

**LOYOLA UNIVERSITY CHICAGO**

**CLINICAL REASONING IN EXPERIENCED NURSES**

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DOCTOR OF PHILOSOPHY  
PROGRAM IN NURSING**

**BY**

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## ABSTRACT

This qualitative descriptive study was designed to explore the cognitive strategies used by experienced nurses as they think about assessment findings on their assigned patients. As an essential component of nursing practice, clinical reasoning is used to assimilate information, analyze data, and make decisions regarding patient care. Changes in health care settings and patient acuity challenge nurses to make complex decisions under conditions of uncertainty and risk. With fewer expert nurses available to act as mentors, experienced nurses who are not yet experts must utilize varied reasoning strategies to care for acutely ill patients. Few studies of nurses' clinical reasoning have been conducted in a practice setting during actual patient care. Information processing theory provided the theoretical framework for the study. Fifteen experienced nurses were asked to 'think aloud' about their beginning shift assessments. An experienced nurse was defined as a registered nurse with no advanced degree or certification who had worked full time on a medical-surgical unit more than 2 years but less than 10 years. Think aloud data were audiotaped and transcribed. Three steps of protocol analysis were used to analyze the data. These included referring phrase, assertional, and script analysis. Referring phrase analysis organized data according to concepts. Assertional analysis

identified the links that were made between concepts, and script analysis revealed the heuristics that nurses used while reasoning. The results of this study indicated that experienced nurses used a conceptual language to reason about patient assessments linked these concepts together to make sense of the information, and consistently used heuristics to reason more quickly and efficiently. Secondary findings included support for the definition and model of clinical reasoning used in this study, as well as support for information processing theory as the underlying theoretical framework used by nurses. A serendipitous finding was that experienced nurses used reasoning strategies that have previously been identified only in experts. Results of this study have implication for practice, education, and further research. The classic work of Benner may need to be revisited in order to identify current skill levels in practice.

**CHAPTER 1**  
**PROBLEM STATEMENT**

**Introduction**

Clinical reasoning is an important aspect of professional nursing and guides the nurse in assessing, assimilating, retrieving, and/or discarding components of information (Cioffi & Markam, 1997; Fonteyn, 1991b, 1995; Hughes & Young, 1990; Jenkins, 1985; Matteson & Hawkins, 1990). With clinical reasoning the nurse analyzes information and ultimately reaches decisions regarding patient care.

It has been identified as the 'hallmark' of an expert nurse and is considered that which separates the nurse from ancillary health care providers (Fowler, 1997, Hughes & Young, 1990). Little is known about the reasoning processes nurses use to make clinical decisions about patient care (Grobe, Drew, & Fonteyn, 1991; Hughes & Young, 1990; O'Neill, 1995). There are suggestions that domain-specific knowledge, experience, and intuition are important components of this process ( Benner, 1984; Benner & Tanner, 1987; Benner, Tanner, & Chesla, 1996; Cioffi, 1998; Corcoran, Narayan, & Moreland, 1988; Crow, Chase, & Lamond, 1995; Parker, Minick, & Kee, 1999; Radwin, 1998; White, Nativio, Kobert, & Engberg, 1992).

**Significance**

As a result of multiple changes in health care and the current nursing shortage, nurses have more responsibility and accountability, and must use reasoning strategies rapidly and with fewer resources ( Fisher & Fonteyn, 1995; Thiele, Holloway, Murphy, Pendarvis & Stucky, 1991). Nursing has expanded into advanced practice roles which

increase the critical decisions that are made affecting the patient, family, and/or community. High patient acuity and complex technology once separated the critical care patient from those in other settings. This distinction is now blurred. With the movement of critically ill patients out of intensive care units and on to general floors or into the community, more and more nurses are required to make complex decisions under conditions of uncertainty and risk ( Ellis, 1997; Taylor, 1997 ). Graduate nurses and nurses orienting to new positions have limited time to learn institutional policies, procedures and standards before assuming full responsibility for patient care. Furthermore, there are fewer experts available to act as mentors.

Improved clinical reasoning can strengthen nursing practice by increasing the accuracy of decisions thereby improving patient outcomes. The results of clinical reasoning research can also be incorporated into nursing education to better prepare novices to manage patient information and make decisions. Most of the research on clinical reasoning to date has been done with novices or experts. Since the majority of practicing nurses are neither novice nor expert, identification of the clinical reasoning strategies used by experienced nurses will provide a better understanding of the dynamic and complex nature of this process at different skill levels.

Only eight studies of clinical reasoning have used a sample of experienced nurses who were not defined as expert. Furthermore, only four published studies have been conducted within a clinical setting during actual patient care (Fisher & Fonteyn, 1995; Fowler, 1997; Greenwood, Sullivan, Spence, & McDonald, 2000; Navin, 1991). Clearly, more research is needed examining the reasoning process used by experienced nurses while providing patient care.

### Aim

With a limited amount of resources and fewer experts available to act as mentors, experienced nurses who are neither novice nor expert must often make rapid and complex decisions (Fonteyn & Grobe, 1993; Watkins, 1998). Therefore, the aim of this study was to describe the cognitive processes used by experienced nurses as they assess patients assigned to their care.

### Research Questions

Based on the above aim of the study, three research questions were identified:

1. What information do experienced nurses concentrate on while reasoning about assessment findings?
2. What information do experienced nurses link together to form relationships among concepts?
3. What informal reasoning strategies (heuristics) do experienced nurses use?

### Definition of Terms

In order to maintain consistency throughout this study three terms must be defined: experienced nurse, patient assessment, and think aloud.

#### Experienced Nurse

An experienced nurse has been defined as a registered nurse who has been working full time on a medical-surgical unit for a minimum of 2 years but less than 10 years. Experience has been additionally defined as "knowing the patient", time spent in nursing practice, and knowledge gained over a period of time (Greenwood, 1998a; O'Neill, 1999; RaRadwin, 1995, 1998; Watson, 1991, 1994). Two years of experience was determined to be the minimum criterion for nurses who are between novice and expert. This decision is based on previous research indicating that two years experience in nursing is a minimum to competently assess and plan patient care (Benner, 1984; Crow, Chase, & Lamond, 1995;

Grobe, Drew, & Fonteyn, 1991; Navin, 1991; Szaflarski, 1997; Tanner, Padrick, Westfall, & Putzier, 1987). Controversy exists over the number of years of clinical experience needed to be considered an expert nurse. An implied definition of expert is time spent in practice. Although earlier studies established five years experience in one practice setting as the criterion for the expert skill level (Benner & Tanner, 1987; Fonteyn, 1991; Lauri, Salantera, Gilje, & Klose, 1999; Parker, Minick, & Kee, 1999; Sims & Fought, 1989), this author noted that nurses working on a medical-surgical unit of the hospital chosen as the research setting had accumulated more than 5 years experience intermittently due to maternity leave and personal needs. Simon (1989) used 10 years of experience as the criterion for expertise in clinical practice. Therefore, the decision was made to extend the maximum number of years' experience for the experienced nurse category to 9 years.

#### Patient Assessment

Patient assessment was the cognitive task chosen for measurement of nursing clinical reasoning skills. In this study, assessment indicated the initial encounter the nurse had with the patient. Patient assessment has been described as the first of many steps of the nursing process that requires reasoning skills (Bittner, 1998; dela Cruz, 1994; Fisher & Fonteyn, 1995; Narayan, 1990; Narayan & Corcoran-Perry, 1997; Navila, 1991; Nissila, 1992; Tanner, Padrick, Westfall, & Putzier, 1987; Thiele, Holloway, Murphy, Pendarvis, & Stucky, 1991; Watkins, 1998; White, Nativio, Kobert, & Engberg, 1992). Assessment includes gathering and organizing patient data, cues, or information into categories for further deliberation (Akers, 1991; Aspinall, 1979; Cioffi & Markham, 1997; Ellis, 1997; Fonteyn, 1995; Jones, 1988; Lee & Ryan-Wenger, 1997; Narayan & Corcoran-Perry, 1997; Tanner, Padrick, Westfall, & Putzier, 1987; Taylor, 1997). Cues gathered during patient assessment are linked together through inductive reasoning in order to determine a patient's status and/or need for care (Byrnes & West, 2000; Carnevali & Thomas, 1993;



Crow, Chase, & Lamond, 1995; Jacovone & Dostal, 1992; Lyneham, 1998; Taylor, 2000; Thompson, 1999; Watson, 1994; White, Nativio, Kobert, & Engberg, 1992).

### Think Aloud

Think aloud is a qualitative method of collecting verbal data about cognitive processes during a problem task (Ericcson & Simon, 1993, 1996; van Someren, Barnard & Sandberg, 1994; VisDube, 1995). It is based on the following assumptions: 1) human cognition is information processing, 2) cognitive processes can be verbalized, 3) thinking aloud does not alter the sequence of thought processes, and 4) verbalizations reflect information that is being attended to (concentrated on) (Ericcson & Simon, 1993, 1996; Fonteyn, Kuipers, & Grobe, 1993; Newell & Simon, 1972; Taylor, 2000; van Someren, Barnard & Sandberg, 1994). Verbal reports may reflect retrospective or concurrent thinking. Retrospective verbalization provides an oral recollection of thinking that occurred in the past. The data rely on memory and thus the longer the time period from thinking to the verbal report the greater the possibility the memory will be incomplete, altered by time, or difficult to retrieve. Concurrent verbalization is an oral report of thinking as it occurs, and is considered to produce more accurate, complete, and consistent data about a subject's reasoning (Fonteyn, Kuipers, & Grobe, 1993). The validity of think aloud data is also enhanced by limiting directions and verbal prompts to subjects (Fonteyn, 1993; VisDube, 1995).

In Chapter 2, the need for concept clarification will be presented and the rationale for using Rodger's Evolutionary Method for concept analysis is discussed. In addition, major theoretical frameworks are reviewed. This analysis resulted in the identification of the antecedents and consequences of clinical reasoning, as well as the conceptual definition of clinical reasoning that was used in this study. Finally, a review of the major

**theoretical frameworks for decision making and an analysis of nursing research using these frameworks are presented.**

## CHAPTER 2

### LITERATURE REVIEW

#### Need for Concept Clarification

A comprehensive review of the literature identified theoretical frameworks and conceptual and methodological issues related to clinical reasoning research. Multiple terms have been used synonymously with clinical reasoning, such as decision making, problem solving, clinical judgment, and diagnostic reasoning (Baker, 1997; Benner, 1984; Benner & Tanner, 1987; Benner, Tanner & Chesla, 1996; Fonteyn, 1991a,b; Fonteyn, 1998; Fonteyn, Kuipers & Grobe, 1993; Grier, 1976; Tanner, Padrick, Westfall & Putzier, 1987). Although these terms are closely related, they are distinct concepts and should not be used interchangeably. Each term may share some characteristics common to the others, while focusing on a particular aspect of the reasoning process. Although individual researchers may define the particular terms that they use, the conceptual and operational definitions are often unique to each study. This inconsistent use of terminology has contributed to a lack of conceptual clarity and a universally accepted definition of clinical reasoning. In addition, the great variety of operational definitions of these terms makes comparison of research findings across studies difficult. Therefore, a concept analysis of clinical reasoning was deemed necessary to clarify its meaning.

#### Method of Concept Analysis

Rodger's Evolutionary Method (1993) was used to analyze the concept of clinical reasoning. This viewpoint is phenomenologic and philosophical. It considers concepts as dynamic, pragmatic, and context dependent. The stages in Rodger's method of concept

analysis are presented in Table 1. They provide a logical format to follow in searching the literature for the identifying features that distinguish the concept under investigation from other similar concepts. This method is most helpful for concepts like clinical reasoning that are still evolving or in the process of change (Rodgers, 1993, p. 75).

Table 1

**Rodger's Evolutionary Method of Concept Analysis**

1. Identify the concept to be analyzed with associated terms
2. Identify literature to be reviewed for data collection
3. Identify surrogate terms, related concepts, antecedents, consequences, and attributes
4. Analyze literature for above characteristics
5. Compare interdisciplinary literature for identified characteristics
6. Suggest implications for research

Attributes comprise the identifiable essences or core of the concept, and can be used to define the concept. Surrogate terms are used interchangeably and synonymously with the concept. Related concepts are similar to, but not identical or synonymous with, the concept being analyzed. Surrogate terms for clinical reasoning include diagnostic reasoning, clinical information processing, decision framing, cognitive processing, and cognitive engagement. Related terms for clinical reasoning include critical thinking, clinical judgment, decision making, problem solving, and intuition.

**Search Strategies**

Multiple data bases and search strategies representing various disciplines were used to review the literature. FirstSearch provided a general overview of the literature in all disciplines investigated for the use of the concept clinical reasoning. The keyword

"decision making" provided the most comprehensive base of literature published, and included literature on other concepts frequently used synonymously with it, including reasoning. The disciplines reviewed included the following: philosophy, education, psychology, business, law/political science, finance, military science, medicine, and nursing. Those disciplines that yielded the most information were retained (philosophy, education, psychology, medicine, and nursing). This is consistent with Rodger's Evolutionary Method of concept analysis. Medline, LMIN, and CINAHL were used to search literature in medicine and nursing, while PsychINFO, ERIC, and Philosopher's Index were used to search literature in the disciplines of psychology, education, and philosophy. LUIS also was used to access book holdings in university libraries. The electronic and manual search was limited to English language only, research and articles published between 1990 and 2000 (unless identified by a content expert as a classic), and literature that could be obtained through university libraries and national interlibrary loan.

In order to retrieve information useful for analysis, a thematic approach to determine the usefulness of citations was employed. Articles that described the process of decision making, reasoning, problem solving, or judgment were included. All research articles were included. All citations were printed, numbered, and catalogued in binders according to database and discipline. Articles and research studies were retrieved by drawing numbers randomly and assessed for their fit with the chosen theme. Over 100 journal articles and texts were reviewed. Rodgers suggestion that 20 percent of the total population of literature be randomly chosen from each discipline was followed (Rodgers, 1993, p. 81).

#### Multidisciplinary Contributions

O'Neill (1995) noted that no descriptive model of diagnostic reasoning unique to nursing has been developed. Instead, nursing adapted attributes and characteristics of

reasoning identified in the literature of other disciplines, such as philosophy, education, psychology, and medicine, to fit clinical nursing practice.

### Philosophy

Nursing's emphasis on reflective thought, logic, and analysis was gleaned from the discipline of philosophy. The earliest references to reasoning were found in the work of Socrates, Plato and Aristotle, who laid the foundation for the theory of knowledge, and emphasized the importance of questioning, argument, debate, and inquiry (Cornford, 1935; Livingstone, 1966). Descartes and Kant further defined reasoning as analytic thinking distinct from truth, knowledge, and logic (Gracyk, 1991; Hutchins, 1952 a,b; Manktelow & Over, 1987). Kant (1934) defined reasoning as the highest form of cognition in Critique of Pure Reason. He also introduced the term "heuristics" to mean a method of solving problems for which no algorithm exists. The work of Husserl, Marcel, Merleau-Ponty, Gadamer, and Heidegger formed the basis for hermeneutic phenomenology.

### Education

The discipline of education introduced the attributes of critical thinking which included reflection, information assessment, analysis, and inference (Dewey, 1933; Ennis, 1985, 1991, 1996; Glaser, 1941; Norris, 1985). Ennis (1985) defined reasoning as a process of gathering information, making inductive and deductive inferences, and weighing alternative outcomes to reach a conclusion. Dewey (1933), Norris (1985), and Kurfiss (1988) stressed the importance of experience and discipline specific knowledge. The link between theoretical knowledge and practice was later adopted by nursing as an essential component of clinical reasoning.

### Medicine

The hypothetico-deductive model of problem solving was proposed by Elstein, Shulman and Sprafka (1978) to guide physicians in diagnosing disease. This model was based on information processing theory, and emphasized hypothesis generation and deductive reasoning (Cohen, 1996; Eeckhoudt, 1996; Elstein, 1995; Elstein, Shulman & Sprafka, 1978, 1990; Gruppen, Wolf & Bille, 1991; Hanckel, 1984; Hershey & Baron, 1987; Higgs & Jones, 1995; Kassirer & Kopelman, 1991; Sox, 1986, 1987; Sox, Blatt, Higgins & Marton, 1988). Padrick, Tanner, Putzier, and Westfall (1987) used this model to study reasoning and found that nurses did generate hypotheses to explain data, and they subsequently searched for additional data to support their hypotheses. The traditional nursing process follows this format. Although many researchers have used this model in nursing (Carnevali, Mitchell, Woods, & Tanner, 1984; Greenwood, 1998; Lyneham, 1998; White, Nativio, Kobert, & Engberg, 1992), Fonteyn (1991 a, b) suggests that clinical reasoning in nursing, unlike medicine, includes but does not emphasize diagnosis or hypothesis generation.

### Psychology

The discipline of psychology was the source of two major theoretical frameworks to explain decision making: subjective expected utility theory (SEUT), and information processing theory (IPT). These two theories, developed in psychology, along with hermeneutic phenomenology from philosophy, are the frameworks used for most nursing investigations of clinical reasoning..

Seminal work in the field of judgment and decision research was done by von Neumann and Morgenstern (1944) who published their theory of utility in Theory of Games and Economic Behavior. Although originally developed as a mathematics and economics game theory, SEUT was adopted by psychology to represent a rational and

analytical model for making decisions under conditions of uncertainty ( Baron, 1994; Goldstein & Hogarth, 1997; von Winterfeldt & Edwards, 1986). Using utility theory, a decision is made by assigning values or utilities, to expected outcomes, and assigning probabilities or decision weights to uncertain outcomes (von Neumann & Morgenstern, 1944). The outcome with the highest value or calculated probability is chosen as the best decision.

Information processing theory (IPT) is a descriptive systems theory of decision making in which the person organizes information using knowledge, experience, and cognitive processes to resolve a problem (Elstein, 1976, 1995; Elstein & Bordage, 1979, 1988; Elstein, Shulman & Sprafka, 1978, 1990; Hamers, Abu-Saad & Halfens, 1994; Higgs & Jones, 1995, 2000; Jones, 1988). It was developed by Newell and Simon (1972) through their work in artificial intelligence as an alternative theory to SEUT. According to this theory, reasoning was defined as a nonlinear, multidimensional process of incorporating data from multiple sources, weighing alternative options, and making a final judgment. IPT describes an interaction that occurs between a problem solver (information processor) and a task environment. Problem solving occurs when the information processor identifies a task, determines the goal to be met, and searches for a pathway to a solution (Greenwood, 1998, 2000; Meyer, 1992; Taylor, 2000). Information is accessed, considered, discarded, or reevaluated as the process moves forward. Rather than analyzing how a decision ought to be made according to calculated probabilities and values, this theory describes decision making as an open system of interaction between a problem solver and a problem task (Ericcson & Simon, 1993; Newell & Simon, 1972; Simon, 1972, 1979). Information is accessed by the problem solver from long term memory and cue assessment and transformed into units that can be cognitively manipulated in short term memory. Experience, formal education, intuition, task



complexity, domain specific knowledge, and the degree of risk are all essential components of the reasoning process (Hughes & Young, 1990; Fonteyn, 1995; Newell & Simon, 1972, 1979; Payne, 1976; Watson, 1994; Woods, 1985). Since the aim of this study was to describe the cognitive processes used by experienced nurses, IPT was chosen as the theoretical framework to guide this study.

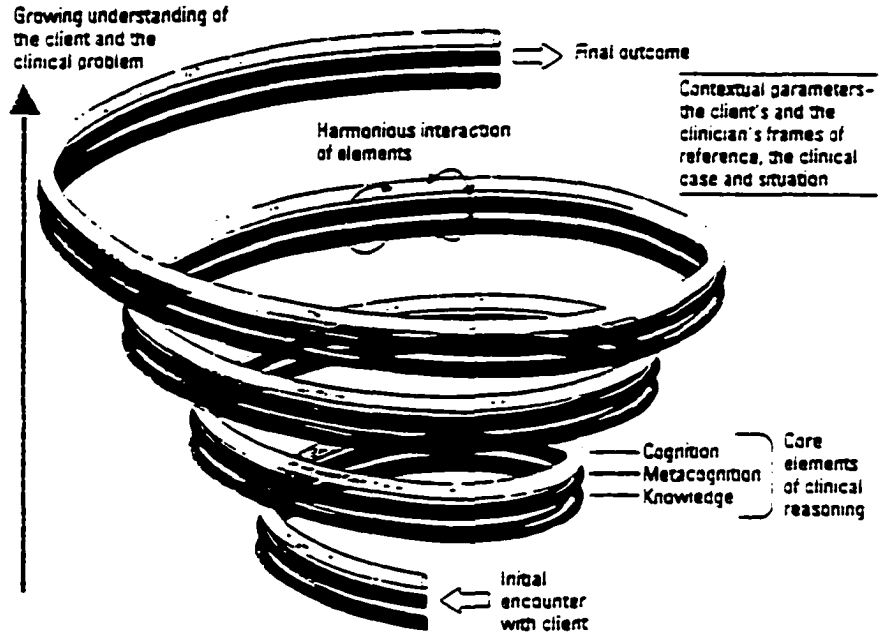
Two assumptions of this theory are that there are limits to the information that can be stored in short-term memory (STM), and that there are limits to the information that can be concentrated on at one time (bounded rationality). Successful problem solving depends on adaptation to these limitations (Taylor, 2000). Information being concentrated on, or attended to, is kept in STM and can be easily accessed for further processing or verbalization (VisDube, 1995). Miller (1956) hypothesized that the capacity of STM is seven pieces of information, plus or minus two. The ability to "chunk" or organize information into familiar patterns may increase storage capacity. Experts may more easily "chunk" information to improve reasoning (Egan & Schwartz, 1979; Fonteyn, 1991, 1995; Glaser, 1988; Glaser & Chi, 1988; Greenwood, 1998a,b; Lee & Ryan-Wenger, 1997). Long-term memory (LTM) is infinite in its capacity to hold information for permanent storage; however, since it is more difficult to access this information, it takes longer to retrieve it. Access is gained only through association of cues with related patterns. Research has shown that experts can retrieve information from LTM by reliance on heuristics (informal reasoning strategies, cognitive strategies), formal education, and experience (Fisher & Fonteyn, 1994; Fonteyn, 1991; Fonteyn & Grobe, 1993; Gilhooly, 1990; Glaser, 1988; O'Neill, 1995).

### Conceptual Model

A model of clinical reasoning is presented in Figure 1. It is adapted from the model of clinical reasoning proposed by Higgs and Jones (1995). Clinical reasoning is

depicted as a multidimensional upward and outward spiral that increases in depth with each turn of the loop. Multiple variables affect this process, including cognition, metacognition, knowledge, task complexity, context within which the decision is made, and life experience (Corcoran, 1986; Fowler, 1997). The amount of information available and/or the uncertainty of the outcome affect the process. Clinical reasoning is also context dependent and discipline specific, incorporating knowledge unique to nursing within the specific practice setting. The use of a formal strategy (information processing) or informal strategies (heuristics) depends on the situation and the experience of the nurse. The recursive nature of the spiral allows the person to move forward and backward as they assess, add or delete information, formulate alternative actions, and move toward a final outcome. The spiral may be entered or exited from multiple points, depending on the cognitive skill, discipline specific knowledge, and experience of the nurse. Ease of cognitive flexibility enables the person to simultaneously assess cues, determine relevance, apply knowledge and experience, and weigh the value of each option. Metacognition enables the person to think about their thinking in specific situations. Each nurse brings to this process a unique set of variables, including education, age, life experiences, maturity, cognitive ability, and clinical experience. In addition, each context within which clinical reasoning is used has its own set of variables (i.e. risk, task complexity, standards of care).

Figure 1. Model of Clinical Reasoning



Note. From *Clinical Reasoning in the Health Professions* (p. 6), by J. Higgs and M. Jones, (Eds.), 1995, Jordan Hill, Oxford: Butterworth-Heinemann. Copyright 1995 by Butterworth-Heinemann. Reprinted with permission.

### **Attributes of Reasoning**

Since health care disciplines have both a theoretical and practice component, reasoning within these disciplines is commonly referred to as "clinical reasoning". Clinical reasoning in nursing is unique in its holistic assessment and focus on health promotion. The following are attributes of reasoning that are common across disciplines:

#### **Cognition**

Cognition (perception or awareness) is the nonlinear, multidimensional process of knowing or assessing information. Knowledge and consciousness organize perceptions into recognizable symbols or information (Allan 1970; Cornford, 1935; Dewey, 1933; Hutchins, 1952a,b).

#### **Metacognition**

Metacognition is reflective thought, or thinking about thinking. It is a higher mental process than cognition, and uses a priori knowledge to mediate judgment. Logic, inference, and the ability to argue logically are characteristics of metacognition (Cornford, 1935; Eliot, 1950; Hutchins, 1952 a,b; Kant, 1934).

#### **Information Processing**

Information processing is the cognitive ability of organizing data, facts, or knowledge. This knowledge is stored in either short or long term memory (Miller, 1956; Newell & Simon, 1972; Simon, 1974). Information is accessed, considered, discarded, or reevaluated as the process continues. Experience, knowledge, intuition, task complexity, and the degree of risk involved are all essential aspects of information processing. Information being concentrated can be verbalized (Byrnes & West, 2000; Easen & Wilcockson, 1996; Ericcson & Simon, 1980; Hanneman, 1998; King & Appleton, 1997).

### Heuristics

Heuristics are informal mental strategies for solving problems when situations are risky or outcomes are unknown. These strategies rely on knowledge gained from previous experiences but are subject to judgment biases (Baron, 1994; Brehmer, 1974; Kahneman, Slovic & Tversky, 1982; Tversky & Kahneman, 1974, 1983). Frequently used heuristics include pattern recognition (similarity), framing, anchoring and adjusting, representativeness, and availability (Fisher & Fonteyn, 1995; Fonteyn, 1997; Fonteyn & Grobe, 1993; Teekman, 2000; Tversky, 1977; Tversky & Kahneman, 1972, 1974, 1981, 1983).

### Analysis

Analysis is the ability to separate information into its essential components and to weigh the value of alternative actions (Allan, 1970; Baron, 1994; Eliot, 1950; Goldstein & Hogarth, 1997; Manktelow & Over, 1987; von Neumann & Morgenstern, 1947; von Winterfeldt & Edwards, 1986).

### Knowledge

Knowledge is truth, fact, or awareness of information through perception and cognition. It may be tacit or explicit (Allan, 1970; Cornford, 1935; Eliot, 1950; Wilson, 1976).

### Information availability

Information availability, the ability to process, store, and retrieve information, and pattern recognition are essential to clinical reasoning (Newman, 1990).

### Antecedents and Consequences

Antecedents are those events that occur prior to the concept under analysis, and consequences are those events that occur after. Antecedents and consequences of reasoning are presented in Table 2.

Table 2

**Antecedents and Consequences of Reasoning**

<b>Antecedents</b>	<b>Consequences</b>
cognitive perception	choices
tacit or explicit knowledge	cognitive awareness of cues
risk taking ability	reevaluation of alternatives
cues	decision
perceived need for action	implied action
discipline specific knowledge	goal attainment
life experience	judgment
short and long term memory	outcome
formal /informal education	

Multiple events or phenomena precede clinical reasoning and may account for the skill with which this process is used. Variables which are difficult to measure may also be involved, including risk taking disposition, maturity, formal and informal education, and experience.

Similarly, events or phenomena that follow clinical reasoning are the outcomes of the concept. Choices may be correct or incorrect, appropriate or inappropriate. Every choice has implications and responsibilities associated with it. The consequences make the concept purposeful and directive. Clinical reasoning in nursing is as concerned with the outcomes (choice, decision, or resolution) as it is with the process (cognition). If better strategies and models of clinical reasoning are identified, outcomes will improve in accuracy.

Actions or outcomes are the result of the process of clinical reasoning and provide additional variables that retrospectively affect the concept. Accountability, responsibility,

implications of actions, and repercussions may positively or negatively affect the willingness with which one enters into the reasoning process. Consequences, if known from previous experience, may actually become antecedents to the process of clinical reasoning.

### Definition of Clinical Reasoning

Clinical reasoning in nursing is defined by this author as a complex, multidimensional, recursive cognitive process that uses formal and informal strategies to gather and analyze patient information, evaluate the significance of this information, and determine the value of alternative actions. Essential to this process is cognition, metacognition, and discipline specific knowledge. Formal and informal thinking strategies (heuristics) organize patient data. Information that is initially discarded as nonessential may be reevaluated at a later point in the process. Simultaneously, alternative actions are cognitively proposed and evaluated. The process is dynamic and expanding as information and alternative actions are retrieved, discarded or used.

### Methodological Issues

A review of the nursing literature revealed that three theoretical frameworks were used to conceptualize the research on clinical reasoning: hermeneutic phenomenology, subjective expected utility theory (SEUT), and information processing. Research methodologies varied according to the theoretical framework used. A qualitative approach was used in studies which had a hermeneutic phenomenology framework. A quantitative methodology was used in studies which had a SEUT framework. Both qualitative and quantitative approaches were used in studies based on information processing.

### **Research Using Hermeneutic Phenomenology**

Research on differentiating levels of ability was originally conducted by Dreyfus (1979). His work was based on the philosophical underpinnings of hermeneutic phenomenology which interpreted everyday, human experiences as they were lived (Gadamer, 1970; Heidegger, 1962). These experiences were personal, contextual, and defined through knowledge acquired within a particular situation being described. Benner (1984) adapted the Dreyfus model of skill acquisition to nursing practice, in which clinical expertise resulted from ongoing theoretical, intuitive, and experiential knowledge. The lived experience of nursing was explored according to the skill level of the nurse: novice, advanced beginner, competent, proficient, and expert. Research that used interpretive phenomenology and a qualitative approach included studies by Benner (1984), Benner and Tanner (1987), Benner, Tanner, and Chesla (1992, 1996), and Benner, Hooper-Kyriakidis, and Stannard (1999) and Parker, Minick, and Kee (1999). Benner's seminal work (1984) provided the foundation for future studies of clinical reasoning according to nurses' skill levels which she defined. Benner and Tanner (1987) extended this work to explore the role of intuition in expert clinical judgment.

Since the purpose of the proposed study was to describe clinical reasoning in experienced nurses by determining what information they concentrate on, how they link information together, and what heuristics they use, investigating the lived experience would not answer these specific questions. Therefore, hermeneutic phenomenology was not an appropriate framework to guide this study.

### **Research Using Subjective Expected Utility Theory**

Multiple studies have used subjective expected utility theory (SEUT) as the theoretical framework, including research on nursing actions, nursing diagnoses, pain management, rapid decision making, hyperthermia and fluid volume excess, patient



outcomes, pressure ulcer dressings, and decision making consistency in critical care (Aspinall, 1979; Grier, 1976; Hicks, 1997; Hughes & Young, 1990; Panniers & Walker, 1994).

Subjective expected utility theory is a normative, analytic, and rational model of decision making under uncertainty (Baron, 1994; Goldstein & Hogarth, 1997; von Neumann & Morgenstern, 1944; von Winterfeldt & Edwards, 1986). Using this model, possible decision outcomes are subjectively assigned probabilities of occurring along with the value or utility of each. The probability of an outcome occurring multiplied by its value yields the expected utility. The outcome with the highest score is the optimal decision (Akers, 1991; Baron, 1994; Corcoran, 1986a; Baumann & Deber, 1989; Grier, 1976; Jones, 1988; Offredy, 1998). There are three assumptions of this theory which must be adhered to for successful application to a decision: 1) alternatives must be mutually exclusive; 2) gold standards or norms, must be established, and 3) links between intervention and outcome must be clearly identified (Akers, 1991; Baron, 1994; Baumann & Deber, 1989; Jones, 1988). If these assumptions are met, it is proposed that SEUT will consistently result in the best decision. SEUT is an analytic and rational model which determines how decisions ought to be made. It is frequently used in medicine to construct algorithms and decision trees. However, this framework was rejected for this study because: 1) the assumptions could not be met, and 2) the purpose of the study was to describe nurses' clinical reasoning processes rather than determine how their decisions ought to be made.

#### **Research Using Information Processing Theory**

As previously discussed, information processing theory (IPT) was developed by Newell and Simon (1972) as a descriptive theory of decision making, and it was used to guide this study. According to this theory information is accessed, considered, discarded

and/or used in the process of reaching a conclusion about a cognitive task. The problem solver accesses information from short and long term memory, experience, formal education, and heuristics (informal reasoning strategies) while engaged in the process. A decision is the result of gathering information and evaluating alternative outcomes. As the following review of clinical reasoning research demonstrates, both quantitative and qualitative research methods were used with this theory.

### Quantitative Methodology

Quantitative research using IPT as the theoretical framework measured clinical reasoning with instruments (Grossman, Campbell & Riley, 1996; Hollen, 1994; Jenkins, 1985; Lauri et al., 1997, 1998; Lauri & Salantera, 1995, 1998; Lauri, Salantera, Gilje, & Klose, 1999; O'Neill, 1994), simulations (Hamers, van den Hout, Halfens, Abu-Saad, & Heijltjes, 1997; Sheidler, McGuire, Grossman, & Gilbert, 1992; Tabak, Bar-Tal & Cohen-Mansfield, 1996; Thiele, Holloway, Murphy, Pendarvis & Stucky, 1991; White, Nativio, Kobert, & Engberg, 1992), and card sort technique (Lamond & Farnell, 1998). The tools used in nursing research on clinical reasoning included the Clinical Decision Making in Nursing Scale [CDMNS](Jenkins, 1985), Clinical Inference Vignettes [CIV](O'Neill, 1994), and the Clinical Decision-Making Assessment [CDA](Grossman, Campbell & Riley, 1996). Each tool measured different aspects of clinical reasoning.

The only tool that was developed and used in research by both its author and other researchers was the CDMNS (Jenkins, 1985), which measured baccalaureate nursing students' perception of their decision making ability. The CDMNS has since been used in three published studies of student and registered nurses' perceptions of their clinical reasoning ability (Byrnes & West, 2000; Girot, 2000; Thiele, Holloway, Murphy, Pendarvis, & Stucky, 1991). Byrnes and West (2000) and Girot (2000) found that registered nurses enrolled in an academic program perceived themselves to be good

decision makers while Thiele et al. (1991) noted that junior level baccalaureate nursing students had low perceptions of their decision making ability.

O'Neill (1994) developed the Clinical Inference Vignette (CIV) to measure the use of heuristics in clinical practice. This tool was based on Kahneman and Tversky's (1979) prospect theory of heuristics which stated that under uncertain conditions judgments are made using informal reasoning strategies. O'Neill adapted this theory to home health nursing, and proposed that nurses used the heuristic "representativeness" to make clinical judgments. Representativeness was defined as matching clinical information with a representative mental picture. O'Neill (1994) reported that nurses who participated in the study used representative thinking in problem solving. However, 43% of ADN nurses chose the normative response to questions posed in vignettes. Normative responses were identified as correct according to the researcher, content experts, and a review of the literature. Baccalaureate and master's prepared nurses chose normative responses 34% of the time. Expert nurses (66%) used heuristics more often than novices (50%). Chi-square, multiple regression, and descriptive statistics were reportedly used for data analysis but the discussion focused only on descriptive statistics. Strengths of this study included a random sample, discussion of sampling method, and development of one of few tools to measure heuristics in clinical reasoning. A potential limitation of this study may be the artificial aspect of vignettes in eliciting thinking strategies. In addition, this investigator questions the use of statistics to measure the use of informal thinking strategies (heuristics).

The Clinical Decision Making Assessment [CDMA](Grossman, Campbell & Riley, 1996) was developed to measure decision making ability and critical care knowledge in nurses before and after completing a four week ICU orientation program. Twenty seven new graduates and 44 experienced nurses orienting to critical care participated in the study over two years. Post test scores were compared to pretest for each orientation group.

Results indicated a significant improvement in nurses' knowledge and decision making ability scores after the four week course ( $p < .0001$ ). While this study attempted to show improvement in nurses' knowledge and clinical decision making ability after a critical care course, methodological limitations included a convenience sample ( $n=71$ ) of both new graduates and experienced critical care nurses ranging in age from 21 to 45 years with varied basic education and years of experience. These variables may have influenced both pretest and posttest scores. Test sensitization may have posed a potential threat to both the internal and external validity of the study.

Several international studies on clinical decision making in nursing were reported in the literature. Lamond and Farnell (1998) used a creative approach to determine what information nurses use to make decisions about pressure ulcer dressings in England. A card sort and decision task was administered to a group of 7 expert and 7 novice nurses to determine what information they used to make decisions. Expert nurses were defined as having greater than 3 years experience, and novices were defined as having less than 2 years experience. Nurses were asked to match cards with pictures of pressure ulcers with appropriate dressings, giving a rationale for their choice. Their decisions were compared to a 'gold standard' established by a panel of experts. Novices chose fewer accurate responses and needed more information to make a decision. Although this study used IPT for its theoretical framework, the emphasis seemed to be placed on a 'gold standard' and mutually exclusive alternative actions which is more consistent with SEUT. In addition, the use of greater than 3 years experience as the definition of an expert nurse is not consistent with other researchers (Benner, 1984; Simon, 1989).

The degree of decisional difficulty and its effect on clinical decision making of experienced and novice nurses was investigated by Tabak, Bar-Tal, and Cohen-Mansfield (1996) in Israel. Ninety-two experienced nurses and 65 senior nursing students rated their

degree of decisional difficulty in reaching nursing diagnoses for two scenarios: one with consistent information and a low degree of decisional difficulty, and the other with inconsistent information and high degree of decisional difficulty. Although this study attempted to correlate decisional difficulty with consistency of information, there were several limitations. Nurses were categorized as "experienced" if they worked at least 3 years full time. Experienced nurses perceived the scenario with inconsistent information as more difficult to interpret. Students varied little in their degree of decisional difficulty. The results of this study suggested that experienced nurses used informal reasoning strategies from past experience to evaluate the scenarios. Nurses also expressed more certainty in their decisions than students.

Ongoing international collaborative research studies on decision-making models in nursing began in 1992 (Lauri & Salanterä, 1995, 1998; Lauri et al., 1997, 1998; Lauri, Salanterä, Gilje, & Klose, 1999). The purposes of these studies, conducted in Finland, Canada, Norway, Northern Ireland, Switzerland and the United States, were to: 1) explore decision making variables, 2) determine whether an analytic or an intuitive model of decision making was used more often, and 3) describe differences in decision making among countries. Half of the questions in the 56 item questionnaire were written to determine if an analytic approach to decision making was used, while the other half were written to determine if an intuitive approach was used. Convenience sampling was used in all studies, and sample sizes ranged from 311 to 500 nurses from six countries. A finding common to all studies was that novice nurses used a more analytic approach to decision making, while expert nurses used a more intuitive approach. Furthermore, European nurses relied more heavily on an analytic approach, while American nurses used a combination of analytical and intuitive decision making methods (Lauri, Salanterä, Gilje, & Klose, 1999). Strengths of these studies included: 1) the development of an instrument to

determine decision making style in nursing, 2) extensive psychometric testing of the decision making tool, 3) identification and discussion of the sampling method, and 4) large sample sizes. Potential limitations included: 1) differences in sample sizes across countries, 2) educational and cultural differences among nurses, 3) lack of a conceptual definition of decision making, and 4) lack of equivalence testing for instrument translations.

In summary, quantitative studies using IPT as the theoretical framework employed instruments, vignettes, simulations, and a card sort to measure nurses' decision making style. Conceptual and methodological issues and limitations of these studies include: 1) the lack of conceptual definitions of reasoning (Hollen, 1994; Lamond & Farnell, 1998; Lauri & Salantera, 1995, 1998; Lauri et al., 1997, 1998); 2) the lack of established reliable and valid tools (Grossman, Campbell, & Riley, 1996; Hollen, 1994; O'Neill, 1994); 3) the fact that most decision making instruments were developed and used only once (Grossman, Campbell, & Riley, 1996; Hollen, 1994; O'Neill, 1994); 4) the use of convenience sampling (reported or implied) which limits generalizability of findings (Grossman, Campbell, & Riley, 1996; Hollen, 1994; Jenkins, 1985; Lamond & Farnell, 1998; Lauri & Salantera, 1998; Lauri et al., 1997, 1998), and 5) the potential limitation to generalizability caused by language, educational, and conceptual differences in international studies (Lauri & Salantera, 1995, 1998; Lauri et al., 1997, 1998; Tabak, Bartal, & Cohen-Mansfield, 1996). Thus, the difficulty inherent in quantifying subjective cognitive processes, the lack of a consistent operational definition, and the state of instrument development in this field suggest that a quantitative approach would not be appropriate for this study.

**Qualitative Methodology**

**Research using IPT as the theoretical framework with qualitative methodology (see Table 3) measured clinical reasoning through observation and interview, line of reasoning, and think aloud methods.**

Table 3

**Qualitative Research Methods****I. Observation and Interview Approach**

Boblin-Cummings, Baumann, & Deber (1999)  
 dela Cruz (1994)  
 Edwards (1994)  
 Ellis (1997)  
 Lyneham (1998)  
 Luker, Hogg, Austin, Ferguson, & Smith (1998)  
 Marsdan (1999)  
 Offredy (1998)  
 Radwin (1998)  
 Taylor (1997)  
 Teekman (2000)  
 Thiele, Holloway, Murphy, Pendarvis, & Stucky (1997)  
 Watkins (1998)  
 Watson (1994)

**II. Line of Reasoning**

Narayan (1990)  
 Narayan & Corcoran-Perry (1997)  
 Nissila (1992)

**III. Think Aloud Method**

Corcoran (1986b)  
 Corcoran Narayan, & Moreland (1988)  
 Cioffi & Markham (1997)  
 Fisher & Fonteyn (1995)  
 Fonteyn (1991)  
 Fonteyn (1997)  
 Fonteyn & Grobe (1993)  
 Fowler (1997)  
 Greenwood, Sullivan, Spence, & McDonald (2000)  
 Grobe, Drew, & Fonteyn (1991)  
 Lee & Ryan-Wenger (1997)  
 Navin (1991)  
 Tanner, Padrick, Westfall, & Putzier (1997)  
 Westfall, Tanner, Putzier, & Padrick (1986)



### **Observation and interview approach**

**Edwards (1994) used a creative approach of simulated phone calls to elicit diagnostic reasoning of experienced triage nurses (n=5). Participants were able to ask questions, and additional information was provided by the investigator. Phone calls were audio-taped, transcribed, and analyzed using a constant comparative method. The emerging theory suggested that decision making was a balance of risk taking and risk reducing. This unique methodology allowed subjects to assess information that was presented in a fixed script as well as request more information. Additional strengths of this study included a conceptual definition of decision making, the use of experienced nurses in the sample who were neither novice nor expert with 3.5 to 9 years experience, and the use of the grounded theory method. Potential limitations included limited information given about the development of scenarios used for the telephone simulations, the small sample size which may not have achieved saturation of data, and the spontaneous nature of additional information that was provided to the subjects upon request. In a similar study, Marsden (1999) interviewed 7 nurse practitioners after telephone triage with actual patients in an emergency department and found that advanced practice nurses used a hypothesis-diagnosis strategy in their decision making.**

**Radwin (1998) also used a grounded theory method with constant comparative analysis to identify strategies that 13 expert CCU nurses used in clinical decision making. Expert was defined as a nurse with a baccalaureate or master's degree with an average of 7.4 years experience in nursing and 5.6 years of cardiology experience. Experience in nursing emerged as the most important aspect of decision making, and was defined as application of previously learned knowledge. Patient focus, nurse's confidence, and skill in pattern recognition were key attributes of experience.**

Studies that used observation with semi-structured interviews described decision making in response to case studies or direct patient care (de la Cruz, 1994; Ellis, 1997; Luker, Hogg, Austin, Ferguson, & Smith, 1998; Lyneham, 1998; Offredy, 1998; Taylor, 1997; Watkins, 1998; Watson, 1994). The findings of these studies indicated that nurses used hypothetico-deductive reasoning when making decisions about patients. However, this author notes that all interviews requested retrospective verbalization of thought processes, rather than concurrent verbalization. Retrospective reporting may be incomplete or altered by time, and semi-structured interviews may account for only some of the data that could otherwise be retrieved if subjects were allowed to verbalize their thoughts as they occur (Ericsson & Simon, 1996; Fonteyn, Kuipers, & Grobe, 1993; Kuipers & Kassirer, 1984; Newell & Simon, 1972). Other potential limitations included minimal discussion of sampling method, sample sizes which ranged from 3 to 49 nurses, and lack of a consistent definition of nurses' skill level.

One study compared problem solving between novices and experts (Taylor, 1997), four studies described decision making in experts ( Lyneham, 1998; Luker, Hogg, Austin, Ferguson, & Smith, 1998; Offredy, 1998; Watkins, 1998), and four studies explored the decision making of experienced nurses in the practice setting (Edwards, 1994; Ellis, 1997; de la Cruz, 1994; Watson, 1994). Sample sizes for 8 of the studies ranged from 3 to 28 subjects, while the sample size for one study consisted of 49 subjects (Luker et al., 1998). This sample for the latter study was unusually large for a qualitative study where the adequacy of the sample size is determined by redundancy in themes and the richness of the data (Denzin & Lincoln, 1998; Fonteyn, Kuipers, & Grobe, 1993; Kuipers & Kassirer, 1984; Parse, Coyne, & Smith, 1985).

There is little agreement and great variation in the definitions of novice, experienced, and expert nurses which make comparisons of findings across studies

difficult. Taylor (1997) defined novice as undergraduate students in a baccalaureate nursing program, while registered nurses who had completed a 'tertiary course' as entry into practice were considered expert. No additional information about determination of skill level was provided by the investigator. Luker et al. (1998) defined experts as advanced practice nurses who had completed a course enabling them to prescribe from a limited list of medications and wound care products. Radwin (1998) defined expert as the nurse the other staff go to for help with decision making. Other definitions of expert nurses included nurses who had completed a nurse practitioner program (Offredy, 1998), nurses who had at least 6 years of full time work experience (Watkins, 1998), and nurses who worked in intensive care for as few as 7 months to as many as 26 years (Ellis, 1992). There was similar confusion in the definition of experienced nurses. Edwards (1994) defined experienced as nurses who had worked in the emergency room for 3 to 10 years. Watson (1994) gave no definition of expert, while dela Cruz (1994) used 2 months to 35 years for her definition of experienced. Novices nurses were defined as nursing students or new graduates with less than 6 months experience. The inconsistency of nursing skill level definitions for experienced and expert nurses limits the applicability of the findings.

Boblin-Cummings, Baumann, and Deber (1999) conducted focus groups with 64 nurses in multiple clinical settings to explore the nature of decision making. Findings revealed a complex network of cognitive processes used to plan and implement interventions. However, no demographic information was collected from any of these nurses. In addition, it is possible that not all nurses contributed equally in the discussion. Therefore, it is unclear if the results reflect only certain nurses at a particular skill level.

The following are some methodological issues related to studies that used observation and interviews to describe nurses' clinical reasoning: 1) definitions of experienced and expert skill levels were inconsistent (dela Cruz, 1994; Edwards, 1994;

Ellis, 1997; Luker, Hogg, Austin, Ferguson, & Smith, 1998; Offredy, 1998; Radwin, 1998; Watkins, 1998; Watson, 1994); 2) no study provided a conceptual definition of clinical reasoning, 3) all studies utilized retrospective verbalization which required subjects to recall their thought processes from a previous event, and 4) sampling method and demographic information were not consistently obtained and/or reported (Boblin-Cummings, Baumann, & Deber, 1999).

### Line of reasoning

Narayan (1990) defined line of reasoning (LOR) as a series of reasoning steps leading to a conclusion. Narayan's (1990) initial study of critical care nurses' decision making about a patient's readiness for ventilator weaning was expanded by Narayan and Corcoran-Perry (1997). Using a hypothetical case study, nurses thought aloud as they incorporated knowledge from education and experience to make a decision. From this verbal data, lines of reasoning were developed to assist critical care nurses of different skill levels with decision making about the patient's 'work of breathing'. Nissila (1992) expanded the original work of Narayan (1990) by developing a LOR to identify potential postoperative complications in orthopedic patients. Nissila (1992) defined experienced nurses as 'experts' with a baccalaureate degree, ANA certification in orthopedic nursing, and at least five years full time experience in this practice area. Narayan (1990), Nissila (1992), and Narayan and Corcoran-Perry (1997) found differences in LOR according to skill level. Experienced nurses assessed and interpreted cues quickly, discarded incorrect lines of reasoning, elicited specific information, and connected seemingly incongruent information. Less experienced nurses made errors in analyzing cues, developed incomplete LOR, and were unable to connect incongruent information. While a strength of these studies is the development of a creative approach to reach a correct decision, a

potential limitation is the representation of LOR templates as decision trees. This may be appropriate for studies using SEUT as the theoretical framework, but it is not consistent with the assumptions of IPT. Since the purpose of this study is to describe cognitive processes rather than making a correct decision, LOR is not an appropriate methodology to use.

#### Think aloud method

Studies that elicited concurrent and retrospective verbal data used the think aloud method. This method adheres to the three assumptions of IPT: 1) cognitive processes can be verbalized; 2) human cognition is information processing, and 3) information that is currently being concentrated on can be assessed through verbal data (Ericsson & Simon, 1996; Fonteyn, Kuipers & Grobe, 1993; Newell & Simon, 1972). Although both retrospective and concurrent verbal reports describe cognitive processes, emphasis has been placed on concurrent verbalization (Ericsson & Simon, 1996). Concurrent verbal data were most often elicited by requesting subjects to think aloud in response to a written or videotaped simulation (Cioffi & Markham, 1997; Corcoran, 1986 b; Corcoran, Narayan, & Moreland, 1988; Fonteyn, 1991, 1997; Fonteyn & Grobe, 1993; Grobe, Drew, & Fonteyn, 1991; Narayan & Corcoran-Perry, 1997; Nissila, 1992; Tanner, Padrick, Westfall, & Putzier, 1987). The use of preceptors, reflective journaling, dialogue, collaboration, simulations, and mind mapping have been suggested as ways to improve students' clinical reasoning (Cioffi, 1998; Cahill & Fonteyn, 2000; Fonteyn & Ritter, 2000; Hart & Ryan, 2000; O'Neill, 1999).

Corcoran (1986b) studied the relationship between task complexity and nursing expertise during a care planning task. Six expert and 5 novice nurses were instructed to think aloud while planning care for hypothetical patients presented in sequenced case

studies of varied complexity. Experts were defined as registered nurses with 18 months experience in hospice, and novices were defined as registered nurses with 6 months experience in hospice. Transcripts were analyzed, coded, and scored for the number and quality of alternative nursing interventions generated, evaluated, sequenced, and chosen for the final plan of care. Results of the study indicated that the number of alternative nursing interventions generated was more a function of task complexity than nursing expertise. However, experts were found to have suggested more drug alternatives, provided more rationale for their evaluations, and developed better final care plans than novices did. While this was one of the first studies in nursing to use the think aloud method, there were several limitations: 1) no definition of clinical reasoning was given, 2) criteria for levels of complexity in the case studies were not stated, 3) coding and scoring methods were not discussed, and 4) statistical analysis was used to evaluate qualitative data. Parametric statistics were used in studies by Cioffi (1998a), Cioffi and Markham (1997), and Tanner, Padrick, Westfall, and Putzier (1987) to measure the use of heuristics while making inferences about patient data. Since these were qualitative studies using the think aloud method to explore cognitive strategies, this author questions the use of statistics.

In an unpublished study, Navin (1991) asked nurses ( $n=6$ ) with experience in nursing which ranged from three and one-half years to twenty-one years to think aloud about their patients' assessments. With the researcher present, data was collected on audiotape as subjects assessed assigned patients. General information about the patient was concurrently documented in writing and used as a guide for follow-up interviews with the subjects. Content analysis of verbal data revealed that nurses used three cognitive modes when gathering information to plan patient care: scanning, focusing, and context building. This study is one of the first conducted in a clinical setting using information

obtained from shift report as well as actual patient assessment. However, numerous differences to the present study can be noted. The definition for experienced nurse was a registered nurse identified as an expert by the nurse manager. No other criteria were stated including the number of years in nursing practice. Also, the presence of the investigator during patient assessment may have altered the validity of the data. Post-assessment interview questions may have guided subjects' responses. The research questions specifically asked if nurses used the scanning or focusing mode for information gathering rather than describing the cognitive processes that they used. Finally, protocol analysis was not used to analyze the data.

Think aloud method with protocol analysis was used to describe the thinking strategies nurses use in clinical practice (Fisher & Fonteyn, 1995; Fonteyn, 1991, 1997; Fonteyn & Grobe, 1993; Grobe, Drew & Fonteyn, 1991). Grobe, Drew and Fonteyn (1991) asked 7 nurses, who worked at least 2 years full time, to think aloud while planning a home health care referral for a hypothetical patient. Results of analysis indicated that nurses concentrated on patient problems and interventions simultaneously in order to reduce cognitive strain. In a similar study, 10 expert nurses, who had at least 5 years experience in ICU, were instructed to think aloud about patient information presented in a written case study (Fonteyn, 1991). Results of this study indicated that expert nurses selectively focused on certain information, linked concepts together, and used informal reasoning strategies (heuristics). Heuristics that were identified were pattern matching, predictive reasoning, enumerating a list, forward reasoning, identifying critical indicators, and questioning. While Grobe, Drew, and Fonteyn (1991) presented a case study to nurses at the beginning of the TA sessions, Fonteyn (1991) and Fonteyn and Grobe (1993) presented data sequentially to better identify links in information processing.

Fisher and Fonteyn (1995) were the first to use the think aloud method during actual patient care. In this study, data were collected as nurses provided immediate postoperative care. Voice activated tape recorders were used to capture subjects' thoughts as they reasoned about patient care. Since patients were heavily sedated, they were not disturbed by participants' verbalizations. In addition to determining that think aloud method was feasible during actual patient care, several heuristics were identified, including pattern recognition, anchoring, attending, focused questioning, and listing.

Two recent studies using the think aloud method in a clinical setting have been published (Fowler, 1997; Greenwood, Sullivan, Spence, & McDonald, 2000). Five experienced home health nurses were instructed to 'think aloud' about anticipated plans or assessment findings prior to and following home visits for chronically ill patients (Fowler, 1997). Protocol analysis of the verbal data revealed complex cognitive processes involved in clinical reasoning which were influenced by experience, knowledge, and cognitive strategies (heuristics). Boblin-Cummings, Baumann, and Deber (1999) reported similar findings using semi-structured interview with focus groups. Greenwood, Sullivan, Spence, and McDonald (2000) found inconsistencies between participants' theoretical knowledge and their clinical practice. They reported that nurses were more comfortable with daily care routines than with implementation of changes based on nursing research. The subculture of the unit and the nurses they were working with also influenced their decision making and subsequent patient care.

Strengths of qualitative studies that used TA method included the following: 1) consistent operational definition of clinical reasoning; 2) verbal data elicited about thought processes as they are occurring; 3) replication of research which built upon previous findings (Corcoran, 1986 b; Corcoran, Narayan, & Moreland, 1988; Fisher & Fonteyn, 1995; Fonteyn, 1991, 1997; Fonteyn & Grobe, 1993; Narayan & Corcoran-Perry, 1997;



Nissila, 1992), and 4) discussion of heuristics as informal thinking strategies (Cioffi & Markham, 1997; Corcoran, Narayan, & Moreland, 1988; Fisher & Fonteyn, 1995; Fonteyn, 1991, 1997; Fonteyn & Grobe, 1993; Grobe, Drew, & Fonteyn, 1991; Offredy, 1998).

Limitations of TA studies included: 1) confusion in definitions of "experienced" and 'expert' nurse (Edwards, 1994; Nissila, 1992); 2) inconsistent data analysis methods with only few researchers using protocol analysis (Fisher & Fonteyn, 1995; Fonteyn, 1991, 1997; Fonteyn & Grobe, 1993; Fowler, 1997; Greenwood, Sullivan, Spence, & McDonald, 2000; Grobe, Drew, & Fonteyn, 1991), and 3) presence of researcher during clinical data collection which may have altered verbalizations (Navin, 1991).

Only three studies used experienced nurses, rather than expert or novice nurses, in TA studies (Grobe, Drew, & Fonteyn, 1991; Navin, 1991; Tanner, Padrick, Westfall, & Putzier, 1987). Multiple authors have encouraged conducting clinical reasoning research in the practice setting (Cioffi, 1998a,b; Fowler, 1997; Gerdtz & Bucknall, 1999; Greenwood, 1997, 1998; Greenwood, Sullivan, Spence, & McDonald, 2000; Taylor, 2000; VisDube, 1995), and yet only four studies reported using TA in a clinical setting as nurses provided care or immediately after patient assessment (Fisher & Fonteyn, 1995; Fowler, 1997; Greenwood, Sullivan, Spence, & McDonald, 2000; Navin, 1991). Thus, additional research using TA method in a clinical setting is needed to explore the thinking strategies used by experienced nurses as they make decisions about actual patient care. The think aloud method was chosen for this investigation because it enabled nurses to verbalize their thoughts and describe their reasoning strategies shortly after they made initial shift assessments of their patients. Chapter 3 will present the methods used to collect and analyze data.

## CHAPTER 3

### METHODS

#### Design and Setting

A descriptive/exploratory small group research design using the think aloud (TA) method was used. This study was conducted on five adult, medical-surgical units of a 250 bed, teaching, community hospital located outside a large Midwestern city. Medical-surgical units were chosen because think aloud data should be transcribed by an individual familiar with the clinical language and terminology (Fonteyn, Kuipers, & Grobe, 1993) and this investigator's clinical expertise is in this practice area. The site was chosen for its educational affiliation with several medical and nursing schools, and its ongoing willingness to provide opportunities for student learning.

#### Sample Criteria

The sample criteria were: 1) licensed registered nurse, 2) English speaking, and 3) employed in med-surg nursing as a full time equivalent for a minimum of 2 years but less than 10 years. These criteria are consistent with those specified in the review of literature for nurses who are between novice and expert skill levels (Benner, 1984; Benner & Tanner, 1987; Fonteyn, 1991; Grobe, Drew, & Fonteyn, 1991; Navin, 1991; Simon, 1980; Sims & Fought, 1989; Tanner, Padrick, Westfall, & Putzier, 1987). Agency nurses from outside the hospital, nurses in specialty units (i.e., intensive care unit, post anesthesia care unit, emergency room, operating room), registered nurses who had recently transferred to a medical-surgical unit and were in orientation, and nurses with an advanced degree or specialty certification were excluded from participation in this study.

### **Recruitment Procedure**

As part of the recruitment strategy, copies of the consent form (see Appendix A), institutional IRB approval, and a letter explaining the study (see Appendix B) were distributed and discussed with managers on five adult medical-surgical units in the hospital used as the study setting. In addition, the investigator attended their monthly staff meeting to present details of the study and enlist their support. Originally, it was anticipated that subjects could be reached through unit meetings and the investigator attended two unit meetings. However, since there was limited staff nurse attendance at those meetings, the investigator asked each manager to develop a list of potential subjects who met the selection criteria. A limitation of this method was potential selection bias by the managers and limited representativeness. Initial contact with all subjects was made during a shift they were scheduled to work. An invitation to participate in the study was distributed (see Appendix C). They were encouraged to contact the investigator directly on the units or by email within the following week if they were interested in participation.

### **Sample**

Twenty two registered nurses initially met the inclusion criteria. Of these, four dropped out prior to data collection, and three were subsequently found to not meet the study criteria because of advanced certification or enrollment in a graduate program. The final sample size consisted of 15 registered nurses. This sample size yielded extensive verbal data and was similar to the sample size of other reported studies using TA method (Cioffi, 1998a; Fisher & Fonteyn, 1995; Fonteyn, 1991, 1997; Fonteyn, Kuipers & Grobe, 1993; Fowler, 1997; Grobe, Drew & Fonteyn, 1991; Fonteyn & Grobe, 1993; Greenwood, Sullivan, Spence, & McDonald, 2000; Kuipers & Kassirer, 1984; Navin, 1991; Taylor, 2000).

### Procedure

Institutional Review Board (IRB) approval from both the hospital and the investigator's university and written informed consents were obtained. A copy of the informed consent was given to each participant. While the study presented no potential risks to subjects, they were informed that participation would involve approximately 20-30 minutes of their time. There also were no personal benefits to participation in this study, except the knowledge that the findings of this study may be used in the future to help less experienced nurses make more accurate decisions and improve nursing education and orientation programs for new employees. Patients' and nurses' privacy and confidentiality were protected by using codes rather than names in the transcriptions. Reports of this research use group data only. All tapes and transcriptions were kept in a secure location.

A pilot study was conducted using the first three RN subjects to determine the feasibility of using 'think aloud' in a clinical setting and if adjustments were needed in the procedure. The data obtained from subjects' verbal reports provided adequate information about clinical reasoning during a cognitive task (patient assessment). The only procedural correction was the timing of the TA practice session and signing the written consent. It was anticipated that nurses would arrive prior to their shift to sign the consent, review that data collection procedure, and practice 'thinking aloud' with the tape recorder. However, most nurses not only did not arrive early, but they were often late for work. Therefore, the investigator decided to wait until immediately prior to data collection to review the procedure and obtain written consent. Since this was the only procedural change made, data collection continued, adding 12 more nurses to the sample.

Prior to the date of data collection the investigator met with the subjects at work to remind them of their scheduled participation in the study. Individual units were also called two hours prior to the beginning of the shift to validate that the subject was

working. A procedure checklist was followed with each subject to ensure consistency of data collection (see Appendix D). Each nurse was greeted by the investigator at the beginning of the shift. The length of time needed to obtain shift report and assess assigned patients was determined by the subject and varied from 30 minutes to 2 hours. During this time the investigator left the unit so there would be no interference in the subject's usual routine or patient care. At the time requested by the subject the investigator returned. A quiet, private location on the unit was used for data collection. The consent was signed, and a copy was given to each subject. A demographic form was also completed for each subject (see Appendix E). After demonstration of the tape recorder, subjects were instructed to think aloud as they reasoned about patient assessment findings. They used their written notes about each patient as they gave report. Although the investigator was present in the room during taping, there was minimal interaction between the subject and investigator except for instructions to "begin thinking aloud" or "continue thinking aloud". Notes were taken by the investigator during TA sessions when drug names, diagnostic tests, or abbreviations were unfamiliar. These terms were clarified upon completion of data collection. The length of time for participation in the study was approximately 20-30 minutes. A small medical-surgical nursing handbook was given to each subject in appreciation for their contribution.

### Data Analysis

Each audiotape was transcribed by the investigator in its entirety into segments of verbal text. These segments were analyzed using the three steps of protocol analysis: 1) referring phrase analysis (RPA), 2) assertional analysis (AA), and 3) script analysis (SA). Protocol analysis is a qualitative method of studying cognitive processes which was initially described by Ericsson and Simon (1984) and adapted by Kuipers and Kassirer (1984), Kuipers, Moskowitz, and Kassirer (1988), Fonteyn (1991), Grobe, Drew, and

Fonteyn (1991), and Fonteyn, Kuipers, and Grobe (1993). Additional work using protocol analysis with verbal reports has been done by Navin (1991), Fowler (1997), and Greenwood, Sullivan, Spence, and McDonald (2000).

In RPA, the transcript was reviewed for general meaning, and nouns and noun phrases were underlined and initially coded according to the concept they represented. These concepts are the information that nurses are concentrating on during a reasoning task (Fonteyn, Kuipers, & Grobe, 1993). Concepts were defined by the investigator and reflected knowledge of adult medical-surgical nursing. The concepts that are identified in referring phrase analysis and the relationships between them form the domain of knowledge used during reasoning (Kuipers, Moskowitz, & Kassirer, 1988). Revisions in coding and/or definitions were made as each subsequent transcript was reviewed. Final codes and definitions were based on verification among all transcripts. Assertional analysis (AA) identified relationships between concepts. Assertions were defined as positive statements or declarations made by subjects about the concepts identified in RPA. These action verbs suggested several reasoning processes that subjects used as they linked information together. In script analysis (SA) a general overview of the reasoning process was described. Based on the initial steps of RPA and AA, script analysis identified the information being concentrated on, showed links among that information, and provided rationale for decisions that were made. The structure of cognitive operators explained the reasoning processes used by experienced nurses during patient assessment. Each research question was answered by a specific step in protocol analysis. Referring phrase analysis isolated the information that experienced nurses concentrated on while reasoning about assessment findings. Assertional Analysis linked information together to form relationships among concepts, and Script Analysis provided an overview of the reasoning strategies that experienced nurses used.

### **Reliability and Validity**

Reliability and validity of the data were strengthened by adherence to the rigors of qualitative research identified by Burns (1988), Denzin and Lincoln (1998), LoBiondo-Wood and Haber (1994), Parse, Coyne, and Smith (1985), Sandelowski (1986), Vis Dube (1995), and Kirk and Miller (1986). All agree that methodologic rigor includes credibility (truthfulness), auditability (flow of research from question through analysis), and fittingness (relevance). Threats to internal validity are inaccuracy of the subjects' verbal reports, underlying theoretical knowledge adjusting thoughts prior to verbalization, inefficiency of recall, and desirability of subjects' reports. Investigator bias and inexperience with the encoding process may also affect interpretation.

Results of the study are interpreted in light of these criteria. Scientific rigor was maintained through the following: 1) use of a research protocol checklist to ensure consistency of data collection; 2) verbalization of concurrent thought processes through the think aloud method; 3) use of a tape recorder to capture verbal data; 4) data collection in the clinical setting; 5) combination of think aloud method with validation by the investigator of unfamiliar terms through questioning; 6) verbatim transcriptions of each audiotape; 7) analysis of the data using the three steps of protocol analysis, 8) use of an expert in think aloud method and protocol analysis to evaluate accuracy of defined concepts, assertions, and overview of the reasoning strategies, and 9) congruence of the theoretical framework with think aloud method and protocol analysis. Chapter 4 will present the study findings.

## CHAPTER 4

### RESULTS

#### Introduction

The purpose of this study was to describe the cognitive processes used by experienced nurses as they assess patients assigned to their care with the ultimate intent of using the results to guide inexperienced nurses' clinical reasoning. A think aloud (TA) method and protocol analysis (PA) were used to determine how nurses reason and what thinking strategies they use. The think aloud method was based on the assumption that verbal reporting described information that was being concentrated on and did not alter the sequencing of thought processes (Ericcson & Simon, 1980, 1984, 1993, 1996). Protocol analysis was used as a systematic method for analyzing transcripts of verbal data for cognitive processes (Ericcson & Simon, 1984). Each of the three steps of PA answered a research question that was asked in this study. The first research question was: What information do experienced nurses concentrate on while reasoning about assessment findings? Referring phrase analysis (RPA) identified those concepts that subjects concentrated on during patient assessment. This set of concepts formed the vocabulary and language of that specific reasoning task. The second research question was: What information do experienced nurses link together to form relationships among concepts? Assertional analysis (AA) identified links or relationships between the concepts. The third research question was: What informal reasoning strategies (heuristics) do experienced nurses use? Script analysis (SA) used the results of RPA and AA to identify and describe the reasoning processes and heuristics nurses used while reasoning.



Accuracy of data analysis was enhanced by following a format of PA reported in the literature (Fonteyn, 1991; Fonteyn, Kuipers, & Grobe, 1991; Fonteyn, Kuipers, Grobe, 1993). Selected transcripts were independently reviewed by another researcher familiar with each step of PA. Adjustment and refinement of concepts, assertions, and cognitive processes established validity through agreement on codes and their definitions. Consistent use of these codes by each subject and across subjects increased validity. Interrater reliability was provided by agreement between researchers.

#### Demographic Data

Four nurses who met the criteria refused to participate for personal reasons. In addition, three nurses who agreed to participate were excluded from the study: one worked additional years as a nurse outside the country, one was enrolled in a graduate program, and one resigned her nursing position the day of data collection. Fifteen nurses agreed to participate in the study and met the sample criteria. The majority of nurses were female, had a mean age of 29.7 years, had a baccalaureate degree in nursing, spoke English as their primary language, averaged 4.6 years of clinical nursing experience, and worked the evening (3-11 PM) shift on a rehabilitation, orthopedic, or neurological nursing unit. The average patient to nurse ratio was approximately 7 patients to one nurse. The average length of time it took for nurses to assess their assigned patients was a little more than 2 1/2 hours. Demographic data are presented in Table 4.

**Table 4**  
**Demographic Data ( N=15 )**

<u>Age *</u>	<u>Years Experience *</u>	<u>Nrsg Educ</u>	<u>Race</u>
29.7 ± 3.8	4.6 ± 2.17	12 BSN 3 ADN	10 Caucasian 5 Asian
<u>Shift</u>	<u>Unit</u>	<u># Patients *</u>	<u>Assessment Time *</u>
7 - 3 = 4	Neuro = 3	6.9 ± 3.4	2 hours ± .6
3 - 11 = 7	Ortho = 4		
11 - 7 = 4	Rehab = 5		
	Cardiac = 1		
	Medical = 2		

\* Mean ± Standard Deviation

### Primary Findings

#### **Research Question One**

The first research question was: What information do experienced nurses concentrate while reasoning about assessment findings? This question was answered by using Referring Phrase Analysis (RPA), the first step of Protocol Analysis (PA). Text segmentation was used in transcribing each audio tape to facilitate data analysis. Nouns and noun phrases in each transcript were identified, underlined, and coded according to the concepts they represented. An example of a transcript segment with referring phrases underlined and coded is shown in Table 5. Codes were tentatively defined by the investigator. As each transcript was reviewed, codes were further examined and definitions were refined. This process continued several times until all phrases in each transcript were identified and analyzed. The 18 final codes represented the information (concepts) that experienced nurses concentrated on while reasoning about patient

assessment. They comprise the vocabulary and language of assessment as a reasoning task. The information that nurses concentrated on came from their patients' assessment findings or from knowledge gained through education and experience and stored in LTM. Examples of information obtained from patient assessment included vital signs, data from the physical exam, laboratory results, and responses to treatment. Examples of information obtained through education and experience and retrieved from LTM included interpretation of assessment findings and lab results, and evaluation of treatment, as well as the development of a plan of action. The 18 concepts identified included the following: amount, care provider, condition/disorder/problem, day/time/date, device, diagnosis, event, family, frequency, location, missing clinical data, patient, plan, rationale, status, test, treatment and value. Although each concept was not referred to in every transcript, many were consistently used and reflected a strategy for grouping information that was unique to that nurse. The complete set of concepts and their definitions is presented in Table 6. Although concepts were broadly defined, examples of their use were specific to the domain of medical-surgical nursing. Eight concepts were further divided into categories to indicate the specific object to which the concept referred. These are presented in Table 7. Table 8 provides representative examples of each code from selected transcripts.

Therefore, the answer to the first research question is that nurses grouped information specific to the reasoning task of patient assessment into 18 concepts: amount, care provider, condition/disorder/problem, day/time/date, device, diagnosis, event, family, frequency, location, missing clinical data, patient, plan, rationale, status, test, treatment, and value.

Table 5

**Referring Phrases and Concepts: Transcript #1-3**

Segment	Concept
<u>He gets up to a bedside commode.</u>	Patient, Status: ambulation, Device
<u>We've just got to keep him clean when he's up</u>	Care Provider, Plan: hygiene, Patient, Status: ambulation
<u>I notice his sacral-perineal area is red and we need to put some Doublegard for him - due to the diarrhea from the c diff.</u>	Status: skin Care Provider, Plan: treatment Problem, Rationale

Table 6

**Concept Codes and Definitions**

<b>Concept</b>	<b>Definition</b>
<b>Amount</b>	measured quantity; the sum total
<b>Care provider</b>	health care professional
<b>Condition/Disorder/Problem</b>	disruption in health
<b>Day/time/Date</b>	chronological sequencing of events
<b>Device</b>	object used in patient care
<b>Diagnosis</b>	term denoting a disease or pathologic condition
<b>Event</b>	occurrence; something that happens
<b>Family</b>	significant other; people who are related
<b>Frequency</b>	rate with which something occurs
<b>Location</b>	designated place
<b>Missing Clinical Data</b>	absent information
<b>Patient</b>	person participating in their own health care
<b>Plan</b>	program of action related to health
<b>Rationale</b>	logical reason to account for a response
<b>Status</b>	state or condition
<b>Test</b>	diagnostic examination
<b>Treatment</b>	therapy used in health care
<b>Value</b>	relative worth or importance

Table 7

**Specific Codes With Objects of Reference: Grouped By Categories**

<b>Care Provider</b>	<b>action, communication, concern, order, plan, response</b>
<b>Event</b>	<b>admission, discharge, surgery, transfer</b>
<b>Family</b>	<b>action, behavior, communication, concern</b>
<b>Missing Clinical Data</b>	<b>assessment, lab results, physician orders, plan, treatment</b>
<b>Patient</b>	<b>action, activity, age, behavior, complaint, concern, condition, knowledge, language, problem, request, response</b>
<b>Plan</b>	<b>action, anticipated, assessment, device, diet, event, hygiene, infection control, lab test, medication, monitor, physician order, positioning, priority, teaching, therapy, treatment</b>
<b>Status</b>	<b>activity, ambulation, change, comfort, communication, condition, device, drainage, dressing, fluids, incision site, infection control, medication, nutrition, physician order, safety, system (cardiac, circulatory, GI, GU, neuro, musculoskeletal, respiratory, psychosocial, skin), therapy, treatment, vital signs, weight, wound</b>
<b>Test</b>	<b>anticipated, completed, preparation, rationale, value</b>
<b>Treatment</b>	<b>blood, device, dialysis, diet, dressing, fluids (oral, IV), medication, oxygen, radiation, skin care, surgery, therapy</b>

Table 8

Complete Set of Coded Concepts With Transcript Examples

AMOUNT		CARE PROVIDER		CONDITION	
two liters	1-3*	doctors	1-3	hyperkalemic	9-2
three	2-2	pm nurse	2-2	infiltrate	2-2
2 cans	2-2	caregiver	4-6	ketoacidosis	3-1
60 mg	3-4	therapist	1-2	atrial fib	9-1
some	4-2	ortho	1-4	problems	1-3
two assists	4-3	senior resident	3-2	knee contusion	1-6
two units	6-6	pm's	3-1	back pain	2-4
so many	6-7	social services	5-2	chest pain	2-5
full	6-8	surgeons	5-6	weakness	2-6
extremely	6-8	pulmonary	6-8	abdominal pain	3-1
70% chance	6-9	24 hour sitter	8-5	skin disorder	3-2
a little bit	6-10	IMS resident	9-4	SOB	3-4
10 units	7-4	psych doctor	9-7	confusion	3-7
most	1-2	oncologist	10-6	diarrhea	4-2
all	1-2	attending	10-7	incontinence	5-1
trace	1-4	am nurse	13-7		
times 3	12-6	speech	5-3		
not much	2-4				
DAY/TIME/DATE		DEVICE		DIAGNOSIS	
5:30 pm	1-2	heel elevator	1-1	gangrene	9-2
2nd of month	1-3	bedside commode	1-2	peritonitis	1-9
on the 28th	1-4	chest tube	1-3	MI	2-5
yesterday	1-6	Dobhoff	2-2	enteritis	3-6
today	4-1	walker	2-3	CHF	2-4
tomorrow	4-2	diaper	3-4	Parkinson's	3-5
7 o'clock	4-3	side rails	3-7	CVA	1-1
morning	4-3	posey	3-7	pneumonia	1-3
in the am	4-4	portacath	4-2	pneumothorax	1-3
1300	4-7	G tube	4-7	UTI	1-6
midnight	4-9	pump	4-5	pulm. edema	12-7
a week	5-2	Foley	5-3	rule out TIA	3-2
1997	5-6	band aid	5-4	Addison's	3-3
evening	6-1	TED's	5-5	diabetes	4-1

EVENT		FREQUENCY	FAMILY	
discharge	1-2	around the clock	12-2	daughter 1-4
transferred	1-3	every 4 hours	12-2	wife 3-7
going home	1-4	a lot	12-2	parents 7-8
admission	3-1	q 2 hours	12-4	family 8-8
came in with	4-9	24 hours a day	12-4	sisters 9-7
gonna go for	4-9	q 6 hours	12-7	mother 10-8
placement	5-3	AC & HS	12-9	husband 14-6
was in here	5-4	every time	2-4	
go home	6-2	twice a day	2-6	
for surgery	6-3	four hour rate	3-1	
retired	6-9	three times	4-1	
therapy	12-3	two episodes	2-2	
placement	3-7	at least twice	6-8	
full code	3-2	48 hour reading	6-8	
		Mon., Wed, Fri.	8-1	
		BID	8-7	
		daily	9-5	
		three doses	9-5	
LOCATION		MISSING DATA	PATIENT	
rehab unit	9-1	I didn't notice	2-5	82 year old 1-1
TCU	9-1	I asked her	2-5	large lady 1-2
in the office	9-3	I don't know	2-5	Polish patient 1-4
home	10-1	I don't think so	3-4	she is Spanish 4-10
pain clinic	10-1	I was not able	3-2	female 1-1
the unit	10-3	I'm not sure	3-2	male 1-1
clinic	12-10	I haven't had a chance	4-5	patient 8-2
hallway	13-5	I assume	4-9	he 6-8
bathroom	14-5	I guess	4-10	
pharmacy	14-5	I don't understand	4-10	
nursing station	14-9	I believe	5-4	
PT	15-2	I don't have	7-4	
ER	15-9	I haven't seen	14-7	
psych	3-6	I'm wondering	14-7	
nursing home	4-10	I did not test	15-4	
surgery	6-3			
MRI office	8-1			
telemetry	9-1			



PLAN		RATIONALE		VALUE	
order	1-1	his glucose was	7-2	very difficult	1-1
dc	1-1	to move secretions	7-3	95%	1-1
talk	1-2	for DVT prevention	7-6	most	1-1
put	1-3	for prophylaxis	7-7	some	1-3
check	1-4	because of Ativan	8-5	normal	1-8
follow-up	1-5	routine for tele	9-1	kind of	1-9
wean	1-6	because she had OR	11-4	positive	4-9
try	1-7	in case she's bleeding	11-7	negative	4-10
call	1-9	they've been high	12-4	K was 3.0	2-4
update	3-1	he's in isolation	13-5	Hgb was 12	2-5
check	3-2	until Zofran kicks in	14-1	Hct was 36.3	2-5
be sure	3-3	because he drained	14-3	pleasant	1-3
give	3-6	to see how she did	15-1	pretty good	1-3
waiting	7-1			cute	10-3
TEST		STATUS		TREATMENT	
PT and INR	1-1	alert and oriented	1-1	total right knee	1-5
BUN, Cr	1-3	waiting for results	1-1	respiratory tx	3-4
ytes	1-3	skin is intact	1-2	pain meds	12-3
PPD	1-8	pulses are palpable	1-2	wet to dry	12-4
stool for Cdiff	2-2	vitals are stable	1-2	IV antibiotics	12-4
GB ultrasound	3-1	edema is down	1-5	D5/.45 NS	12-8
blood sugar	3-1	satting fine	1-3	insulin	12-4
phosphorus	3-1	very poor eater	1-3	Lasix	12-7
CT of head	3-3	weaned off	1-4	pacemaker	12-9
echo	3-4	denies any pain	1-8	oxygen	12-9
H & H	3-5	still flaccid	2-1	Unipen IVPB	12-10
CT of chest	3-7	no movement	2-1	ACE wrap	12-11
chest X-ray	3-7	starting to eat	2-2	soft cast	12-13
amylase	8-2	doing real well	2-3	legs elevated	13-2
alcohol level	4-1	nothing significant	2-4	TED hose	13-2
MRSA culture	4-3	plus one edema	2-5	Morphine	13-3
biopsy	4-7	stage 4 decubitus	7-5	dressing	15-1
EGD	4-7	hypoactive sounds	7-7	transfusion	15-1
accucheck	5-3	CMS to the toes	15-1		
swallow eval	4-10	expiratory wheezes	7-1		
cysternogram	5-4				

\* refers to transcript and page number

### **Research Question Two**

**The second research question was: What information do experienced nurses link together to form relationships among concepts? This question was answered by using assertional analysis (AA), the second step of protocol analysis (PA). Assertions were statements made by subjects that connected the concepts previously identified in RPA. These statements further facilitated understanding of the cognitive processes used during patient assessment by showing how concepts were linked together for greater understanding. Transcripts were reviewed for phrases that provided explanations or combined concepts for some purpose. Four types of assertions were found: 1) anticipative (relationships of action or looking forward), 2) causal (relationships of cause and effect), 3) declarative (relationships stating facts), and 4) evaluative (relationships judging significance). An example of the types of assertions made in a transcript segment is presented in Table 9. Table 10 provides representative examples of each type of assertion with associated concepts. Although assertions were not made between all concepts, several patterns emerged during analysis. Anticipative assertions were made by forming relationships among the concepts plan, test, and treatment. Causal assertions were made by forming relationships among the concepts action, problem, test, and rationale. Declarative assertions were made by forming relationships among the concepts status, treatment, test, action, and problem. Finally, evaluative assertions were made by forming relationships among the concepts status, test, and value.**

Table 9

**Assertions: Transcript #1-3**

<b>Segment</b>	<b>Assertion</b>	<b>Concepts Linked</b>
<b>He gets up to a bedside commode. We've just got to keep him clean when he's up.</b>	<b>Declarative Anticipative</b>	<b>Pt + Status + Device Care Provider + Plan + Patient activity</b>
<b>I notice his sacral-perineal area is red</b>	<b>Evaluative</b>	<b>Care Provider + Status: skin</b>
<b>and we need to put some Doublegard</b>	<b>Anticipative</b>	<b>Care Provider + Plan: treatment</b>
<b>for him - due to the diarrhea from the C. diff.</b>	<b>Causal</b>	<b>Pt + Problem + Rationale</b>

Table 10

**Assertional Analysis With Transcript Examples**

<b>Transcript</b>	<b>Assertions</b>	<b>Concepts</b>
	<b><u>Anticipative</u></b>	
1-1*	She will get two cans with 150 flush before and after	Patient, Plan, Time, Amount
1-1	We are waiting for the INR to be greater than 2	Care Provider, Plan, Test, Value
1-4	I need to call the doctor this am for those orders	Care Provider, Plan, Time, Treatment
1-6	She will also be getting Tylenol before her therapies today	Patient, Treatment, Plan, Time
2-1	She's been kind of calm so hopefully she stays like that the whole shift	Patient, Status, Plan, Time
2-3	So two more days in therapy should be good enough for her	Plan, Treatment, Value, Patient
3-1	After that he does need some diabetic teaching in regards to his diet mainly	Time, Patient, Plan, Treatment
3-7	We will be taking a blood sugar on him this morning and we'll let you know if it's abnormal	Care Provider, Plan, Test, Time, Value
	<b><u>Causal</u></b>	
1-3	He has a hernia causing his scrotum to be extremely swollen and red and tender	Patient, Problem, Rationale
1-2	She is alert most of the day which makes her want to get out of bed	Patient, Status, Event

2-2	It's been like that since he started having diarrhea	Patient, Status Rationale
2-4	I think she just used the oxygen because she has a history of CHF	Patient, Treatment, Rationale
7-1	He's on Solumedrol for the breathing	Patient, Treatment, Rationale
7-3	He's receiving chest PT every 4 hours just to move the secretions	Patient, Treatment, Rationale
7-6	He's got TED hose on and SCD's for circulation and DVT prevention	Patient, Treatment, Device, Rationale
8-3	We had to limit her fluid intake because she is just going to dilute herself	Care Provider, Plan, Rationale
	<b><u>Declarative</u></b>	
10-1	They did change her Vicodan to around the clock	Care Provider, Plan, Patient, Treatment, Frequency
10-3	She went today with the doctor for a bronchoscopy	Patient, Event, Care Provider, Test
10-4	She has an IV .9 to keep open and that's going per pump	Patient, Treatment, Device
10-5	She had a biliary scan that just showed some enteritis	Patient, Test, Condition
11-2	She uses the bedpan during the night	Patient, Status, Device, Time
11-9	There is no repeat potassium level ordered	Missing Data, Test
12-2	She is here with a fractured left femur	Patient, Event, Diagnosis

12-4	He has a PICC line to his right antecubital	Patient, Device, Location
	<b>evaluative</b>	
12-4	He's got a stage 4 to his buttocks	Patient, Status, Location
12-7	She's a little bit more oriented than she was two days ago	Patient, Status Day
12-11	I don't think we can even try to wean him off of it	Care Provider, Plan, Patient, Device
12-13	I don't think anyone's assessed it	Missing Data
14-9	She's got a good pulse on that leg	Patient, Status, Location
15-3	She did quite well walking to the bathroom	Patient, Status, Value, Location
7-1	His lung sounds are coarse and he has some expiratory wheezes	Patient, Status, Value
7-2	His potassium came back at 2.9 this morning	Patient, Test, Value, Time

\* refers to transcript and page number

Therefore, the answer to the second research question is that nurses formed four types of relationships (assertions) by grouping specific information (concepts) that they were concentrating on. These relationships were anticipative, causal, declarative, and evaluative. This step facilitated the final description of the reasoning processes and strategies used by experienced nurses in patient assessment by showing how information is connected.

### Research Question Three

The third research question was: What informal reasoning strategies (heuristics) do experienced nurses use? This question was answered by using script analysis (SA), the third and final step of protocol analysis (PA). Script analysis provided an overall description of the reasoning processes used during the specific cognitive task of patient assessment by incorporating both the information that subjects concentrated on and the links (assertions) that were made between and among this information. The set of concepts and assertions identified in RPA and AA provided a description of the language and vocabulary that experienced nurses used to relate assessment findings of their patients. As the level of abstraction advanced through the steps of PA, cognitive processes were able to be described. These processes provided a description of how nurses organized assessment information. In protocol analysis the term cognitive operator was used to represent a reasoning process used by subjects. Script analysis was completed when all phrases in the transcripts could be organized under a cognitive operator. Finally, heuristics were then identified by looking for instances when nurses verbalized use of a thinking strategy. A distinction is made between reasoning processes and reasoning strategies. Reasoning processes are abstract cognitive events. Heuristics are informal reasoning strategies or mental techniques that help organize information and speed cognitive processes.

#### Cognitive Operators

Five cognitive operators (reasoning processes) were defined by the investigator and identified in the transcripts when subjects concentrated about patient assessment information. When subjects related or narrated patient information, that process was defined as describe. When subjects interpreted information or provided a rationale, that process was defined as explain, and when they anticipated a nursing action, that process

was defined as plan. An opinion about patient status was defined as evaluate. The operator conclude was used to make a final statement about information or to end the verbal report. These cognitive processes could be arranged on a continuum from simple (describe, conclude) to moderate (plan) to complex (explain, evaluate). All operators were used by each subject, but their combinations were varied. Table 11 shows how TA data were organized under these operators, and Tables 12 and 13 show the same data with concepts and assertions (Anticipative, Causal, Declarative, and Evaluative) listed.



Table 11

Script Analysis : Transcript # 1-3

Describe	Explain	Plan	Evaluate	Conclude
Third patient is 89 years old  in with pneumonia			This man has multiple problems	
Right now he has c diff	due to his antibiotics			
He had a pneumothorax	after doing the thoracentesis	they had to put a chest tube in	He was in pretty bad shape	
His oxygen level- I don't have it in front of me	being on isolation it was difficult to get		He's been satting fine He's over 92% on 2 L	
He has a Dobhoff in				
He gets bolus feedings		I will be giving him a feeding at 2 o'clock		
He also eats a pureed diet			He's a very poor eater	
He has a hernia	causing his scrotom to be extremely swollen, red, and tender			Doctors are not doing anything for this
		just keeping an eye on that and keeping him comfortable		

Table 12

Script Analysis: Transcript # 1-3 With Concepts

Describe	Explain	Plan	Evaluate	Conclude
Third patient is 89 years old (Pt)				
in with pneumonia (Diagnosis)			This man has multiple problems (Status)	
Right now he has C Diff (Problem)	due to his antibiotics (Rationale)			
He had a pneumothorax (Problem)	after doing the thoracentesis (Rationale)	they had to put a chest tube in (Treatment)	He was in pretty bad shape (Status)	
His oxygen level- I don't have it in front of me (Missing Data)	being on isolation is was difficult to get (Rationale)		He's been satting fine He's over 92% on 2 L (Status, Value)	
He has a Dobhoff in (Device)				
He gets bolus feedings (Treatment)		I will be giving him a feeding at 2 o'clock (Treatment)		
He also eats a pureed diet (Treatment)			He's a very poor eater (Status)	
He has a hernia (Problem)	causing his scrotom to be extremely swollen, red, and tender (Rationale)	just keeping an eye on that and keeping him comfortable (Plan)		Doctors are not doing anything for this (Plan)

Table 13

Script Analysis : Transcript # 1-3 With Assertions

Describe	Explain	Plan	Evaluate	Conclude
Third patient is 89 years old  in with pneumonia D *				
Right now he has C Diff	due to his antibiotics C		This man has multiple problems E	
He had a pneumothorax	after doing the thoracentesis C	they had to put a chest tube in D	He was in pretty bad shape E	
His oxygen level- I don't have it in front of me	being on isolation is was difficult to get C		He's been satting fine He's over 92% on 2 L E	
He has a Dobhoff in, and he gets bolus feedings D		I will be giving him a feeding at 2 o'clock A		
He also eats a pureed diet D			He's a very poor eater E	
He has a hernia	causing his scrotom to be extremely swollen, red, and tender C			Doctorsare not doing anything for this D
		just keeping an eye on that and keeping him comfortable D		
* A (anticipative), C (causal), D (declarative), E (evaluative)				

This systematic arrangement accounted for every phrase in each transcript and further validated the five reasoning processes that were identified. Completion of SA enabled the researcher to better understand how experienced nurses structured assessment information (concepts) they were concentrating on and how the reasoning processes were used to link information together (assertions). Nurses verbalized patient information (describe), clarified their meaning (explain), identified a plan of care (plan), gave an opinion about patient status (evaluate) and expressed completion of their thought processes for that patient (conclude). An interesting pattern of concepts and assertions was noted under each operator. Fourteen of the 18 concepts identified through RPA were used to describe patient assessments. Eleven concepts were used to plan patient care, six were used to evaluate patient response, one was used to explain assessment findings, and four were used to conclude. Declarative assertions were made while describing patient assessment, causal assertions were made linking descriptions with explanations, while anticipative and evaluative assertions were made linking descriptions with a plan or care and a patient response.

### **Heuristics**

Further analysis revealed 11 reasoning strategies (heuristics) that experienced nurses used when thinking about assessment findings of their patients. These heuristics were identified by reading through the transcripts and noting those statements that indicated how nurses were thinking. The use of these strategies seemed to expedite the reasoning process by consolidating information and applying knowledge that was previously learned to the present situation. Heuristics were defined according to their use in the cognitive task of assessment with medical-surgical patients. However, the names of each were consistent with those identified by previous researchers. The heuristics that were identified included the following: Drawing Conclusions, Enumerating a List,

**Forming Relationships, Judging the Value, Providing Explanations, Recognizing a Pattern, Searching for Information, Setting Priorities, Stating a Practice Rule, Stating a Proposition, and Summing Up.**

Heuristics were used by all nurses. However, the selection of a specific strategy was dependent on the nurse's past experience and the amount of patient information being concentrated on. The most frequently used heuristics were Judging the Value, Providing Explanations, Forming Relationships, and Drawing Conclusions. It is interesting to note that these heuristics were associated with the complex operators explain and evaluate which may account for their frequent use. The association of heuristics with cognitive operators is presented in Table 14.

Table 14

**Heuristics Identified Under Cognitive Operator**

<b><u>Describe</u></b>	<b><u>Explain</u></b>	<b><u>Plan</u></b>
<b>Recognizing a Pattern</b> <b>Enumerating a List</b> <b>Searching for Information</b>	<b>Forming Relationships</b> <b>Providing Explanations</b> <b>Stating a Practice Rule</b> <b>Stating a Proposition</b>	<b>Setting Priorities</b> <b>Stating a Practice Rule</b> <b>Stating a Proposition</b>
<b><u>Evaluate</u></b>	<b><u>Conclude</u></b>	
<b>Judging the Value</b> <b>Drawing Conclusions</b>	<b>Summing Up</b> <b>Drawing Conclusions</b>	

### **Drawing Conclusions**

**Drawing Conclusions was defined as stating an opinion, making an inference, or reaching a decision about assessment information. Opinions and inferences are based on similarities to previous clinical experiences stored in LTM. A bias associated with the use of this heuristic is premature closure of the reasoning process by "jumping to conclusions" when all information has not been adequately considered. This heuristic was one of the four most frequently used by nurses and was associated with the complex cognitive operator evaluate. It facilitated rapid reasoning by interpreting what was held in STM in order to free up cognitive space. Nurses used this heuristic when they made a judgment about information or expressed their opinion.**

- 6-3 I don't think she can understand the logic behind the pca.**
- 8-1 I know for a fact that this patient's foot was cultured on the 19th because I admitted**
- 4-7 I went and looked back at all his previous assessments and he has always been confused, oriented to his person only so I think they're going to get a new consent tomorrow before he goes anywhere.**

### **Enumerating a List**

**Enumerating a List was defined as listing pieces of information consecutively, or grouping information together that could be interpreted as a unit. Nurses used Enumerating a List when facts about a patient's history, laboratory tests, or physical exam were presented without interpretation or comment. This heuristic was associated with the less complex cognitive operator describe and was used less frequently than some of the other heuristics.**

- 1-1 She's a no CPR.  
She is alert and oriented times 3 to 3.  
She's unable to swallow.  
She has failed her video swallow.**

- 2-3 Her lungs are clear.  
No complaints of pain at this time.  
Bowel sounds are present.
- 5-1 He came in with pneumonia, rule out sepsis,  
history of CAD, hypertension, anemia,  
possible CVA, and a left AKA.

### **Forming Relationships**

**Forming Relationships** was defined as connecting information together to show an association or indicate understanding of it's meaning. Nurses formed relationships between assessment data and treatment, problems and treatment, and medical history and assessment findings. This heuristic was one of the most frequently used and seemed to help nurses make sense of assessment findings. It was associated with the cognitive operator explain which, together with evaluate, were found to be more complex reasoning processes.

- 1-3 He had a pneumothorax and after doing the thoracentesis they had to put a chest tube in.
- 5-1 He is incontinent and does have diapers.
- 9-4 He has a history of a CVA; no evidence of residual on assessment.

### **Judging the Value**

**Judging the Value** was defined as determining the significance, worth, or importance of information. This heuristic was also used frequently as nurses quickly evaluated the meaning of assessment findings, test results, appropriateness of treatment, or patient response. It was associated with the cognitive operator evaluate. This heuristic was used to evaluate assessments or a patient's response to treatment. There was a rich qualitative nature to the language that was used, suggesting that the nurses had a wide

range of descriptors that they used to judge the value of a specific assessment finding (i.e. "that much", "minimal", "much improved").

- 11-1 She really doesn't talk that much... minimal verbal response.
- 9-4 His breathing is much improved.
- 9-1 She has staples in her right knee; still some minimal swelling there.

### Providing Explanations

Providing Explanations was defined as stating the reason behind one's actions, beliefs, or comments. It helped the nurse mentally justify their interpretation of a test result, assessment finding, or the patient's response to a treatment. This heuristic was one of the four most frequently used and was associated with the cognitive operator explain. Together with Forming Relationships, Drawing Conclusions, and Judging the Value, this heuristic enabled the nurse to efficiently reason about assessment findings. Nurses used this heuristic to justify their actions.

- 1-2 We'll probably try doing some O<sub>2</sub> sats for her to see if she would qualify for home O<sub>2</sub>.
- 3-7 He was getting out of bed on his own so I just put all side rails up times 4.
- 7-7 I was waiting until she had a decent amount of fluid in her stomach before I gave the Tylenol 3.

### Recognizing a Pattern

Recognizing a Pattern was defined as identifying similarities of present information to previous situations, or recalling something familiar from the past. Various types of patterns were identified: similarities in assessment findings, patient progress, choice of treatments. Sometimes nurses used this heuristic to identify an inconsistency with what



was expected. Recognizing a Pattern connected data about patient history with that related to present hospitalization, and patient assessment findings with a diagnosis and a problem.

- 1-6 This lady has been in our unit numerous times. Goes home, lives alone, ends up falling. She has fallen six or seven times in the past several months.
- 10-7 She has very diminished lung sounds. She sounds like a lung cancer patient. she's got the lung cancer kind of crackles.
- 10-8 It really sounded like she aspirated.

### Searching for Information

Searching for Information was defined as questioning the absence of information, looking for missing information, or acknowledging the importance of information that was not obtained. Nurses searched for information about a doctor's order, the reason for an accucheck, and a patient's plan of care. This heuristic was used less frequently and was associated with the less complex operator describe.

- 12-13 I don't know if we have an order to change it.
- 4-1 We are doing accuchecks on him every four hours and actually I'm not sure why.
- 8-2 I forgot what they are supposed to do on this patient.

### Setting Priorities

Setting Priorities was defined as ranking nursing actions or patient problems according to their importance. Setting priorities was used when a patient situation was urgent or the patient's condition warranted quick action. Setting Priorities was also used to discount information that was not considered to be important enough to be given further consideration. Nurses also set priorities to determine the relative value of

physiological or psychosocial data in directing the outcome. This heuristic was associated with the moderately complex cognitive operator plan.

- 14-8 My next patient is not back from surgery, so when she comes back I'm gonna check vital signs immediately and then check her out and make sure she's got a good pulse in that foot.
- 14-5 So the first thing I did before going in her room was check out her chart to see if he left prescriptions or what the plan was for her going home.
- 14-7 My first priority will be just to look at the chart when he comes back to make sure there is nothing immediate that I need to get done.

### Stating a Practice Rule

Stating a Practice Rule was defined as verbalizing adherence to established policies and procedures, or asserting what was always followed in clinical practice. Nurses who had experience in the past with the same assessment findings, patient problems, or nursing interventions applied that knowledge to the present circumstance. However, following what worked before may lead to errors in thinking. In the following examples nurses stated practice rules about hospitalization, and treatment regimen.

- 2-6 Usually they would dc this kind of patient like 2 days after they get admitted.
- 6-6 Usually when you're on hospice they're not very aggressive and you just have pain control, and you wouldn't even go for surgery, let alone be on an antibiotic or receive blood.
- 2-6 I don't think we have to do that many dressings for just a little skin tear the right arm. Normally we just do it once a day on those kinds.

### Stating a Proposition

Stating a Proposition was defined as using an IF-THEN statement to explain the relationship between pieces of information. Using this rule of logic, the nurses expected a result would follow if certain conditions were met, and vice versa. Nurses used Stating a

**Proposition to anticipate or watch for a response to patient ambulation, verbal communication, and patient transfer. This heuristic was also associated with the cognitive operator plan.**

- 1-7 I told her if she gets up and uses the bedside commode she will be emptying her bladder better.
- 3-7 If they call and let me know that they're coming at a certain time, I'll let you know.
- 6-2 If she goes to our extended care facility at TCU, she'll probably do well.

### **Summing Up**

**Summing Up was defined as reaching the end of a reasoning task and verbalizing its completion. Nurses used this heuristic at the conclusion of their reasoning about assessment findings. It was associated with the operator conclude.**

- 1-2 That's pretty much all that's going on with her.
- 12-8 Basically that's it.
- 2-1 That's all I could say about this patient.

**In summary, script analysis was used to identify 11 heuristics that experienced nurses used when thinking about assessment findings on their patients: Drawing Conclusions, Enumerating a List, Forming Relationships, Judging the Value, Providing Explanations, Recognizing a Pattern, Searching for Information, Setting Priorities, Stating a Practice Rule, Stating a Proposition, and Summing Up. These heuristics were associated with cognitive processes that could be organized along a continuum from simple to complex and included describe, explain, plan, evaluate, and conclude. The four most commonly used heuristics were Forming Relationships, Providing Explanations, Judging the Value, and Drawing Conclusions. They were associated with the complex**

cognitive processes evaluate and explain. Heuristics enabled nurses to reason more efficiently, especially when thinking process was complex.

### Secondary Findings

Several secondary findings emerged through data analysis. Nurses used cognitive processes that fit the definition of clinical reasoning as proposed in this study. They gathered information, interpreted it, searched for or deleted information as necessary, used knowledge from education and practice, proposed possible actions, and came to a conclusion. Their verbal reports indicated that this cognitive process moved forward and backward as assessment data were collected, discarded, and again retrieved when its importance was determined. A picture of the patient was created with increasing breadth and depth as more information became available. Nurses made sense of this data by using domain specific knowledge and clinical experience to identify concepts, link them together, and structure their reasoning. Nurses used a cyclical and recursive reasoning process as they assessed patients, moving their thoughts forward and backward. By doing this nurses planned patient care concurrently with assessment. Clinical reasoning as defined in this study is a complex, multidimensional, recursive cognitive process that uses formal and informal strategies to gather and analyze patient information, evaluate its significance, and determine the value of alternative actions. The findings of this study support the proposed definition.

In addition, this definition was also congruent with the Higgs and Jones (1995) conceptual model which depicts clinical reasoning as an evolving upward and outward spiral increasing in depth and width as cognitive processes become more complex and more information is included. The three core elements of this model are cognition, metacognition, and knowledge which interact simultaneously. In this study nurses used

reasoning processes and knowledge from education and experience to resolve problems. Thus the model and the definition of clinical reasoning were supported by the findings.

Finally, information processing theory (IPT) was upheld as the underlying theoretical framework for decision making that experienced nurses used during the reasoning task of patient assessment. Nurses used assessment information stored in short term memory (STM) and information acquired through education and clinical experience stored in long term memory (LTM) to reason about patient care. Assessment information was organized around 18 major concepts, nine of which were consistently used. Domain specific knowledge in medical-surgical nursing as well as experience in clinical practice were essential components of the reasoning process. Therefore, the study findings supported information processing theory as the underlying framework for clinical reasoning.

#### **Serendipitous Finding**

Unexpected results of this study were the similarities of the experienced nurse to characteristics that have previously only been identified in experts. Experienced nurses, who, by selection criteria for inclusion in the sample were not experts, considered multiple data simultaneously, planned care concurrently with assessment, expressed an overall, holistic understanding of the patient, utilized intuitive rather than analytic reasoning, and employed heuristics to speed the reasoning process, reduce cognitive strain, and improve efficiency. The years of experience for nurses in this study ranged from 2 years one month to 9 years, with the average experience of 4.6 years. Three nurses had 8 to 9 years of experience, with the remaining 12 having no more than 6 years of experience. All nurses had practiced only in medical-surgical nursing. Twelve of the 15 nurses had a baccalaureate degree in nursing. Three nurses spoke English as a second language.

### Overall Summary of Findings

In summary, protocol analysis revealed what information nurses focused on, how they formed relationships, and what heuristics they used while reasoning about assessment findings of their patients. Eighteen concepts were used to group information specific to the reasoning task. Nine of these concepts were further divided into categories to specify certain details, and six of the 18 concepts were consistently used. Next, the nurses combined those concepts and grouped them into four types of assertions or relationships (anticipative, causal, declarative, and evaluative) to make sense of the information. Then, using one or more of the 11 heuristics identified, nurses interpreted assessment information to reach a patient outcome. While heuristics were employed by all nurses, the selection of a specific strategy was dependent on the nurses' past experience.

Secondary findings of this study were congruent with the proposed definition of clinical reasoning used and with the Higgs and Jones (1995) model. Information processing theory was supported as the theoretical framework. A serendipitous finding was that experienced nurses had an overall understanding of the cognitive task of patient assessment and used reasoning strategies that previously have only been identified in experts.

## CHAPTER 5

### DISCUSSION

This chapter discusses research findings and relates conclusions to the literature. Limitations of the study will be addressed and implications for nursing practice, education, and further research will be presented. The purpose of this study was to describe the cognitive strategies used by experienced nurses as they assessed patients assigned to their care. Focusing on this seminal reasoning task the following questions were asked.

#### Research Question One - Information Focus

The first research question asked what information experienced nurses concentrated on while reasoning about assessment findings. As previously listed in Chapter 4, 18 concepts were identified in the transcripts using referring phrase analysis (RPA) and defined by the investigator. Similar concepts have been identified by Fonteyn (1991) and Greenwood et al. (2000) in studies of nurses' clinical reasoning while assessing and planning care. Although all coded concepts were not referred to in every patient report they were consistently used throughout the transcript and across all subjects. These concepts represented the information that was held in short-term memory (i.e. that experienced nurses concentrated on while reasoning).

The 6 concepts most frequently referred to were: plan, rationale, status, test, treatment, and value. These concepts represented the core concepts nurses used to organize assessment information and they formed the essence of assessment. Specific examples of each concept together with the entire conceptual set form the vocabulary and language these nurses used to think about and organize assessment information. According to Kuipers and Kassirer (1984) and Kuipers et al. (1988) the complete set of

concepts is specific to the reasoning task and the domain being investigated. In this study the reasoning task was patient assessment and the domain being investigated was medical surgical nursing. Subjects had a particular format that they followed to give report that was consistently used for all patients. Nurses began report with a patient description ("my first patient is..."), provided statements about their diagnosis or condition ("he's in with pneumonia"), and ended with a summary statement ("that's it for her").

In this study nurses used domain specific knowledge and experience when they linked diagnoses with assessments and expected treatment, as well as when they interpreted the value of a laboratory test, the appropriateness of an ordered treatment, or the progress of a patient in therapy. Similar findings have been reported by Narayan and Corcoran-Perry (1997), Grobe et al. (1991), Lee and Ryan-Wenger (1997), and Corcoran (1986b) who demonstrated that subjects used knowledge, experience, and cognitive processes to reason about a patient's readiness to wean from a ventilator, a patient's discharge referral to home health, a plan of care for a child with pharyngitis, and a drug administration plan for pain control. It is interesting to note that the lack of knowledge and subsequent oversimplification of the reasoning task were the difficulties noted in novices (Corcoran, 1986b).

#### **Research Question Two - Forming Relationships**

The second research question asked what information experienced nurses link together to form relationships among concepts. Using assertional analysis (AA), the researcher identified statements in the transcripts that indicated how nurses made sense of assessment information. This analysis showed how certain concepts were consistently linked through thought processes. Four assertions were identified: anticipative, causal, declarative, and evaluative. Similar assertions have been identified in previous research (Fonteyn, 1991; Fonteyn & Grobe, 1993; Fonteyn, Kuipers, & Grobe, 1993). This pattern



of structuring information was consistent within and between subjects and may be explained by the nature of the cognitive task and/or the use of knowledge and experience.

It was also interesting to note that experienced nurses considered assessment information and planned care concurrently. Grobe et al. (1991) had similar findings and concluded that the nursing process is not linear, as has been traditionally taught. The results of this study further support the model of clinical reasoning proposed by Higgs and Jones (1995) and adapted for use in this study. According to the model, clinical reasoning is an upward and outward recursive spiral that incorporates knowledge, experience, and information at multiple entrance and exit points in order to reach a final outcome, patient care. Findings from this study indicate that experienced nurses used domain-specific knowledge (medical-surgical nursing) and past clinical experiences to process present assessment information while concurrently planning care. Nurses assessed and reassessed, added and deleted information, planned and evaluated information in a recursive, cyclical, and expanding cognitive process. Not only do the findings of this study support the Higgs and Jones (1995) model but they also support information processing theory. According to this theory, reasoning is defined as a multidimensional cognitive process of incorporating information from STM and LTM with knowledge and experience to resolve a problem. In the present study experienced nurses used information from STM (assessments) and LTM (past clinical experience) together with domain specific knowledge (medical surgical nursing) to reach conclusions about patient care.

#### **Research Question Three- Heuristic Use**

The third research question asked what informal reasoning strategies (heuristics) nurses use when reasoning about assessment findings. Script analysis (SA) provided a general overview of clinical reasoning by using cognitive operators to organize the concepts and assertions identified in RPA and AA. Thinking strategies (heuristics) were

subsequently identified and described. As explained in Chapter 4, five cognitive operators (reasoning processes that produce judgments) were identified by the investigator to direct further analysis: describe, explain, plan, evaluate, and conclude. Similar cognitive operators were used by Fonteyn (1991), Fowler (1997), and Greenwood et al. (2000). As was similar with the concepts and assertions identified in RPA and AA nurses were not consciously aware of the cognitive processes they were using or how they organized information. The operators describe and conclude (as defined in this study) were used for simple reasoning tasks, plan was used for moderate reasoning tasks, and explain and evaluate were used when reasoning was more complex. Dela Cruz (1994) and Fowler (1997) noted that expert nurses chose among a continuum of cognitive processes during simple to complex tasks.

Each nurse structured information through reasoning processes that they found to be most useful for patient assessment. Two cognitive operators were frequently used concurrently to better understand information. The operators describe and evaluate were most often used together, followed by evaluate and plan. Fowler (1997) described a similar finding (using cognitive operators "conjointly") in a think aloud study of home health nurses. Fowler's work lends support to this author's definition of clinical reasoning as multidimensional, dynamic, and recursive, using several cognitive processes simultaneously. This finding can be further explained by the nature of the reasoning task. Assessment has been defined as a process of information gathering and evaluation for the purpose of planning care (Bittner, 1998; Crow et al., 1995; Szaflarski, 1997). Nurses in this study related details about their patients (describe), provided rationales (explain), determined significance (evaluate), anticipated the need for action (plan), and/or reached a decision (conclude). They used the cognitive processes describe, evaluate, and plan most often to reason about the assessment findings related to their patients.

Reasoning strategies (heuristics) are specific cognitive techniques that can be used to make reasoning easier and more efficient by reducing complex tasks to simpler processes. In this study, nurses used multiple heuristics to reason about assessment data. Heuristics have been defined as rules of thumb, mental shortcuts, or methods of processing large amounts of data to reduce cognitive strain (Buckingham & Adams, 2000; Corcoran, 1986b; Fonteyn & Grobe, 1993; Grobe et al., 1991; Kassirer & Kopelman, 1991; Kuipers et al., 1988; Tversky & Kahneman, 1974). While heuristics may speed the reasoning process, they can also lead to biases and errors in thinking that could contribute to negative patient outcomes (Fonteyn, 1991).

In this study, 11 heuristics were used by experienced nurses to reason about assessment findings. Each heuristic incorporated domain-specific (medical-surgical nursing) knowledge and experience. Only a few studies to date have identified the heuristics that nurses use in clinical practice, and these studies have been conducted with expert nurses (Fisher & Fonteyn, 1995; Fonteyn, 1991, 1997; Fonteyn & Grobe, 1993; Fowler, 1997). Benner (1984) has identified expert decision-making as holistic, global, intuitive, and based on experience. The present study is unique because it represents the first attempt to identify heuristics used by nurses with 2 to 10 years experience.

One heuristic that was frequently used among experienced nurses while reasoning about patient assessment was Recognizing a Pattern. This finding supports the previous work of Fonteyn (1991, 1997), Fisher and Fonteyn (1995), Benner and Tanner (1987) and Fonteyn and Grobe (1991). Recognizing a Pattern has also been referred to as Pattern Matching and Pattern Recognition by these authors. This heuristic enabled the nurse to use information stored in long term memory (LTM) by recognizing present similarities to a pattern found in clinical experience. However, if data being concentrated on are inaccurately matched to previous patterns, erroneous conclusions may be hastily reached

and an incorrect decision may be made. Clinical manifestations and treatments associated with a particular medical surgical problem, recollection of similar circumstances with other patients, and general progression in orthopedic rehabilitation are examples of patterns that were recognized by the nurses in this study.

**Enumerating a List** was another frequently used heuristic that helped nurses mentally collect physiological and psychosocial information at the beginning of each patient report, and as needed when additional information was being concentrated on. **Enumerating a List** may be helpful in organizing or chunking information. However, important data may not be included on the list thereby limiting deliberation, or too much time may be spent compiling the mental list.

Links between information for the purpose of making sense of the data were described as **Forming Relationships**. **Forming Relationships** is a helpful tool which connects information to improve understanding. A negative aspect of this heuristic's use may be the incorrect connection of one piece of information with another leading to judgmental errors.

Mental requests for missing clinical data were described as **Searching for Information**. This heuristic provided time to mentally look for data that was considered necessary to proceed. Reflective thinking and asking questions determined what information was necessary in order to continue reasoning.

The heuristic **Setting Priorities** enabled nurses to rank actions or considerations according to relative importance. Priorities were ranked from general concerns to emergency interventions. However, it is possible that a priority may be incorrectly ranked too high or too low delaying appropriate cognitive attention. **Setting Priorities** was utilized when nurses recognized the need for action in more acute situations, i.e. immediate postop assessment, dyspnea, and hypotension.

Nurses justified their actions, beliefs, or interpretations of data by Providing Explanations, i.e. the need for a new consent form or moving a patient closer to the nurses' station. Providing Explanations was a method that nurses used to justify their concerns, opinions, actions, or medical treatment. They used this strategy to convince themselves that a particular response was indeed correct. It enabled them to actively reflect on a choice. A negative aspect of this strategy may be an incorrect explanation for an action which then becomes stored in LTM and subsequently used incorrectly again.

When nurses determined the significance of data or the effectiveness of a therapeutic regimen they were Judging the Value. Judging the Value was one of the most frequently used heuristics and enabled the nurse to voice an opinion about the relative worth of assessment information, laboratory results, or the patient's response to treatment. It is interesting to note the heuristics that nurses used to actively reflect on assessment information, nursing plans, or patient concerns: Searching for Information, Forming Relationships, Providing Explanations, and Judging the Value. These heuristics provided a 'self check', and, if used often and together, may have prevented thinking errors.

Stating a Practice Rule indicated what was typically seen or done in practice and was used as a template for a current situation. It guided actions by linking current situations with similar past outcomes. A negative aspect of this heuristic may be its inappropriate use when rules change. Examples of Stating a Practice Rule included the usual criteria for home oxygen use and the type of wound dressing that was needed.

IF-THEN statements were identified as Stating a Proposition when nurses used information to rule in or to rule out a response, i.e. if the patient got up to the bedside commode then he would urinate better. These rules of logic enabled nurses to collect and interpret data quickly by following established criteria. A negative aspect of this heuristic

is its application when inferences are not valid for the situation leading to premature conclusions.

**Drawing Conclusions** was used when nurses made decisions about information (i.e., "This does not seem to be a concern; we are not treating it"). **Drawing Conclusions** allowed nurses to make tentative decisions about the information they were concentrating on. However, premature closure or inaccurate information may lead to the wrong conclusions.

**Summing Up** was the last heuristic found in the transcripts and was used when nurses verbalized completion of thinking aloud about that patient (i.e., "That's it on her").

#### **Secondary and Serendipitous Findings**

The results of this study support the definition of clinical reasoning as a complex, multidimensional, recursive cognitive process which uses formal and informal strategies to gather and analyze patient information, evaluate its significance, and consider alternative actions. Nurses assessed multiple cues simultaneously, pondered back and forth, and used domain-specific knowledge and clinical experience to reach conclusions about patient care. These results also lend support to the Higgs and Jones (1995) model of clinical reasoning which depicts this process as an upward and outward spiral that incorporates cognition, metacognition, and knowledge to reach a final outcome. The recursive nature of the process was evident in the relative ease with which information could be assessed, evaluated, discarded, and retrieved again. The core elements of cognition, metacognition, and knowledge were supported by identification of nurses' thought processes and their use of heuristics.

The results of this study also support information processing theory (IPT) as the theoretical framework for clinical reasoning during patient assessment. According to IPT, a person organizes information using knowledge, experience, and cognitive processes to

resolve a problem (Ericcson & Simon, 1993; Newell & Simon, 1972; Simon, 1972, 1979). An assumption of this theory was based on the classic work of Miller (1956) who demonstrated that short-term memory (STM) can only process  $7 \pm 2$  units of information at one time. Nurses in this study grouped or 'chunked' information into manageable units (concepts) in order to manage large amounts of information. Another assumption was that information acquired through knowledge and experience is stored in long-term memory (LTM) which can be accessed through associations with familiar patterns. Nurses in this study used knowledge about medical-surgical conditions and treatment together with experience from clinical practice to 'chunk' large amounts of information into smaller, more manageable units. While previous research has shown that everyone 'chunks' information, this reasoning approach was used more efficiently by expert nurses (Benner, 1984; Benner, Tanner, & Chesla, 1992; Corcoran, 1986c; Fonteyn, 1991, 1998, 2000; Fonteyn & Grobe, 1993; Narayan & Corcoran-Perry, 1997; Parker et al., 1999; White et al., 1992; Watkins, 1998; Watson, 1994). In the present study the findings showed that experienced nurses (who were not experts) organized information and used a similar reasoning process that previously had only been identified in experts.

#### Summary of Findings

In summary, the primary findings were:

1. Experienced medical-surgical nurses seemed to concentrate on a finite number of concepts to group patient assessment information as revealed in their thoughts.
2. Nurses seemed to connect concepts together to make sense of information and provide structure for their reasoning.
3. Frequent heuristic use seemed to be a way to make reasoning easier and more efficient.

**The secondary findings were:**

- 1. The definition of clinical reasoning used in this study was supported through the verbal reports of experienced nurses' cognitive processes.**
- 2. The definition of clinical reasoning was congruent with the Higgs and Jones (1995) model.**
- 3. Information processing theory (IPT) helped explain how experienced nurses used while reasoning about assessment findings of their assigned patients.**

**The serendipitous finding was:**

- 1. Experienced nurses used reasoning strategies that have previously only been identified in expert nurses.**

### **Conclusions**

**Based on the above discussion the following conclusions can be made. The verbal reports of experienced medical-surgical nurses seemed to indicate that they used 18 concepts to organize patient assessment information in a clinical setting. Nurses were not aware that they were organizing information according in this manner. These concepts formed the language used by nurses during this reasoning task. Of the 18 concepts, nine were subdivided into categories for further clarification. Six concepts were consistently used by all nurses. These six (status, rationale, test, value, plan, and treatment) comprised the the essence of nursing assessment and allowed "chunking" of similar types of information into large categories. While the concepts formed a universal language, the terms used by nurses to refer to these concepts were specific to the domain of medical-surgical nursing. Together they formed the language and vocabulary that experienced nurses used to think about and organize assessment information.**

**Next, in order to make sense of this information, nurses subconsciously linked concepts together to show relationships. It is interesting to note that the assertions**



identified in the transcripts linked those concepts that were most frequently used: plan, rationale, status, test, treatment, and value. Finally, five cognitive operators (i.e. reasoning processes) believed to be used by subjects to produce judgments, were identified and defined. These operators indicated that nurses chose among a continuum of cognitive processes for tasks ranging from simple to complex. Finally, operators helped identify the heuristics that nurses used to speed their reasoning processes. Heuristics were consistently used by all experienced nurses. This may be the first study to find heuristics used by experienced nurses rather than only by expert nurses. It is possible that experience in nursing may be more accurately defined by clinical reasoning skills rather than number of years in practice.

#### Limitations

The findings of this study are limited to experienced medical-surgical nurses practicing in a small community hospital. Only one subject was male. In addition, findings are specific to the domain of medical-surgical nursing. Although consistent with other qualitative research, the sample size was small. However, the focus of this study was on elucidation of the cognitive processes used and not on generalizability of the findings. Selection bias may have resulted from convenience sampling. The definition of experienced nurse varies and needs further refinement. The number of years in practice which was used to select experienced nurses for this study may not be an appropriate or sufficient indicator of the experienced nurse skill level. Three nurses spoke English as a second language which may have effected understanding and verbalization. Cultural differences may also have biased nurses' interpretation of assessments. Finally, history may be a potential threat to the internal validity of the design because of the existence of hospital management changes and staffing problems at the time of data collection.

### **Implications**

**The current nursing shortage, together with an aging workforce, fewer experts, and increased patient acuity have left all nurses increasingly more responsible for making rapid decisions often in complex situations. The results of this study have numerous implications for nursing practice, education, and research.**

#### **Practice**

**The results of this research may guide the development of documentation forms, report sheets, and decision support software packages to help nurses organize assessment findings according to the concepts found in this study. Since the concepts are universal they may apply across all domains of nursing. Specific examples of each concept's use will vary according to practice setting. Assessment flow sheets developed around this format would provide a better method to organize information, provide cues for reasoning, and assist less experienced nurses. Computerized charting could also be adapted for data entry according to these concepts. Innovative technology, such as personal hand-held systems (Palm Pilots) could provide conceptual assessment cues and probe possible relationships that could speed the reasoning process during direct patient care. Nurses would benefit from learning to use heuristics imbedded in their practice to reason more efficiently. Clinical inservices and continuing education programs could provide this information. Finally, an evaluation of new employee assessment skills during orientation programs using preceptors would help nurses improve this reasoning task in clinical practice.**

#### **Education**

**While one study is not sufficient to make curricular changes several suggestions can be made. Study findings could be incorporated into the undergraduate curriculum to teach clinical reasoning. Beginning courses could introduce the universal language of assessment concepts with subsequent courses showing how assessment data can be**

organized according to the domain being studied. Practice linking essential concepts together (forming relationships or assertions) in required theory and clinical assignments might enable students to determine what information is essential and how it can be structured to make sense. Patient assessment findings could be 'mapped' using universal concepts to organize information and assertions to show meaning. Each course could advance in complexity of reasoning processes expected to be used to prepare graduates to use these concepts, form relationships of meaning, and use heuristics in their practice.

#### Research

The results of this study provide direction for further research. This study was conducted in a small, community hospital. Additional studies in both community hospitals and medical centers are needed to validate and expand the present findings. The cognitive task chosen for measurement of nursing clinical reasoning skills in this study was patient assessment. Data collection was performed only at the beginning of the shift after initial patient rounds. It would be helpful to determine how reasoning changed by collecting data several times throughout the shift, or at the beginning and then at the end. Other cognitive tasks may provide additional insight into the reasoning process (i.e., patient admission, patient teaching). Since only medical-surgical nurses were chosen as subjects for this study, the use of domain-specific knowledge and experience in other areas of practice needs to be studied. Three nurses spoke English as a second language. This may have effected their verbalization of the cognitive task. Since nursing relies heavily on communication, it is important to determine if this caused changes in thinking. The profession is also ethnically diverse, and future research is needed to determine how culture may influence the decision making process. International studies have shown that decision making approaches vary by country suggesting differences in culture and education (Lamond & Farnell, 1998; Lauri et al., 1997, 1998; Tabak et al., 1996). It

would also be helpful to determine what gender differences exist. The criteria used to select experienced nurses (clinical practice for a minimum of 2 years but less than 10 years) may not have accurately defined this skill level. It is possible that the upper limit for years in practice was too high. Additional research is needed to identify current skill levels and determine if those initially proposed by Benner (1984) are still followed. Finally, additional research in the clinical setting is needed to provide a better understanding of reasoning as it occurs in practice.

### Summary

The purpose of this study was to describe the cognitive processes used by experienced nurses as they assessed patients assigned to their care. Three research questions asked what information nurses concentrated on, how they made sense of the information, and what heuristics they used while reasoning. Using a think aloud method nurses verbalized actual patient assessment findings shortly after completing their rounds. The three steps of protocol analysis provided a description of experienced nurses' clinical reasoning in practice. Multiple findings included the set of universal concepts nurses used to organize assessment information, how they structured their reasoning, and what heuristics they used to make the process easier. Both the definition and model of clinical reasoning were supported by the findings. Information processing theory was the underlying framework that nurses used while reasoning about assessment findings. Implications for practice, education, and further research were discussed. Finally, based on the serendipitous finding that experienced nurses used reasoning processes that have previously only been identified in experts, Benner's (1984) seminal work needs to be revisited and updated so that skill levels in nursing reflect current practice.

**APPENDIX A**  
**STUDY INFORMATION SHEET AND CONSENT**

## Appendix A

### Study Information Sheet and Consent

IRB # 03 00 06 E

TITLE Clinical Reasoning in Experienced Nurses

Investigator Conducting Research: Barbara Simmons, MS, RN

#### **PURPOSE**

You are being asked to participate in a research project. The purpose of this study is to describe the cognitive processes used by experienced nurses as they assess patients assigned to their care. In order to describe these processes, the researcher is interested in what patient information experienced nurses concentrate upon, how they link that information together, and what informal reasoning strategies they use. The knowledge gained from this study will improve the reasoning of less experienced nurses and provide direction for nursing education and staff orientation programs.

#### **STUDY SPONSOR/ NUMBER OF PARTICIPANTS**

This study is a doctoral project sponsored by Loyola University Chicago, Niehoff School of Nursing, and the Department of Nursing . Approximately 15 nurses will participate in this study from medical-surgical units in the hospital.

#### **DESCRIPTION OF THE STUDY**

You will be asked to talk out loud about your beginning shift assessment findings on patients assigned to your care. This process is called "think aloud". Your thoughts will be audiotaped in a manner similar to taping an end-of-shift report. A brief practice session will be conducted before you begin your shift to familiarize you with the "think aloud" method and the tape recorder that will be used. You will then begin your shift, receive report on all assigned patients, and follow your usual assessment routine. When all patients have been assessed, you will tell the researcher that you are ready to begin "thinking aloud" about your patients' assessments.

A quiet and private location on the unit will be used. The researcher will be present in the room but will not interact with you during the "think aloud" process except to instruct you to "begin thinking aloud" or "continue thinking aloud". As you are talking, the tape recorder will be on and the researcher will take notes to help her identify your reasoning strategies. After the "think aloud" session is completed, the researcher may ask you questions if clarification is needed. The length of your participation in the "think aloud" session is 20 minutes.

### **RISKS**

Participation in this study involves no risks to you or the patients.

### **BENEFITS**

There are no personal benefits to you from participation in this study. However, the knowledge gained from this project may help less experienced nurses make more accurate decisions and improve nursing education and orientation programs for new employees.

### **ALTERNATIVE**

The alternative to this study is not to participate.

### **COSTS/COMPENSATION**

There is no monetary compensation for participation in this research project. You will, however, receive a small medical-surgical nursing handbook upon completion of data collection as recognition for your participation in the study.

### **WITHDRAWAL FROM STUDY**

You are free to withdraw your participation in this study at any time.

### **CONFIDENTIALITY**

Patient names will not be used when audiotapes are transcribed. Nurses will not be identified by name on audiotapes or transcripts. Instead, codes will be used to protect privacy and maintain confidentiality. All audiotapes and transcripts will be kept in a safety

deposit box. When results of this study are published, the tapes and transcripts will be destroyed. Reports of this research will use group data only, and you will not be identified by name.

### **NURSES' RIGHTS**

Taking part in this research is entirely voluntary. You have the right to refuse to participate. If you agree to participate, you may withdraw from the study at any time without anyone objecting and without any effect on your nursing position. If you have any questions concerning this study or your rights as a research participant, you may contact Barbara Simmons, the principal investigator for this study or the Institutional Review Board.

I have read and understand the information in this Study Information Sheet and Consent and have received a copy. I have volunteered to participate based on this information

\_\_\_\_\_  
Subject's Name (printed)

\_\_\_\_\_  
Subject's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Investigator's Signature

\_\_\_\_\_  
Date



**APPENDIX B**  
**LETTER TO NURSING UNIT MANAGERS**

**Appendix B**  
**Letter to Nursing Unit Managers**

Dear \_\_\_\_\_,

I am a doctoral student at Loyola University Chicago, Niehoff School of Nursing, and I have received approval from the Human Investigation Committee Institutional Review Board to begin data collection for my dissertation research. This project, entitled "Clinical Reasoning in Experienced Nurses", will examine the clinical reasoning skills of 15 experienced nurses as they think aloud about assessment findings of patients assigned to their care.

Experienced nurses, who are not yet considered expert nurses, comprise the majority of practicing nurses in a variety of clinical settings. Given the changes in healthcare and the increased responsibility placed on nurses to make decisions about patient care, it is important to determine the reasoning strategies that nurses use about their assessment findings. This information will provide direction for nursing education, staff orientation programs, performance evaluations, and decision support software.

Approximately 15 nurses from medical-surgical units in the hospital are needed for participation in the study. With your help, I would like to attend a unit staff meeting or otherwise explain my study in person to staff nurses so that I may request voluntary participation. I will emphasize that this study is non-invasive, poses no risks to the nurses, and only involves audiotaping of the nurses's thought processes about assessments that they made on assigned patients. Confidentiality of both nurses and the patients they refer to on tape will be maintained through the researcher's use of codes in the tape transcripts. Consent forms will be signed by participants. A nurse may choose whichever day and assigned shift to participate in the study. At the beginning of the shift, the researcher will

review the procedure and demonstrate the "think aloud" method by having the nurse who agrees to participate in the study add simple numbers or count backwards into the tape recorder. The nurse will then begin the shift and receive report on all assigned patients. After report, assessments will be done according to the nurse's usual routine. Once this is completed, the nurse will tell the researcher that data collection can begin. A quiet and private location on the unit will be needed for data collection (i.e. locker room, conference room, etc.). The researcher will be present in the room as the nurse "thinks aloud" into the tape recorder in a manner similar to a taped end-of-shift report. The only interaction between nurse participant and researcher will be verbal reminders by the researcher to "begin thinking aloud" or "continue thinking aloud". After all patients have been discussed on tape, the researcher may ask questions if clarification is needed. The length of time for participation in data collection is 15-20 minutes. Nurses will receive a medical-surgical nursing handbook upon completion of data collection as recognition and appreciation for their participation in the study. I will report my findings to you after analysis.

Experienced nurses may participate in the study if they meet the following criteria:

1) hospital employees on a medical-surgical unit; 2) English speaking; 3) no advanced degree; 4) no advanced certification; 5) not in a new employee orientation, and 6) experience in nursing greater than 2 years but less than 10 years full time.

I am including a copy of the consent form and approval from the Office of Research Administration Human Investigation Committee: The Institutional Review Board. I am excited to begin this project and I look forward to working with you and your staff.

Sincerely,

Barbara Simmons, MS, RN

**APPENDIX C**  
**AN INVITATION TO PARTICIPATE**

## Appendix C

### An Invitation to Participate

I would like to invite you to participate in a nursing research study about clinical reasoning in experienced nurses. This study will help describe the thinking processes nurses used as they review initial assessment findings of patients assigned to their care.

#### Criteria for participation:

1. Registered nurse employed by the hospital
2. English speaking
3. Experience in nursing greater than 2 years but less than 10 years full time
4. No advanced degree
5. No advanced certification
6. Not in new employee orientation
7. Currently practicing on a medical-surgical unit of the hospital

Each nurse participating in this study will begin his or her shift, receive report, and assess assigned patients in the usual manner. Once this is completed, the nurse will tell the researcher that data collection can begin. A quiet and private location on the unit will be used as the nurse thinks out loud about initial assessment findings on assigned patients. These thoughts will be recorded on tape. This method is called "think aloud".

The length of time involved for each nurse participating in this study includes a brief "think aloud" practice session of a few minutes, 5 minutes to answer questions about demographic information and sign a hospital consent form, and 15-20 minutes to "think aloud" about patient assessment findings into a small tape recorder. These tapes will then be transcribed and analyzed. The day and shift is scheduled at your convenience. No additional time is requested. Nurses will receive a medical-surgical nursing handbook upon completion of data collection as recognition and appreciation for participation in this

**study. Nurses interested in participating can contact me directly on the units or via email. Thank you for taking your time to read this information and consider participation in the study.**

**Barbara Simmons, RN, MS**

**Doctoral Candidate, Loyola University Chicago**

**APPENDIX D**  
**RESEARCH PROCEDURE CHECKLIST**

## Appendix D

### Research Procedure Checklist

1. Contact subject 1 day before data collection to confirm day, date, and shift.
2. Arrive on the unit 15 minutes before shift starts
3. Greet subject and thank them for participating
4. Instruct subject to get their patient assignment, obtain shift report, and assess all patients.
5. Ask subject how long this assessment will take.
6. Leave the unit while the subject is assessing patients and return at a time designated by them
7. If the subject has not yet completed all assessments, extend the time.
8. Find a quiet, private location on the unit for data collection.
9. Set out the consent form, demographic data form, tape recorder, and notebook in the room.
10. When the subject is ready have the consent signed, fill out the demographic data form, and review the "think aloud" method to collect data.
11. Demonstrate the tape recorder.
12. Have subject practice TA by saying what he or she is currently thinking about out loud into the tape recorder.
13. Remind subject that this research is interested in his/her clinical reasoning:  
"What are you thinking about as you review your patients' assessment findings?"
14. Sit on the side of the room as the subject TA. Once data collection has begun, do not interact with subject except to remind each to "continue TA" if pauses of >3 seconds occur.



15. **Write down unfamiliar terms or abbreviations in the notebook during TA to be clarified at the end.**
16. **Turn off the tape recorder when the subject indicates that assessments for all patient are done.**
17. **Thank subject for participating and present with med-surg handbook.**

**APPENDIX E**  
**DEMOGRAPHIC DATA FORM**

**Appendix E**  
**Demographic Data Form**

Subject # \_\_\_\_\_

**Basic Nursing Education**

**Diploma** \_\_\_\_\_

**Associate** \_\_\_\_\_

**BSN** \_\_\_\_\_

**Years of Med-Surg Experience**

**Part-time** \_\_\_\_\_

**Full-time** \_\_\_\_\_

**Age** \_\_\_\_\_

**Sex** \_\_\_\_\_

**Ethnic Background** \_\_\_\_\_

**Type of Med-Surg Unit currently employed on**

\_\_\_\_\_

**Shift currently working** \_\_\_\_\_

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