</td>
<td>-.057</td>
<td>-.194</td>
<td>.847</td>
</tr>
<tr>
<td>Pediatric nursing subspecialty area</td>
<td>-.070</td>
<td>-.356</td>
<td>.725</td>
</tr>
<tr>
<td>Level of nursing education</td>
<td>-.070</td>
<td>-.310</td>
<td>.759</td>
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</tbody>
</table>

*Note.* Model summary $r^2 = .019$.  

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Table 8

Predictors of Scores on the Clinical Decision Making in Nursing Scale (CDMNS) Subscale C, Evaluation and Reevaluation of Consequences

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standardized beta</th>
<th>t</th>
<th>Significance level</th>
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<tbody>
<tr>
<td>Age</td>
<td>.064</td>
<td>.196</td>
<td>.846</td>
</tr>
<tr>
<td>Employment status</td>
<td>-.115</td>
<td>-.557</td>
<td>.582</td>
</tr>
<tr>
<td>Years of nursing experience</td>
<td>.211</td>
<td>.747</td>
<td>.462</td>
</tr>
<tr>
<td>Pediatric nursing subspecialty area</td>
<td>.089</td>
<td>.468</td>
<td>.643</td>
</tr>
<tr>
<td>Level of nursing education</td>
<td>-.060</td>
<td>-.276</td>
<td>-.785</td>
</tr>
</tbody>
</table>

Note. Model summary $r^2 = .089$

Table 9

Predictors of Scores on the Clinical Decision Making in Nursing Scale (CDMNS) Subscale D, Search for Information and Unbiased Assimilation of New Information

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Significance level</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>.489</td>
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<tr>
<td>Employment status</td>
<td>.039</td>
<td>.200</td>
<td>.843</td>
</tr>
<tr>
<td>Years of nursing experience</td>
<td>-.322</td>
<td>-1.210</td>
<td>.237</td>
</tr>
<tr>
<td>Pediatric nursing subspecialty area</td>
<td>.288</td>
<td>1.609</td>
<td>.120</td>
</tr>
<tr>
<td>Level of nursing education</td>
<td>.025</td>
<td>.121</td>
<td>.904</td>
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Note. Model summary $r^2 = .189$

Research Question 2

The second research question asked, "Is there a relationship between overall scores on the MCT and age, gender, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area?" A linear regression analysis was computed to assess the association between the independent variables of age, gender, employment status, level of nursing education, years of nursing experience, and pediatric
nursing subspecialty area and the dependent variable, medication dosage-calculation ability. Because the sample was composed of 96.9% females and only 3.1% males (n = 2), the linear analysis was computed without gender as an independent variable. The variable of pediatric nursing subspecialty was collapsed into two categories (see Table 3), intensive care and nonintensive care, in order to meet the assumptions of the regression model.

There was no statistically significant association between the five demographic variables and MCT overall scores at the 0.5 level of significance, as presented in Table 10.

Table 10

Predictors of Medication Calculation Test (MCT) Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standardized beta</th>
<th>t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.277</td>
<td>.848</td>
<td>.404</td>
</tr>
<tr>
<td>Employment status</td>
<td>.143</td>
<td>.694</td>
<td>.494</td>
</tr>
<tr>
<td>Years of nursing experience</td>
<td>-.233</td>
<td>-.825</td>
<td>.417</td>
</tr>
<tr>
<td>Pediatric nursing subspecialty area</td>
<td>.145</td>
<td>.764</td>
<td>.452</td>
</tr>
<tr>
<td>Level of nursing education</td>
<td>.069</td>
<td>.320</td>
<td>.752</td>
</tr>
</tbody>
</table>

Note. Model summary $r^2 = .090$

Research Question 3

The third research question asked, "Is there a relationship between overall and subscale scores on the CDMNS and overall scores on the MCT?" A Pearson's product-moment correlation coefficient was computed to assess the association between the CDMNS's overall and subscale scores and MCT overall scores. There was no statistically significant association between the Medication Calculation Test overall scores and CDMNS Subscale A, Search for Alternatives or Options; Subscale B, Canvassing of
Objectives or Values; Subscale C, Evaluation and Reevaluation of Consequences; Subscale D, Search for Information and Unbiased Assimilation of New Information; and the CDMNS overall scores, as presented in Table 11.

Table 11

**Clinical Decision Making in Nursing Scale (CDMNS) Overall and Subscale Association With Medication Calculation Test (MCT) Overall Scores**

<table>
<thead>
<tr>
<th>Variable</th>
<th>MCT scores</th>
<th>Pearson correlation</th>
<th>Significance (two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDMNS overall scores</td>
<td>.047</td>
<td>.715</td>
<td></td>
</tr>
<tr>
<td>Subscale A–search for alternatives or options</td>
<td>.044</td>
<td>.732</td>
<td></td>
</tr>
<tr>
<td>Subscale B–canvassing of objectives or values</td>
<td>-.115</td>
<td>.367</td>
<td></td>
</tr>
<tr>
<td>Subscale C–evaluation and reevaluation of consequences</td>
<td>-.209</td>
<td>.098</td>
<td></td>
</tr>
<tr>
<td>Subscale D–search for assimilation and unbiased assimilation of new information</td>
<td>.069</td>
<td>.588</td>
<td></td>
</tr>
</tbody>
</table>

**Summary of Findings**

A descriptive analysis of the demographic data revealed a sample of pediatric registered nurses with diverse demographic characteristics. There was a 36-year range of ages of the subjects, with ages ranging from 21 to 57 years. The overwhelming majority of the sample was female, as only 2 of the 64 subjects were males. The majority of the sample was hired as full-time employees. The subjects had a wide range of educational preparation, including diplomas in nursing, associate degrees in nursing, baccalaureate
degrees in nursing and nonnursing areas, and Master’s degrees in nursing and nonnursing areas. The majority of the subjects had earned a baccalaureate degree in nursing. The sample had a 30-year range of nursing experience, with years of nursing experience ranging from 0 to 30 years. Almost half of the subjects were new graduates with no professional clinical experience. The subjects reported a total of 17 pediatric nursing subspecialty areas, and nearly half of the subjects reported the following four subspecialty areas as the areas that they had been hired to work in upon completion of the orientation program: medical-surgical, emergency department, pediatric intensive care, and adolescent/young adult.

The CDMNS overall scores ranged from 106 to 146, with possible overall scores ranging from 40 to 200. The possible range of scores for a single CDMNS subscale is 10 to 50. The CDMNS subscales that had the highest range of scores are Subscale A, Search for Alternatives or Options (30 to 42); and Subscale B, Canvassing of Objectives or Values (29 to 42). Subscale C, Analysis of Consequences, had the lowest range of scores (19 to 37).

The MCT scores were based on a 0 to 100% range, and scores on this instrument ranged from 84 to 100%. The institution that administers this test to registered nurse orientees employs a passing standard of a minimum score of 90%. If this minimum score was not achieved on the first attempt, then the subject was subsequently given an additional opportunity to achieve a passing score on the test; however, only the subject’s first attempt on this test was included as data in this study.

The optional open-ended question on the demographic data form received only two narrative responses from subjects; however, the responses were interesting. The
open-ended question asked, "Is there anything in your professional or personal life that may affect your perceptions of your clinical decision-making skills or medication-calculation abilities?" One subject responded that her prior experience as a patient would impact these cognitive skills, and a second subject commented that her religious background would make it difficult for her to make ethical decisions in a patient’s end-of-life time period. These two responses indicate that the decision-making process of registered nurses might be influenced by a registered nurse’s personal and learning experiences in the affective learning domain; however, it is difficult to draw any conclusion for this question based on the low response that it received.

Statistical analyses using linear regression revealed that age, gender, employment status, level of nursing education, years of nursing experience, and pediatric subspecialty area did not serve as predictors of pediatric registered nurses’ medication-calculation skills and clinical decision-making abilities. A Pearson product-moment correlation coefficient did not identify a significant relationship between the MCT overall scores and the CDMNS overall scores, as well as the four CDMNS subscale scores.
CHAPTER 5
DISCUSSION, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this descriptive study was to describe the relationship between nurses' clinical decision-making skills and the accuracy of medication dosage calculation. The sample was composed of 64 pediatric registered nurses who were enrolled in a nursing orientation program at a pediatric acute care institution. The instruments that were utilized in this study were a demographic data instrument, the CDMNS (Jenkins, 1983), and the MCT that was developed by pediatric nurse educators who were employed at the site where data were collected. The conceptual framework of this study was based on Simon's (1977) theory of decision making. Descriptive statistics, Pearson product-moment correlation coefficient, and a linear regression analysis were employed to answer the three research questions with the SPSS Base 9.0 statistical software (SPSS, 1999). This chapter presents a discussion of the findings, conclusions, implications, and recommendations for future research.

Discussion

Instruments

In this study, the four subscale mean scores on the CDMNS (Table 4) were higher than the four reported subscale scores obtained in a study by Thiele et al. (1991). One explanation for obtaining higher mean subscale scores might be that the subjects in the present study were graduates of a registered nurse program, and many had several years of
clinical nursing experience. The CDMNS assesses a subject’s self-perceptions of decision making, and 43.8% of the subjects in this study were new graduates who should feel more confident than student nurses regarding their decision-making skills; thus, high CDMNS mean scores should be expected in this study. It is important to note that experienced registered nurses comprised 56.2% of the sample in this study. Del Bueno (1990) reported that new baccalaureate graduates stated that they did not feel confident about their clinical decision-making skills until after about 8 months of postgraduate employment in a clinical setting. This finding can also account for the higher mean overall and subscale scores on the CDMNS in this study. Even though there are two divergent explanations for obtaining high subscale scores in this study, it is important to note that both explanations are reasonable.

The mean scores for CDMNS Subscale A, Search for Alternatives or Options (35.0865), and Subscale B, Canvassing of Objectives or Values (34.8548), were the highest two mean subscale scores of the four subscales. This indicates that the subjects perceived their clinical decision-making abilities to be stronger in Simon’s (1977) decision-making phases of intelligence and design. Conversely, the two lowest mean CDMNS subscale scores were reported on Subscale C, Evaluation and Reevaluation of Consequences (30.0806), and Subscale D, Search for Information and Unbiased Assimilation of New Information (27.5161). According to Simon’s (1977) theory of decision making, the subjects viewed their clinical decision-making skills as weak in the decision-making phases of choice and review. It is important to note that the subjects reported strong decision-making abilities in the early two phases of clinical decision-
making, intelligence and design, and were weaker in the final two phases of decision
making, choice and review.

The Cronbach’s alpha value for the CDMNS in this study was 0.43. Another
study that utilized the CDMNS also reported a low Cronbach’s value, 0.48 (Cruickshank
et al., 1994). This low value may be due to the abundance of new graduates in the sample
who had undergone only supervised experiences with clinical decision making. The
CDMNS was originally tested on a group of generic nursing students; however, Jenkins
(1983) did offer a recommendation to administer the CDMNS to registered nurse
populations. A second possible explanation for a low Cronbach’s value might be that the
subjects may be at "various stages of their own awareness of decision-making activities"
(Jenkins, p. 66).

Del Bueno (1990) stated that the most reliable method for measuring clinical
decision making is by directly observing nursing performance, not by administering a
quantitative instrument. Therefore, caution should be used in interpreting CDMNS
scores, as the data reflect self-perceptions of decision making and do not provide a direct
measure of cognitive ability.

The MCT data revealed that the subjects had difficulty computing dosage
calculations regarding adding a medication to an intravenous fluid bag, computing an
intravenous drip rate, and calculating the dose of a reconstituted medication. Bindler and
Bayne (1991) reported similar results and reported that intravenous calculations were the
most difficult for registered nurses to compute. Oral and intramuscular/subcutaneous
calculations were ranked second and third, respectively, for level of difficulty. It is
interesting to note that intravenous dosage calculations involve multiple steps and require
the cognitive skill of dosage calculation to be integrated with psychomotor skills that
involve setting up and programming the intravenous equipment.

Research Question 1

The first research question asked, "Is there a relationship between the overall and
subscale scores on the CDMNS and age, gender, employment status, level of nursing
education, years of nursing experience, and pediatric nursing subspecialty area?" This
research question addressed six possible predictors of clinical decision-making abilities.
Due to having only two males in this convenience sample, gender was not entered as a
variable in the linear regression. None of the other five variables were found to be
significant predictors of clinical decision-making abilities. There is some support in the
literature for these findings. Del Bueno (1990) reported no difference in clinical decision­
making abilities of nurses by level of education. Experience was not identified as a
predictor of clinical decision making in a study by Grossman et al. (1996).

Research Question 2

The second research question asked, "Is there a relationship between overall scores
on the MCT and age, gender, employment status, level of nursing education, years of
nursing experience, and pediatric nursing subspecialty area?" Due to having only two
males in the sample, gender was not entered as a variable in the linear regression. None of
the other five variables was found to be a significant predictor of medication dosage-
calculation ability.
As reported earlier in this study, registered nurses perceived themselves as being weak in the last two phases of Simon's (1977) decision-making process, the choice and review phases. Therefore, it is not surprising that intravenous problems were especially challenging to the registered nurses, because this type of dosage calculation problem required the execution of clinical decisions in Simon's decision-making phases of choice and review.

A consensus does not exist in the literature regarding predictors of medication dosage-calculation ability. Calliari (1995) reported that years of nursing experience was not a predictor of medication dosage-calculation ability; however, level of nursing education was found to be a significant predictor of this skill. Another study investigated institutional and procedural reasons for medication dosage errors by nurses and reported that being interrupted during medication preparation and having illegible physician medication orders were the top two reasons for medication dosage errors (Wakefield et al., 1998). Because the reasons for medication dosage calculation errors are complex and multifactorial, continued investigation into the many contributing causes of these errors is imperative.

Research Question 3

The third research question asked, "Is there a relationship between overall and subscale scores on the CDMNS and overall scores on the MCT?" Data revealed no significant associations among the variables. The two variables of clinical decision making and medication dosage calculation have not been investigated simultaneously, thus, rendering the literature incapable of either supporting or disputing the findings of this
research question. These two variables have been investigated in isolation of each other; however, it is important to continue to engage in research that investigates the two variables in conjunction with each other.

Calliari (1995) reported that registered nurses were more likely to make medication errors if they did not achieve a passing score on a medication calculation test that was administered during nursing orientation. Because medication errors can have potentially devastating outcomes, it is important to continue to investigate the decision-making processes that are activated by registered nurses during the process of medication dosage calculation. If problems can be identified in a specific phase of Simon's (1977) decision-making process, then remediation can be designed to assist registered nurses to strengthen decision-making abilities in the weakest phase or phases of the decision-making process.

Conclusions

This research proposed to describe the relationship between registered nurses' clinical decision-making skills and the accuracy of medication dosage calculation. There were no statistically significant associations identified between the clinical decision-making abilities and medication dosage-calculation abilities of registered nurses. Furthermore, the variables of age, employment status, level of nursing education, years of nursing experience, and pediatric nursing subspecialty area did not emerge as significant predictors of clinical decision-making abilities and medication dosage-calculation abilities of registered nurses.

The findings did suggest that registered nurses perceived themselves as having stronger clinical decision-making skills in the initial two phases of Simon's (1977)
decision-making process. This implies that registered nurses are capable of gathering the data that are needed to compute the medication dosage and to identify the variables that may impact that dosage calculation. In addition, the data indicated that registered nurses perceive their decision-making skills as weak in the choice and review phases, the final two phases of Simon's (1977) clinical decision-making process. This suggests that registered nurses believed that they were not viewing their clinical decision-making skills as strong when they were analyzing consequences and assimilating information.

In conclusion, when a weakness in the clinical decision-making phases of choice and review are viewed in the context of actually performing medication dosage calculation, it is reflective of significant weaknesses with the actual process of mathematical calculation, as well as the administration of the medication to the client. Registered nurses may concentrate more and, subsequently, perform better during the earlier two phases of the process of clinical decision making, but they are challenged by the type of decisions that are required in the final two stages of the clinical decision-making process.

Implications

The results of this study have important implications for nursing education, nursing service, and nursing research. This section will present a discussion of these implications.

Nursing Education

The cognitive skill of medication dosage calculation is a skill in which precision and accuracy are extremely important. With pediatric dosages many medications have narrow therapeutic dosage ranges, and a slight miscalculation can result in injury or even
death to the pediatric patient. The unit dose system is widely used at hospitals nationwide; however, many pediatric dosages are not available in unit dose form, and calculations must be performed to determine accurate dosages. Generic nursing instructors need to emphasize the accurate performance of pediatric medication dosage calculation and to seize opportunities on the clinical unit to provide students with this experience. Nurse educators should be cognizant of the fact that medication dosage calculation is not a skill that occurs in a vacuum; rather, it must be viewed holistically, and consideration must be given to the many clinical decisions that are inherent in the overall medication dosage-calculation process.

As registered nurses gain more autonomy in the clinical area, the number of independent clinical decisions that a registered nurse will need to execute will certainly increase. Therefore, nurse educators need to develop comprehensive teaching strategies that integrate the clinical decision-making process into the many clinical roles that registered nurses assume in the workplace. Simply reviewing decision-making theory in a lecture course is not sufficient. Nursing students need actual clinical experiences that challenge them to put decision-making theory into action with patients. Further, the debriefing of such clinical experiences should be done in the context of a decision-making model to strengthen nursing students’ conscious awareness of the cognitive skills involved.

Nurse educators should focus on clearly explaining and reinforcing the intricacies of the challenging types of pediatric medication-dosage problems, such as intravenous drip rates, intravenous medication dilutions, and reconstituted powdered medications. These types of problems involve multiple steps in the set-up of the mathematics, as well as
knowledge of conversion factors. Medication dosage-calculation content, which has been identified as challenging to registered nurses, should be given more attention both in the classroom and on the clinical unit. A safe and effective registered nurse must be able to perform medication dosage calculations at a level of mastery.

Nursing Service

When a registered nurse is tested on medication-calculation content and misses one answer, the outcome is a less than perfect score but is usually high enough to pass the test. When a registered nurse makes a medication-dosage calculation error on the clinical unit, the outcome can be life-threatening to the patient. Therefore, staff development sessions are needed for registered nurses to review essential medication-dosage calculation content and to provide remediation in problematic areas. Perhaps nurse administrators could add medication dosage calculation to the list of annual skill competencies that are assessed by institutions, instead of limiting this assessment to a one-time test during the orientation period.

Because clinical decisions are made by registered nurses and because the outcomes of these decisions directly impact that patient’s overall condition, the skill of clinical decision making deserves to be assessed during nursing orientation at institutions. These data can be shared with nurse preceptors on the unit who will work with orientees. The preceptors should make a concerted effort to discuss the rationale for selecting particular directions and for rejecting alternate solutions during the decision-making process. By incorporating a role model system for clinical decision making into an already existing unit
orientation experience, the orientee is afforded the unique experience of a one-on-one
opportunity for learning to think like a professional.

It is obvious that collaboration must occur between nurse educators and nursing
service leaders in order to gain insight into what medication dosage-calculation abilities
and what type of clinical decision-making abilities are presented to students in generic
nursing programs. Furthermore, nursing service leaders need to share with nurse
educators what is expected of registered nurses in the workplace regarding the skills of
medication-dosage calculations and clinical decision making. The development and
strengthening of partnerships between clinical agencies and generic nursing programs can
serve as a bridge to narrow the gap that currently exists between theory and practice in the
nursing profession.

Nursing Research

Based upon the findings of this study, several recommendations for future research
were identified. The first recommendation is for research that analyzes the outcomes of
clinical decisions that are made by registered nurses. This study focused on individual
self-perceptions of clinical decision making and resulted in a subjective measure of this
skill. Thus, the development of an objective measure of clinical decision-making ability is
warranted.

Medication dosage-calculation errors continue to emerge as an issue in nursing
malpractice lawsuits; therefore, research should be directed at identifying and eradicating
the causes of dosage-calculation errors. Other areas to investigate include the effect of
remediation of medication dosage-calculation skills for registered nurses and the monetary
cost of medication dosage-calculation errors. Because registered nurses are not the only health care personnel who calculate medication dosages, a replication of this study should be conducted with physicians, pharmacists, respiratory therapists, and any other members of the health care team who calculate medication dosages.

This study should be replicated with registered nurses in other specialty areas, and the findings should be compared to those of this study. This study should be expanded to include an increased number of subjects at multiple sites. Efforts should be taken to recruit male subjects into the sample.

A qualitative research methodology may be of value to employ for investigating the decision-making processes that are used in various clinical situations. This methodology would also be useful to capture the perceptions of registered nurses regarding medication dosage-calculation skills and possibly identify common misconceptions of the actual mathematical process.

**Recommendations**

Based upon the findings of this study, the following recommendations are offered.

1. Basic nursing programs need to incorporate decision-making content into clinical experiences throughout the curriculum.

2. The amount of mathematics prerequisites at the collegiate level should be examined to see whether the amount is facilitating or hindering the medication dosage-calculation ability of nursing students.

3. An annual competency assessment of medication dosage-calculation ability should occur at all institutions that employ registered nurses.
4. Opportunities for dosage calculation remediation for registered nurses should be offered by nursing staff development personnel.

5. The feasibility of using other instruments that measure clinical decision making should be investigated.

6. Nursing staff development personnel should provide continuing education sessions that are designed to enhance the clinical decision-making abilities of registered nurses. One possibility for implementing this suggestion would be to offer weekly nursing grand rounds to discuss current clinical cases and the related clinical decisions.

7. Collaboration must be fostered between nursing education and nursing service in order to prepare the future workforce of the nursing profession.

8. Psychometric development of the CDMNS should continue in order to address criterion, face, and construct validity of this instrument. As the CDMNS is refined, another factor analysis should be performed to assess whether a single construct is represented by the instrument.
REFERENCES


Demographic Data Instrument

Age in years: _______

Gender: male / female (circle one)

Employment Status According to Your Institution: Full-time _____ Part-time _____ (check one)

Highest Level of Education Completed: (check one)

- Diploma in Nursing
- Associate Degree in Nursing
- Baccalaureate Degree (non-nursing)
- Baccalaureate Degree in Nursing
- Master's Degree (non-nursing)
- Master's Degree in Nursing
- Doctoral Degree (non-nursing)
- Doctoral Degree in Nursing
- Post-Doctoral Studies in Nursing

Years of Nursing Experience: _______________________

Pediatric Nursing Subspecialty Area:
Please indicate the pediatric subspecialty area that you were hired to work in at Children’s Hospital: __________________________________________________

Is there anything in your professional or personal life that may affect your perceptions of your clinical decision-making skills or your medication calculation abilities?

Yes / No (circle one)

OPTIONAL:
If yes, please briefly identify what you believe may interfere with your perceptions of your clinical decision-making skills and/or your medication calculation abilities.

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
The Clinical Decision Making in Nursing Scale (CDMNS)

Directions:
For each of the following statements, think of your behavior while caring for clients. Answer on the bases of what you are doing now in the clinical setting. There are no "right" or "wrong" answers. What is important is your assessment of how you ordinarily operate as a decision maker in the clinical setting. None of the statements cover emergency situations.

Do not dwell on responses. Circle the answer that comes closest to the way you ordinarily behave.

Answer all items. About 20 minutes should be required to complete this exercise, but if it must be taken from the classroom, a 24-hour time-limit will be imposed for its return.

SCALE FOR THE CDMNS

Circle whether you would likely behave in the described way:

A = Always; What you consistently do every time.
F = Frequently; What you usually do most of the time.
O = Occasionally; What you sometimes do on occasion.
S = Seldom; What you rarely do.
N = Never; What you never do at any time.

Sample statement: I mentally list options before making a decision.

Key: A F O S N

A circle around response F means that you usually mentally list options before making a decision.

Note: Be sure you respond in terms of what you are doing in the clinical setting at the present time.

<table>
<thead>
<tr>
<th>Statement</th>
<th>A</th>
<th>F</th>
<th>O</th>
<th>S</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. If the clinical decision is vita and there is time, I conduct a thorough search for alternatives.</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>2. When a person is ill, his or her cultural values and beliefs are secondary to implementation of health services.</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
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<tr>
<td>3. The situational factors at the time determine the number of options that I explore before making a decision.</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>4. Looking for new information in making a decision is more trouble than it is worth.</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>Statement</td>
<td>A</td>
<td>F</td>
<td>O</td>
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<td>--------------------------------------------------------------------------</td>
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<tr>
<td>5. I use books or professional literature to look up things I don’t understand.</td>
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<td>6. A random approach for looking at options works best for me.</td>
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<td>7. Brainstorming is a method I use when thinking of ideas for options.</td>
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<td>8. A go out of my way to get as much information as possible to make decisions.</td>
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<tr>
<td>9. I assist clients in exercising their rights to make decisions about their care.</td>
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<tr>
<td>10. When my values conflict with those of the client, I am objective enough to handle the decision making required for the situation.</td>
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<tr>
<td>11. I list to or consider expert advice or judgment, even though it may not be the choice I would make.</td>
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<td>12. I solve a problem or make a decision without consulting anyone, using information available to me at the time.</td>
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<tr>
<td>13. I don’t always take time to examine all the possible consequences of a decision I must make.</td>
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<tr>
<td>14. I consider the future welfare of the family when I make a clinical decision that involves the individual.</td>
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<tr>
<td>15. I have little time or energy to search for information.</td>
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<tr>
<td>16. I mentally list options before making a decision.</td>
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<td></td>
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</tr>
<tr>
<td>17. When examining consequences of options I might choose, I generally think through &quot;If I did then, then...&quot;</td>
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<td></td>
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<tr>
<td>18. I consider even the remotest consequences before making a choice.</td>
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</tr>
<tr>
<td>19. Consensus among my peer group is important to me in making a decision.</td>
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<tr>
<td>20. I include patients as sources of information.</td>
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<tr>
<td>21. I consider what my peers will say when I think about possible choices I could make.</td>
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</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Statement</th>
<th>A</th>
<th>F</th>
<th>O</th>
<th>S</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>22. If a colleague recommends an option to a clinical decision-making</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>situation, I adopt it rather than searching for other options.</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>23. If a benefit is really grat, I will favor it without looking at all</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>the risks.</td>
<td></td>
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<tr>
<td>24. I search for new information randomly.</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>25. My past experiences have little to do with how actively I look at</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>risks and benefits for decisions about clients.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>26. When examining consequences of options I might choose, I am aware of</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>the positive outcomes for my client.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>27. I select options that I have used successfully in similar</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>circumstances in the past.</td>
<td></td>
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</tr>
<tr>
<td>28. If the risks are serious enough to cause problems, I reject the</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
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<tr>
<td>option.</td>
<td></td>
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<tr>
<td>29. I write out a list of positive and negative consequences when I</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
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<tr>
<td>am evaluating an important clinical decision.</td>
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<tr>
<td>30. I do not ask my peers to suggest options for my clinical decisions.</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>31. My professional values are inconsistent with my personal values.</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>32. My finding of alternatives seems to be largely a matter of luck.</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>33. In the clinical setting, I keep in mind the objectives for the</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
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<tr>
<td>day's experience.</td>
<td></td>
<td></td>
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<tr>
<td>34. The risks and benefits are the farthest thing from my mind when I</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
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<tr>
<td>have to make a decision.</td>
<td></td>
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<tr>
<td>35. When I have a clinical decision to make, I consider the institutional</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
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<tr>
<td>priorities and standards.</td>
<td></td>
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<tr>
<td>36. I involve others in my decision making only if the situation calls</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>for it.</td>
<td></td>
<td></td>
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<tr>
<td>37. In my search for options, I include even those that might be thought</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>of as &quot;far out&quot; or not feasible.</td>
<td></td>
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</tr>
<tr>
<td>38. Finding out about the client's objectives is a part of my clinical</td>
<td>A</td>
<td>F</td>
<td>O</td>
<td>S</td>
<td>N</td>
</tr>
<tr>
<td>decision making.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
39. I examine the risks and benefits only for consequences that have serious implications.

40. The client's values have to be consistent with my own in order for me to make a good decision.

Thank you for being a participant in this study. Do you have any ideas about decision making in nursing that were not covered by the scale that you would like to share? You can speak to specific items or give general comments if you would like to. Feel free to use this last page or back of the answer sheet.

(Permission obtained from Helen Jenkins to use this instrument in this study.)
Copyright 1983, Helen Jenkins
APPENDIX C

MEDICATION CALCULATION TEST (MCT)
The Medication Calculation Test that was used in the study is currently being administered to nurse orientees at a pediatric health care institution. In order to maintain confidentiality of the Medication Calculation Test, this test is not available for publication in the public domain.
APPENDIX D

INSTITUTIONAL REVIEW BOARD APPROVAL FORM,
UNIVERSITY OF ALABAMA AT BIRMINGHAM
The Assurance became effective on February 1, 1994 and the approval period is for five years.

The Assurance number is M-1149

Principal Investigator: **LYNN M. STOVER, RNC, MSN**
Protocol Number: X990127009
Protocol Title: The Relationship Between Perceived Decision Making Ability and Medication Dosage Calculation Ability of Registered Nurses

The IRB reviewed and approved the above named project on 2/15/99. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

Date: 2/15/99

Marilyn Doss, M.A.
Vice Chair of the Institutional Review Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.
APPENDIX E

INSTITUTIONAL REVIEW BOARD APPROVAL FORM,
CHILDREN’S HOSPITAL
To: Lynn Stover
From: Beverly Barrett, Chairman Nursing Research Board
Date: 02/19/99
Re: Research Proposal

I am pleased to announce that your research proposal "Relationship Between Clinical Decision Making Ability and Medication Dosage Calculation Ability of Registered Nurses" has been approved. Per our telephone conversation, the following was a recommendation but not a directive:

1. The demographic page should have the employee list where they work. Some of the choices you have listed would be marked more than once because of the way the units are set-up.

2. The OR does not attend the nursing orientation, so that area will not be represented.

3. On the consent letter, you may want to add the following statement "the results of this test will have no bearing on your employment status".

4. It was also recommended that the test be administered before the medication test.

We also ask that you return the exams to Nursing Education to be shredded. Additionally, there is a quarter summary that we ask that you submit to the Nursing Board addressed to me.

Again, congratulations and if there is anything else we can do for you, please call.
Dear Nurse Orientee,

I am a Doctoral Student in Nursing Education at The University of Alabama School of Nursing, University of Alabama at Birmingham. I am currently collecting data for my dissertation that will examine the relationship between perceived clinical decision-making skills and medication calculation abilities of registered nurses.

All nurse orientees (registered nurses and new graduates who are Nurse Graduates-Registered Nurse Program, NG-RNP) at Children’s Hospital are eligible to participate in this study. Participants will complete three brief instruments: the Demographic Data Instrument, the Clinical Decision Making in Nursing Scale (CDMNS), and the Medication Calculation Test that is administered to all nurse orientees at Children’s Hospital during a scheduled Nursing Orientation session.

There are no identifiable risks related to your participation in this study. Results will be reported as a group, and the confidentiality of your responses will be maintained. Consent to participate in the study will be indicated by your completion of the Demographic Data Instrument and the CDMNS. The results of the Demographic Data Instrument and the CDMNS will have no bearing on your employment status at Children’s Hospital. Medication Calculation Tests completed during Nursing Orientation will be analyzed in a confidential manner and your anonymity will be assured.

During this session, you can ask the researcher any questions you may have regarding the study, either before or after you complete the two instruments. If you have any questions after this session, please feel free to contact the researcher, Lynn Stover, at (205) or (w) 205-975-7000.

Thank you for your time and assistance with this endeavor!

Sincerely,

Lynn M. Stover, RNC, MSN
Doctoral Candidate
University of Alabama at Birmingham
University of Alabama School of Nursing
Name of Candidate ______ Lynn Stover ____________________________________

Major Subject __________ Educator of Nursing ______________________________

Title of Dissertation _____ The Relationship Between Perceived Clinical Decision ______ Making Abilities and Medication Dosage Calculation Abilities in ______
_____________ Registered Nurses ____________________________________________

I certify that I have read this document and examined the student regarding its content. In my opinion, this dissertation conforms to acceptable standards of scholarly presentation and is adequate in scope and quality, and the attainments of this student are such that she may be recommended for the degree of Doctor of Science in Nursing.

Dissertation Committee:

Name

__________ Dr. Lyn Reilly ___________ Chair

__________ Dr. Penelope Wright

__________ Dr. Alfred Bartolucci

__________ Dr. Marsha H. Adams

__________ Dr. Carol Schlichter

Signature

Chair

Director of Graduate Program

Dean, UAB Graduate School ____________________________

Date _______________ 3/23/00 ____________________________

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