THE CLINICAL REASONING OF EXPERT ACUTE CARE
REGISTERED NURSES IN PRE-CARDIOPULMONARY
ARREST EVENTS

Approved by

Dissertation Committee:

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THE CLINICAL REASONING OF EXPERT ACUTE CARE REGISTERED NURSES IN PRE-CARDIOPULMONARY ARREST EVENTS

by

Alyce Louise Smithson Ashcraft, B.S.N., M.S.N.

Dissertation
Presented to the Faculty of the Graduate School of
The University of Texas at Austin
in Partial Fulfillment
of the Requirements
for the Degree of
Doctor of Philosophy

The University of Texas at Austin
May 2001
To my Father who gave me life
and
To my family who sustains life
Acknowledgments

This has been a long journey and one which I could not have made alone. To my husband, Glen, and son, Donovan, thank you for allowing me to fulfill a dream. To my mother Elise, thank you for telling me that I can do anything then making me believe it. To my father Wiley, thank you for acknowledging my special place in your heart.

To everyone at work who listened to the bright spots and low spots in this arduous journey, thank you.

To Dr. Susan Grobe, you are a very special person, teacher, and mentor to work with novice researchers. Thank you for your patience. To Dr. Angela Clark, thank you for your inspiration. To Dr. Claire Ellen Weinstein, you weave a special magic with students. To Drs. Kuipers and McDougall, thank you for your additional words of wisdom that enhanced the final product.

One last word(s). Donovan, you too, can do anything which you desire. Dream, imagine, play.

This journey has ended, but another is about to begin.

May 1, 2001
THE CLINICAL REASONING OF EXPERT ACUTE CARE REGISTERED NURSES IN PRE-CARDIOPULMONARY ARREST EVENTS

Publication No. __________

Alyce Louise Smithson Ashcraft, Ph.D.
The University of Texas at Austin, 2001

Supervisor: Susan J. Grobe

The purposes of this study were to (a) identify the clinical reasoning processes of expert acute care Registered Nurses (RNs) in pre-cardiopulmonary arrest events using empiric indicators and to (b) make inferences about the expert acute care RN's reasoning processes during pre-cardiopulmonary arrest events. Data were collected from 15 subjects using think aloud (TA) as they verbalized their thoughts concerning how their presence and attention prevented a patient from experiencing cardiopulmonary arrest. Protocol analysis (PA) provided a description and structure for the information attended to while reasoning about the care to prevent cardiopulmonary arrest.

The data that expert acute care attend to when reasoning about the care required by a patient thought to be in danger of experiencing a cardiopulmonary arrest cluster around the operators scenario set, intervene, decision/rationale, and outcome. In addition, the experts used five type of assertions in the transcripts to determine relationships between the operators: observational, indicative, conditional, decisional/action, and...
interpretive. Detailed analysis of these relationships revealed the following implications:

1. Experts predominately used the operator Scenario Set. This is indicative of their searching for an evolving pre-cardiopulmonary arrest pattern.

2. The operator decision/rational is important because it reflects that a decision was made and/or a rational supplied concerning delivery of care.

3. Experts predominately used indicative assertions to link the largest amount of data within the operator Scenario Set. Indicative assertions represent the nurses' search for a pattern that can link all other operators.

4. Expertise takes time to develop within an specific area of practice and is nontransferable despite similarities in the work environment.

5. The definition of expert acute care Registered Nurse may need to be limited to individuals who maintain a full time practice providing direct patient care in the critical care environment.

6. Expertise may be attained by through continual refinement of clinical reasoning processes in the practice environment or by constant exposure to different situations in the practice environment.

7. Self perception of expertise may be one indicator that expertise in a nursing has been attained.
# Table of Contents

Dedication........................................................................................................ iv
Acknowledgments.................................................................................................. v
Abstract................................................................................................................ vi
Table of Contents............................................................................................... viii
List of Tables........................................................................................................ xv

Chapter 1—Introduction...................................................................................... 1
  Purpose of the Study.......................................................................................... 2
  Background and Significance........................................................................... 2
  Statement of the Problem.................................................................................. 7
  Research Questions........................................................................................... 7
  Theoretical Framework..................................................................................... 7
  Antecedents....................................................................................................... 11
  Clinical Reasoning............................................................................................ 11
  Conclusion.......................................................................................................... 12
  Patient/Client Outcome.................................................................................... 12
  Clinical Reasoning............................................................................................ 12
  Conclusion.......................................................................................................... 12
  Patient/Client Outcome.................................................................................... 12
  Metacognition.................................................................................................... 13
  Definitions of Terms......................................................................................... 13
  Assumptions....................................................................................................... 15
  Limitations......................................................................................................... 16
  Summary............................................................................................................. 17
Appendix I
Expert Nurse Nomination by Head Nurse/Nurse Manager Consent .......................................................... 217
Appendix J
Subject Consent Form .......................................................................................................................... 218
Appendix K
Demographic Information ................................................................................................................. 219
Appendix L
Research Protocol Checklist .............................................................................................................. 220
Appendix M
Subjects 1 through 15 RPA .............................................................................................................. 225
Appendix N
Subjects 1 through 15 Objects and Referents of Major Verbs .......................................................................................................................... 281
Appendix O
Subjects 1 through 15 Assertional Analysis ...................................................................................... 335
Appendix P
Definition and Categorization of Major Verbs and Verb Phrases ...................................................... 380
Appendix Q
Figure 3 The Structure of Clinical Reasoning: Operators, subcategories, and subject’s terms .................................................................................................................. 388
Appendix R
Data Analysis--Scenario Set ............................................................................................................. 389
xiii

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List of Tables

Table 1  Higher Order Thinking Instruments ................................... 38
Table 2 Selected Criteria for Nursing Expertise ............................... 57
Table 3  Variables in Prearrest Tools .............................................. 63
Table 4  Referring Phrases (Pilot Study) ......................................... 89
Table 5  Assertions (Pilot Study) ................................................... 90
Table 6  Conceptual Objects Derived from RPA and AA
(Pilot Study) ........................................................................ 91
Table 7  Clinical Characteristics Prioritized by Expert Panel .......... 98
Table 8  Description of the Sample ............................................... 104
Table 9  Previously Evaluated Prearrest Variables by Study ....... 110
Table 10 Assertional Analysis: Example Linkages Extracted from
Major Verbs/Verb Phrases .............................................. 119
Table 11 Missing Operators by Subject ......................................... 122
Table 12 Probe Question Results by Subject ................................. 124
Table 13 Comparison of Groups A and B ...................................... 145
Table 14 Operator Use by Group .................................................. 147
Table 15 Assertion Use by Group ................................................ 148
Table 16 Assertional Analysis: Examples of Observational
Assertions .......................................................................... 154
Table 17 Assertional Analysis: Examples of Indicative
Assertions .......................................................................... 156
Table 18 Assertional Analysis: Examples of Conditional
Assertions .......................................................................... 157
Table 19  Assertional Analysis: Examples of Decisional/Action Assertions........................................................................................................... 158
Table 20  Assertional Analysis: Examples of Interpretive Assertions......................................................................................................................... 159
Table 21  Comparison of Variables of Importance Between Literature, Panel of Experts, and Sample................................................................. 162
Table 22  Expert (Group B) Variables/Use of Operators........................................... 166
Table 23  Expert (Group B) Variables/Use of Assertions......................................... 172
Table 24  Average Use of Operators by Experts (Group B) Types of Operators by Subject............................................................. 174
Table 25  Average Use of Assertions by Experts (Group B) Types of Assertions by Subject............................................................. 176
Chapter 1
Introduction to the Study

A patient is admitted to the Post Anesthesia Care Unit (PACU) after surgery. The nurse observes that the patient's respirations are at a rate of eight per minute and shallow. Pulse oximetry reveals a saturation of 88%. Blood pressure is 120/80. The electrocardiogram reveals a sinus tachycardia at 120. The patient does not respond to verbal stimuli. As the patient has just been extubated post operatively, the nurse hypothesizes that the cause of the decreased oxygenation could be secondary to: (a) the tongue occluding the patient's airway; (b) inadequate respirations; or (c) extensive blood loss during surgery. The cues confirm the most likely cause of the problem to be a combination of hypotheses (a) and (b) secondary to the general anesthesia. The nurse performs a chin lift/jaw thrust maneuver and places the patient on 100% oxygen via face mask. Within two minutes, the patient's respirations increase to sixteen per minute with an oxygen saturation of 95%. The patient begins to open his eyes and respond to simple verbal commands. The nurse records the results and continues to observe the patient for changes.

This scenario emphasizes the importance of clinical reasoning by an expert Registered Nurse present at the bedside. Expert nurses are thought to be adept at anticipating and intervening to prevent potentially fatal complications from advancing to stages that often cannot be reversed by the best medical and technological interventions available (Benner, 1984). Understanding the clinical reasoning processes of expert nurses'
actions in these potentially life threatening situations can provide educators, nursing students, and novice nurses with a blueprint for action in similar clinical situations. Though an algorithm is a poor substitute for an expert clinician, it provides a starting point for the thoughts and actions of novice nurses and conjecture for the more advanced nurses.

Purpose of the Study

The purposes of this study were to: (a) identify the clinical reasoning processes of expert acute care nurses in pre-cardiopulmonary arrest events using empiric indicators, and (b) make inferences about the expert acute care nurse's clinical reasoning processes during pre-cardiopulmonary arrest events. Data were collected from subjects using think aloud (TA) as they verbalized their thoughts concerning how their presence and attention had prevented a patient from experiencing cardiopulmonary arrest. Protocol analysis (PA) provided a description and a proposed structure for the information attended to while reasoning about the care to prevent cardiopulmonary arrest.

Background and Significance of the Study

A review of the literature reveals three areas that are in need of further exploration regarding the concept of clinical reasoning as placed within an evolving theory of nursing expertise: (a) differentiation between clinical reasoning and clinical judgment, (b) comparison of clinical reasoning with the nursing process, and (c) clarification of the importance of content in clinical judgment. Studies of clinical reasoning and clinical judgment frequently lack a clear and concise differentiation between
clinical reasoning and clinical judgment. For the best conceptual clarity, the researcher must specify if the two terms are mutually inclusive or exclusive. Studies that provide specific definitions, separating process and outcome, would be preferable to enhance model testing and refinement of the evolving theory of nursing expertise.

Nurse researchers have begun to delineate between reasoning as a process and judgment as a conclusion and are relating these concepts to the nursing process (reasoning equating with assessment; judgment equating with nursing diagnosis) (Crow, Chase, & Lamond, 1995; Doona, 1995; Radwin, 1990; Regan-Kubinski, 1991). The profession, however, must be cautious in agreeing that this relationship exists because studies support the hypothesis that experts see patient problems more holistically, using pattern recognition, and do not rely on linear thinking (Benner, 1984; Fonteyn, 1991; Jacavone and Dostal, 1992; Pyles & Stern, 1983). The nursing process is increasingly seen as a tool for teaching the circular method of assess, diagnose, plan, implement and evaluate. However, it is not the epitome on which to base the development of nursing expertise. Process is not, in itself, adequate to describe, measure, and teach expertise. Expertise appears to require different types of patient/client situations in order to learn different types of clinical reasoning processes.

The literature about the relationship between critical thinking and clinical judgment provides interesting and perplexing findings that reinforce the need to study clinical reasoning. These investigations reveal the following: (a) lack of support for the impact of nursing education on
critical thinking; (b) limited support for the impact of nursing education on clinical judgment; and (c) lack of support for the relationship between critical thinking and success in nursing education (Kintgen-Andrews, 1991; Tanner, 1996). These findings suggest content as an intervening variable between clinical reasoning and clinical judgment—content that is discipline-specific. By focusing on the clinical reasoning of expert acute care Registered Nurses in pre-cardiopulmonary arrest events, the content of the think aloud was narrowed.

Because the effectiveness of cardiopulmonary resuscitation remains questionable despite 40 years of research since the reintroduction of closed chest massage in 1960 by Kouwenhoven, Jude, and Knickerbocker (1960) and 27 years of research since the introduction of Advanced Cardiac Life Support (ACLS) in 1974 (International Consensus on Science, 2000), further research concerning pre-cardiopulmonary arrest variables needs to be completed. Data reveal wide variation concerning the effectiveness of in-hospital resuscitation, partially because of large differences in inclusion criteria and outcome definitions as reported in the literature (American Heart Association, 1997). McGrath’s (1987) study of 42 publications from 1961 to 1984 (N = 12,961 patients) found a post-CPR survival rate of 14.6% (range of 3% to 27%) at discharge. Cohn, Lefevre, Yarnold, Arron, and Martin (1993) conducted a meta-analysis of 21 studies from 1965-1989 (N = 8221 patients) and found a 13.7% (range of 3.8% to 25%) survival to discharge post-CPR. Similar to these reviews, Schneider, Nelson, and Brown (1993) analyzed 98 reports from 1960 to 1990 (N =
19,995 patients) and found a 15% (range not stated) survival post-CPR to discharge. More importantly, however, these authors stated that the rate of successful CPR had not changed since its inception ($r = -0.14, p > 0.05$) and that there has been a steady decline in the optimism regarding its value ($r = -0.29, p = 0.01$). A meta-analysis conducted by Saklayen, Liss, and Markert (1995) consisted of 113 reports ($N = 26,095$) spanning 3 decades. They found overall worldwide survival to discharge to be 15.2% (range of 3% to 29%). These meta-analyses review many of the same articles and reach the same conclusion: 15% of individuals who require cardiopulmonary resuscitation will survive to be discharged from the hospital or, stated another way, six out of seven individuals who reach the point of requiring cardiopulmonary resuscitation will die before discharge.

One last study is worthy of mention because of its large sample size. The British Hospital Resuscitation Study (BRESUS) (Tunstall-Pedoe, Chamberlain, Marsden, Ward, & Zideman, 1992) gathered information on survival from both in-hospital and out-of hospital resuscitation. The BRESUS sample included 3765 attempted cardiopulmonary resuscitations from 12 hospitals throughout Britain. This large scale project found that 17% of patients survived to discharge. The survival to discharge statistic remains significantly unchanged.

Fifteen percent is a disappointing statistic in view of the standardized techniques for cardiopulmonary resuscitation (CPR) that have become routine in the healthcare setting and in view of the major improvements [i.e., ACLS] implemented during the 1970s in pre-hospital
as well as hospital settings. What this statistic does reflect, however, is the frequently irreversible nature of cardiopulmonary arrest, as well as the severity of underlying illness(es) (George, Fold, Crecelius, & Campbell, 1989).

The American Heart Association's Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (International Consensus on Science, 2000) emphasizes the importance of a “periarrest” or “prearrest” period, which requires personnel to recognize and treat effectively patients who may be “on their way to a cardiac arrest” or recovering in the immediate postresuscitation period. The primary periarrest/prearrest conditions emphasized include: (a) acute coronary syndromes; (b) acute pulmonary edema, hypotension, and shock; (c) symptomatic bradycardias; (d) stable and unstable tachycardias; (e) acute ischemic stroke; and (f) impairments of rate, rhythm, or cardiac function in the postresuscitation period. Algorithms are presented to help healthcare personnel identify and treat a multitude of potentially lethal signs and symptoms for each of these conditions but true early recognition before the patient experiences deleterious effects is missing.

If patient outcome has been maximized with current resuscitation protocols, then early recognition and intervention is fundamental for prevention of the arrest state. Nurses, ever present at the bedside, are in the best position to recognize and intervene before an arrest state occurs.
Statement of the Problem

The practice of nursing requires the processing of clinical information. When expert clinical reasoning processes are used by the Registered Nurse, then patient outcomes may be positively affected by the nurse's ability to accurately and efficiently evaluate the clinical data and rapidly implement appropriate interventions. To aid in the development of a theory of nursing expertise, this study: (a) distinguishes clinical reasoning as a concept separate from clinical judgment and (b) identifies the clinical reasoning processes of expert acute care nurses from recalled pre-cardiopulmonary arrest situations using empiric indicators.

Research Questions

1. What data do expert acute care Registered Nurses attend to when reasoning about the care required by patients thought to be in danger of experiencing a cardiopulmonary arrest?

2. What are the similarities and differences in the clinical reasoning of expert acute care nurses in these pre-cardiopulmonary arrest events?

3. What inferences can be made about expert acute care nurses' clinical reasoning in identifying and deciding to intervene in these pre-cardiopulmonary events?

Theoretical Framework

The theoretical framework for this study is a blend of information processing theory (IPT) (Baddeley & Hitch, 1974; Newell & Simon, 1972) as elaborated by Elstein, Shulman, and Sprafka (1978), Kataoka-Yahiro and Saylor (1994), and Hanneman (1996). Newell and Simon (1972)
and Saylor (1994), and Hanneman (1996). Newell and Simon (1972) developed and refined the concept of an information processing system for human cognitive systems. This theory postulates that a set of processes exist in the central nervous system that produce the behavior of a thinking human. The emphasis is not the investigation of problem solving, but rather the exploration of complex processes and the acceptance of the need to be explicit about internal, symbolic mechanisms. The theory's explicit assumptions are as follows:

1. Some human behavior is viewed as an instantiation of the symbol manipulating capacity of a general-purpose machine.
2. The resulting information processing theory will be adequate to explain human competence and complexity.
3. The concept of representation is essential to the paradigm.
4. The human mind has parts, and they interrelate as a natural system.
5. Man's cognitive system is constantly active; it adds to its environmental input and literally constructs its reality.
6. Innate capacities, some of which evolution has been to man alone, combine with experience to produce cognition.
7. Cognitive processes are noninstantaneous—they take time; their duration is informative.
8. Some processing stages can be isolated.
9. Sufficiency conditions require that cognitive theory have the capacity to predict or perform the requisite tasks of its domain application— in or out of the laboratory. The theory is a deductive synthesis based on neobehaviorism, verbal learning, human engineering, communication engineering, computer science, and linguistics. It takes a descriptive focus, tracing and explaining the steps in memory and cognitive processing.

Empirical research utilizing information processing theory began by specifying short term memory (STM), long term memory (LTM) and delineating the role of chunks and chunking. Short term memory is viewed as the temporary holding of impressions just perceived, identified, or recalled as input is received. The STM is critical to anything that happens in the central nervous system because it represents consciousness. Because of its limited capacity (7 ± 2 units), a strict upper limit is placed on the complexity of the elementary information processes that can be executed by the system (Miller, 1956; Simon, 1974). Long term memory has a vast array of storage systems with variable routes taken by information in the process of LTM assimilation. Storage in LTM is a selective process that is time independent, allowing for encoding of greater depth and complexity (Kintsch, 1982).

Baddeley and Hitch (1974) abandoned the assumption of a unitary short-term store and proposed instead a multi-component working memory. According to their theory, working memory is divided into a least three subsystems: (a) the central executive; (b) the visuo-spatial sketchpad; and (c) the phonological loop. The central executive is the
attentional controller and forms the interface between long term memory, the visuo-spatial sketchpad, and the phonological loop. The visuo-spatial sketchpad maintains visuo-spatial information and the phonological loop maintains visual information. Working memory allows the individual to perform tasks that involve simultaneous storing and manipulation of information. Nursing expertise is dependent upon the nurse’s ability to process information from patient cues, retrieve information from LTM, and manipulate the data in working memory.

Elstein, Shulman, and Sprafka (1978) developed and tested a general model of diagnostic reasoning based on IPT in an effort to understand the reasoning process. In the first stage (Cue Acquisition), cues are obtained by a variety of methods. In Stage Two (Hypothesis Generation), usually four to five hypotheses are generated based on only a few cues. During Stage Three (Cue Interpretation), cues are analyzed as confirming or refuting a hypothesis, or as noncontributory. Finally, in the fourth stage (Hypothesis Evaluation), a judgment is reached. This model succinctly outlines what cognitive steps may be involved in clinical reasoning.

Kataoka-Yahiro and Saylor (1994) constructed a nursing model of critical thinking. They defined critical thinking as “. . . reflective and reasonable thinking about nursing problems without a single solution and is focused on deciding what to believe and do” (p. 352). Their model links the antecedents of critical thinking (specific knowledge base, experience, competencies, attitudes, and standards) with levels of critical thinking.
Hanneman (1996) developed a model to describe the characteristics of the practice of expert and nonexpert nurses. She found that expert practice was characterized by a gestaltic nursing process and practice independence whereas nonexpert practice was characterized by dissociative nursing process and practice dependence. The expert's "presence" with patients allowed for the evaluation of selected chunks of data and decisive action—early and aggressive interventions—with a patient outcome orientation. Presence is more than "being there." It is a connection between the nurse and the patient situation, a "knowing," and it can occur at first contact even when the nurse has no previous knowledge or has had no previous interaction with the patient. These models have been combined into a Nursing Expertise Model (Appendix A) which serves as a framework for this study.

Using the introductory scenario, the Nursing Expertise Model (Appendix A) may be described as follows:

Antecedents. The nurse brings to a nurse/patient interaction individual characteristics which include theoretical knowledge, experiential knowledge, disposition, and personal and professional standards. These characteristics are believed to influence the clinical reasoning of the nurse dependent upon the time and the context of the nurse/patient interaction. Antecedents were not present in the introductory scenario.

Clinical Reasoning. Multiple cues observed by the nurse include the patient's vital signs, oxygen saturation, and mentation. The nurse thought about the probable reasons for the patient's decreased
oxygenation (multiple hypothesis generation). The nurse confirmed the
cues (cue interpretation) as consistent with the formulated hypotheses
almost simultaneously with reaching a judgment (the occluded
airway/inadequate respirations).

**Conclusion.** The nurse reasoned that the decreased
oxygenation was related to an occluded airway and inadequate
respirations secondary to general anesthesia. Quickly intervening, the
nurse performed a chin lift/jaw thrust and placed the patient on 100%
oxygen via face mask.

**Patient/Client Outcome.** The patient outcome at this time was
prevention of a cardiopulmonary arrest.

**Clinical Reasoning.** The nurse used clinical reasoning, specifically
cue interpretation, to evaluate the patient’s response to the nursing
interventions. She reasoned that the patient’s respirations increased to
sixteen per minute with an oxygen saturation of 95% and a return of
mentation because of the selected nursing interventions, thus confirming
the earlier hypothesis as correct.

**Conclusion.** The nurse confirmed the earlier judgment as correct
and implemented continued surveillance.

**Patient/Client Outcome.** The patient outcome at this time was
purposeful recovery.
Metacognition. This stage involves “thinking about thinking” and may not occur immediately after an event. As a result of this experience, the nurse is able to place in long term memory the patient cues and the result of the clinical reasoning that produced results. Metacognition is not present in the introductory scenario. Though explained in its entirety, this study will focus only on clinical reasoning.

Definitions of Terms

Expert nurse (theoretical definition)—a Registered Nurse (RN) who is able to actively transform and refine expectations and perceptions in evolving situations; a nurse who has a clinical grasp and response-based practice, as well as an embodied know-how; a nurse who sees the big picture and the unexpected; a nurse who is involved, manages technology, and works with and through others (Benner, Tanner, & Chesla, 1996).

Expert nurse (operational definition)—An expert Registered Nurse who is able to understand the problems, issues, and concerns of patients and their families and is able to respond to try and meet these needs in concerned and involved ways. An expert Registered Nurse sees the “big picture” and can anticipate the unexpected. The expert Registered Nurse is recognized by peers and management as expert and as being involved and working well with others for the benefit of the patient.

Acute care nurse—a Registered Nurse who practices in a structured hospital setting in one of the following areas: Intensive Care, Coronary Care, Progressive Care, Subacute Care, Telemetry, or Post-Anesthesia Care.
Clinical reasoning—an interactive process of human thought and information processing in clinical situations that require the nurse’s “presence” (multiple cue acquisition), multiple hypothesis generation (the deriving of meaning from observed data), and cue interpretation (the confirming or refuting of cues) relative to any hypotheses generated. Each of these theoretical stages of clinical reasoning are defined next. Process (clinical reasoning) is followed by outcome (clinical judgment) (Elstein, Shulman, & Sprafka, 1978).

“Presence” involves a “knowing” of the patient as well as a “knowing” of the clinical environment and is influenced by the time and the context of the patient/nurse interactions (Jenks, 1993; Jenny & Logan, 1992; Hanneman, 1996; Radwin, 1995, 1996; Tanner, Benner, Chesla, & Gordon, 1993). Cues may be acquired using a variety of patient/client assessment methods and are affected by nurses’ theoretical knowledge, experiential knowledge, disposition, and standards (Benner, 1984; Hammer, Abu-Saad, & Halfens, 1994; Kataoka-Yahiro & Saylor, 1994; Pardue, 1987).

Multiple hypotheses generation (usually three to five hypotheses) concerning the patient’s status is a cognitive effort to confirm or refute a limited number of patient cues to attribute meaning to data. The formulated hypotheses serve as a base upon which the nurse reaches a judgment (conclusion). Affirmation or contradiction of patient cues may be repeated as many times as required prior to the validation of a single hypothesis or multiple hypotheses and the subsequent making of a judgment about the
Clinical judgment is the basis for an action or an intervention of this reasoning process (Elstein, Shulman, & Sprafka, 1978; Kassier & Gorry, 1978; Miller, 1956; Tanner, 1982; Westfall, Tanner, Putzier, & Padrick, 1986).

Pre-cardiopulmonary arrest event (theoretical definition)--a critical condition that, if unrecognized or untreated, can lead to full cardiopulmonary arrest (ECC, 1992).

Pre-cardiopulmonary arrest event (operational definition)--the presence of actual or potentially life threatening health problems requiring complex assessment, high intensity therapies and interventions, and continuous nursing vigilance (American Association of Critical Care Nurses, 2001).

Cardiopulmonary arrest--cessation of circulatory and/or respiratory function.

Assumptions

1. Expert nurses are adept at anticipating and intervening to prevent potentially fatal cardiopulmonary arrest events from advancing to stages that cannot be reversed by the best medical and technological interventions available (Benner, 1984).

2. Cardiopulmonary arrest is a potential patient outcome sensitive to nursing care (Jordan, 2000).

3. Expert clinicians use both analytical and intuitive processes (Benner, 1984; Benner & Tanner, 1987; Benner, Tanner, & Chesla, 1992; Correnti, 1992; Rew, 1988).
4. Working memory stores and processes information needed for planning and reasoning (Baddeley & Hitch, 1974).

5. Working memory consists of visual and verbal short term memory buffers and a central executive that coordinates the information for planning and reasoning (Baddeley & Hitch, 1974).

6. A verbal report from Think Aloud (TA) can be viewed as a search through working memory (Ericsson & Simon, 1993; Fine, 1997; Fonteyn, 1991).

7. The data and information from verbal reports can be used to describe clinical reasoning (Ericsson & Simon, 1993; Fine, 1997; Fonteyn, 1991).

8. The research participants will respond to the researcher truthfully and thoughtfully (Burns and Grove, 2001).

Limitations

This study has the following limitations:

1. One or more of the assumptions listed above will be violated.

2. Information retrieved at the time of a retrospective verbal report may be different from the information retrieved while actually performing the task (Ericsson & Simon, 1993).

3. As retrieval duration increases, recall will be increasingly difficult and incomplete (Ericsson & Simon, 1993).

4. A small purposive sample can limit generalizability of the findings (Burns & Grove, 2001).
5. Data collected on the nursing units during subjects scheduled shifts may be limited because of uncontrollable environmental influences.

**Summary**

This chapter presented the purpose of the study, background and significance of the study, statement of the problem, research questions, theoretical framework, definitions of terms, assumptions, and limitations. The next chapter will review the literature using the clinical reasoning section of the theoretical framework as a guide to studies relevant to nursing clinical reasoning and the selected methodology.
Chapter 2

Review of the Literature

This chapter will include a discussion of clinical reasoning as a concept, as well as a discussion and evaluation of clinical reasoning studies using the clinical reasoning section of the Nursing Expertise Model (Appendix A) as a framework for organization for the literature review. Information on the methods for examining clinical reasoning, emphasizing verbal protocol/think aloud (TA) and protocol analysis, will conclude this first section. Next, the concepts of expertise and pre-cardiopulmonary arrest will be defined and explored and relevant studies concerning variables affecting cardiopulmonary arrest presented. The support these studies offer for this current study will be synthesized.

Clinical reasoning is a key concept in an evolving theory of clinical expertise for nursing. When investigating this concept, however, one finds that this term has been used interchangeably with a number of other terms in the literature including: (a) clinical decision making; (b) clinical inference; (c) clinical judgment; (d) clinical problem solving; (e) critical thinking; and (f) intuition. This presents what Laudan (1977) called an "internal" conceptual problem related to a lack of clarity about basic concepts and this serves as an important reason for delineating clinical reasoning from other concepts prior to a discussion and evaluation of clinical reasoning studies.
Clinical Reasoning as a Concept

Part of the conceptual problem originates from Information Processing Theory (IPT) itself. Newell and Simon (1972) defined an information process as "a process that has symbol structures for (some of) its inputs or outputs" (p. 20). This definition, along with others in the theory (e.g., symbol, symbol structure, memory, and processor), provide very wide boundaries for application and can be contorted to fit any field of study.

Our colleagues in medicine have been studying problem solving using the information processing approach since the 1970's and share a concern about clinical inquiry. As stated previously, Elstein, Shulman, and Sprafka (1978) developed and tested a general model of diagnostic reasoning in an effort to understand the reasoning process. Their model concerns itself with the process of diagnostic reasoning as a cognitive process and judgment as a conclusion of this cognitive processing. Their findings of hypothetico-deductive reasoning and early hypothesis generation remain supported today (Elstein, Shulman, & Sprafka, 1990).

Educators have also studied critical thinking extensively. Because of the confusion concerning the conceptualization of critical thinking, the American Psychological Association (APA) commissioned a Delphi Report in 1990 to form a consensus about the meaning of critical thinking. As a result of that study, critical thinking was defined as "the process of purposeful, self-regulatory judgment" (Facione, p. 11). This definition delineates critical thinking to be concerned with process, but leaves the second ubiquitous term, "judgment," open to interpretation.
In nursing, the first and most frequently cited historical studies involving cognition were published in 1964 and 1966 (Hammond, 1964, 1966; Hammond, Kelly, Castellan, Schneider, & Vancini, 1966a; Hammond, Kelly, Schneider, & Vancini, 1966b, 1966c, 1967; Kelly, 1964a, 1964b). Kelly (1964a) defined clinical inference in nursing as "a conclusion or judgment made in the ward situation when the inferrer (the nurse) is in a face-to-face relationship with the person-object (the patient)" (p. 315). Hammond (1966) shortened the definition, concluding that clinical inference is the determination of the state of the patient. This early definition implies that clinical inference is a conclusion. Building on this original work, Tanner (1987) defined clinical judgment to be "a series of decisions made by the nurse in interaction with the client, regarding: (a) the type of observations to be made in the client situation; (b) the evaluation of the data observed and derivation of meaning (diagnosis); and (c) nursing actions that should be taken with or on behalf of the client (management)" (p. 154). This definition, a refinement of Tanner's 1983 definition, encompasses the process of clinical reasoning, the conclusive aspects of clinical judgment, as well as the actions the nurse would take based on the conclusion.

Benner (1982, 1984) has also used the term clinical judgment skills in her landmark study describing the evolution of expertise in nursing. Clinical judgment skills and skilled nursing interventions were seen as key to describing a nurse's practice. Clinical judgment skills include cognitive processing and conclusion prior to implementation of skilled nursing
interventions. According to Benner (1984), clinical experience contributes to clinical judgment as the nurse moves “from reliance on abstract principles to the use of past concrete experience as paradigms; . . . [as the nurse perceives] more and more as a complete whole; . . . [and as the nurse becomes an] involved performer” (p. 13). Benner’s early definitions are similar to Tanner’s in that clinical judgment is viewed both as a reasoning process and a conclusion.

The early 1990s saw a resurgent interest in conceptualizing clinical reasoning and clinical judgment. Radwin (1990) saw nurses’ reasoning as a form of clinical judgment occurring in five stages: (a) encountering the patient; (b) gathering clinical information; (c) formulating possible diagnostic hypotheses; (d) searching for more information to confirm or reject the hypotheses; and (e) reaching a nursing diagnosis. This study viewed clinical judgment as a reasoning process and a conclusion (nursing diagnosis). Regan-Kubinski (1991) stated that a nursing “diagnosis represents the clinician’s judgment of the patient’s functional capacities, interpreted in light of a contextual background” (p. 267). Her view emphasizes clinical judgment as a conclusion in the form of a nursing diagnosis.

Moving away from the strict utilization of nursing process terms, Fonteyn (1991) defined the clinical reasoning process as “cognitive activities used to make sense of client data and to develop a treatment plan to resolve the client’s health problems” (p. 8). Fowler (1997) succinctly defined clinical reasoning as “... the process of entertaining multiple...
possibilities when making judgments about client situations" (p. 350).

Chase (1995) defined clinical judgment as the “complex cognitive process by which a clinician interprets patient behaviors and builds communicable descriptions of the status of patients . . . [it] involves making a decision about whether a patient needs the initiation or modification of treatment” (p. 154). Utilizing these definitions, a process (clinical reasoning) occurs and a decision (clinical judgment) is made about nursing actions. Crow, Chase, and Lamond (1995) share this view of the concept of clinical judgment, hypothesizing that when a nurse performs a nursing assessment, the solution to a patient’s condition or situation is a judgment. It is this judgment which “enables the nurse to select the appropriate interventions for managing the patient’s care” (p. 209).

Doona (1995) further elaborated on the concept of nursing judgment, noting that the nurse must first perceive the data, apprehend the truth of the data, then affirm or deny its existence. It is at this moment that judgment occurs. Whereas judgment may occur in a flash, the processes before (clinical reasoning) and after clinical judgment (selection of nursing interventions) could be lengthy and detailed.

The constructed definition of clinical reasoning for this current study takes into account these multitude of definitions, acknowledging that clinical reasoning is an interactive process of human thought and information processing in clinical situations. In an effort to unravel the intricacy of the process, the constructed definition defines clinical reasoning as consisting of the nurse’s “presence” (multiple cue
acquisition), multiple hypothesis generation (the deriving of meaning from observed data), and cue interpretation (the confirming or refuting of cues) relative to any hypotheses generated (Appendix A). Process (clinical reasoning) is followed by outcome (clinical judgment) (Elstein, Shulman, & Sprafka, 1978).

**Clinical Reasoning Studies**

Because so many terms are used interchangeably in the study of nursing clinical reasoning, the review of the nursing literature will be approached using the major concepts from the definition of nursing clinical reasoning as an organizational framework for the review of literature. Its major concepts include: (a) presence (multiple cue acquisition); (b) multiple hypothesis generation (the deriving of meaning from observed data); and (c) cue interpretation (the confirming or refuting of cues).

**Presence (multiple cue acquisition).** Presence is the context in which nursing care occurs. It is this presence with the patient that allows for acquisition of data. Presence requires the nurse to “know” both the patient and the clinical environment. Studies addressing cue acquisition began to appear in the literature in the early eighties when nursing diagnosis was a new concept. One of the first studies was presented by Cianfrani (1984) at the Fifth National Conference on the Classification of Nursing Diagnoses. This study utilized a single written patient vignette that was purposefully constructed to concentrate on three frequently identified nursing diagnoses (decreased cardiac output, alterations in comfort, and alterations in peripheral circulation). The results of the study showed that
the number of identified health problems and diagnostic accuracy of the 180 RNs in the sample (120 graduate RNs and 60 members of a local chapter of the American Association of Critical Care Nurses) varied with the amount and relevance of information presented. As data increased, more health problems were hypothesized (decreased cardiac output: $F(2,174) = 2.88, p = .05$; alterations in comfort: $F(2,170) = 5.22, p = .01$) and more time was required to identify the health problems (decreased cardiac output: $F(2,171) = 5.41, p = .005$; alterations in peripheral circulation: $F(2,171) = 2.87, p = .05$). In addition, accuracy decreased with low relevance data for all three problems (decreased cardiac output: $x^2 (1, N = 120) = 36.5, p = .00005$; alteration in comfort: $x^2 (1, N = 120) = 24.21, p = .00005$; alteration in peripheral circulation: $x^2 (1, N = 120) = 40.53, p = .00005$). Implications for this study include: (a) nurses with increased amounts of data and/or low relevant data take more time and are less likely to be accurate and (b) low relevant data may discourage nurses in their attempts to make judgments about health states and result in premature termination of the task necessary for making decisions about nursing care.

In a similar study presented at the subsequent Seventh National Conference on the Classification of Nursing Diagnoses, Fitzmaurice (1987) had 25 master's prepared RNs make a judgment about the likelihood of a patient having the nursing diagnosis of activity intolerance using a set of 125 written patient vignettes. Using multiple regression techniques, she
found that only 12% of nurses' judgments ($R^2 = .12, p = .001$) could explain six cues (fatigue, weakness, dyspnea, discomfort, heart rate, and blood pressure) postulated by the North American Nursing Diagnosis Association (NANDA) as important defining characteristics. This study reiterated the complexity of the judgment process because the number and cognitive organization of patient generated cues varied with each nurse.

The results of these two studies in the early stages of nursing clinical reasoning research deserve mention because of their flaws. Both authors stated that they used an experimental design. This assumes random sampling, researcher-controlled manipulation of the independent variable, and control of the experimental situation. Random sampling was not used to select the sample from the larger population and neither study has a conceptual or operational definition of expert nurse. Subject selection was convenience in nature, based entirely on location, education, and membership in a specialty organization. In addition, the reader must assume that the independent variable for each study consisted of the vignettes while the dependent variable is judgment. Hypotheses were not stated because of the lack of information concerning the state of the science in nursing at that time. In addition, the researcher-controlled environment (vignettes) was artificial because, in real situations, nurses select and prioritize data from a multitude of sources and consider multiple patient problems simultaneously; not necessarily in terms of a nursing diagnosis. In essence, the selected design assumed an evolved state of
the science, that did not exist, with a compromised design and high potential for subject bias.

Exploratory-descriptive research designs for the study of cognitive concepts, using quantitative and qualitative methods, followed. Tanner, Padrick, Westfall, and Putzier (1987) examined the cognitive strategies of 15 RNs and 28 nursing students in deriving nursing diagnoses from 3 simulated videotaped patient situations using a verbal protocol method. They concluded that ninety-five percent of subjects used a predominantly cue-based strategy for data acquisition. Itano (1989) confirmed these findings with a sample of 13 nursing students within 1 month of graduation and 13 practicing RNs identified as highly skilled judgment makers (HSJMs). Using a nurse-patient interview, the judgment process of each nurse was rated on an investigator developed tool. The HSJMs collected a mean of 104.1 cues, while the students collected a mean of 78.2 cues. Each group utilized cues in the same proportion, with no significant difference in the type and number of cues [$x^2(1, N = 120) = 40.53, p = .00$].

These two studies attempted to differentiate the clinical reasoning of student nurses and practicing nurses. When selecting the RN sample, additional criteria for inclusion in the study beyond just current employment in nursing had to be met. Tanner et al., (1987) required their practicing nurses to: (a) hold a bachelor of science degree in nursing; (b) be rated by their immediate supervisors as excellent nurses who consistently made sound clinical judgments; and (c) have at least two years of clinical nursing
experience. Itano's HSJMs were identified by three clinical nurse specialists as being able to (a) collect appropriate data within a realistic time frame; (b) prioritize patient problems; (c) make accurate assessments of patient's states of health in a realistic time frame; (d) clearly state one's assessment; and (e) consciously plan and organize one's workday. The methods for data collection used by these researchers more closely approximated the reality of nursing, and the data analysis identified data acquisition strategies and clinical cues as common to the two different groups. Results of both studies reveal that the process of reasoning is complex and its components must be further analyzed in terms of how they affect the whole; however a consensus on the components of reasoning was begun.

Using verbal protocol methodology, Corcoran (1986a, 1986b) and Fonteyn (1991) also described the clinical reasoning processes of nurses. Corcoran (1986a, 1986b) articulated the approaches to planning used by 6 expert and 5 novice RNs in three written patient cases of varying complexity. She found that the experts varied their approaches based upon case complexity ($Q = 6.5, p < .05$), while novices had a narrow approach, focusing on single problems ($Q = 3, p < .3$). The strategy utilized by the experts conserved limited information processing resources, especially in complex situations. Fonteyn (1991), in a descriptive analysis utilizing a think aloud method with a written simulation, studied ten critical care certified Registered Nurses (CCRNs) and found that expert nurses were able to sort through large amounts of information and attend to
relevant information concerning the patient's health problem. The selected information allowed the nurse to conclude about a health problem, choose an action or treatment, and provide a rationale for the choice in terms of a treatment goal. Adding support to this work, Fisher and Fonteyn (1995) conducted a concurrent verbalization study utilizing three Registered Nurses in a critical care setting and found that multiple cue acquisition occurs when a nurse “attends” to patient/client data. Attending, as a heuristic, focuses on distinguishing relevant indicators from all available patient data. These studies reflect definitions of nursing expertise that recognize the mastery of nursing in practice may range from novice to expert by stating specific criteria for a subject’s inclusion in the study and their explicit data analysis contributes to methods reflecting the complex nature of coding that attends to all the data.

Qualitative studies in recent years have also added to the information available about clinical reasoning, especially concerning an individual nurse’s characteristics and its affects on cue acquisition. Dela Cruz (1994) conducted a qualitative study (grounded theory) of 21 home health nurses, of varying clinical expertise, to describe decision making styles. The identified styles were descriptive of how cues were obtained during patient care and included skimming, surveying, and sleuthing. The skimming style was used to expedite required tasks and obligated the nurse to draw upon a store of knowledge about medical conditions and their treatment for application in the clinical setting. Surveying, on the other hand, required the amassing of information prior to diagnosis and
allowed the nurse to address routine, recurrent, well-structured patient situations. Sleuthing was used by experienced nurses when managing ambiguous, uncertain, complex, ill-defined, unstructured problems and allowed ill-structured situations to be changed into well-structured ones with agreed upon solutions. Style was dictated by the nurse's knowledge and experience as well as the context of the situation. In another study of decision making styles, Lauri and Salantera (1995) administered a Likert-type questionnaire using two theoretical perspectives: information processing theory (IPT) (Newell & Simon, 1972) and the Dreyfus model of skill acquisition as applied to nursing by Benner (1984). The sample consisted of 100 Registered Nurses working in inpatient clinics and 100 public health nurses working in preventative health care. They found four different types of decision making that revealed how cues are acquired: (a) unquestioning/ questioning; (b) creative-diversive decision making; (c) patient/nurse oriented decision making; and (d) rule- and situation-based decision making. Nurses with the least experience used a questioning, nurse oriented approach to data collection and data processing. As experience increased (greater than 6 years), unquestioning and a patient oriented approach became more the norm. Public health nurses were questioning and patient-oriented in their decision making, while the clinic nurses were unquestioning and nurse oriented in their decision making. This was explained as secondary to the different tasks and contexts between the two subsamples. Together these studies reveal the structure of information leading to decision making and the role experience plays in
the structuring.

"Knowing," as a concept, started to emerge in the qualitative nursing literature in the early nineties in an effort to further understand clinical reasoning at the bedside. "Knowing" cannot occur without a theoretical knowledge base and is thought to be enhanced by experience. Nursing knowledge is discipline specific, focused on patient/client responses, and affected by different theories (Hammers, Abu-Saad, & Halfens, 1994). "One cannot diagnose what one does not recognize or understand" (Carnevali, 1984, p. 32). Corcoran (1986a, 1986b) found that lack of knowledge led to incomplete and erroneous planning of care. The novice in nursing may possess theoretical knowledge but lacks practical application of that knowledge. As a result, sensory abilities are used separately to analyze and weigh each cue. The expert, on the other hand, has the ability to change from a deliberative, systematic analysis of clinical data to rapid recognition of the whole clinical situation (Tanner, 1983). Experts use past concrete experiences, select only relevant bits of information, and are fully involved in the situation (Benner, 1984). Based on the theory of movement from novice to expert, Benner, Tanner, and colleagues (Benner, 1983; Benner, 1984; Benner 1991; Benner & Tanner 1987; Benner, Tanner, & Chesla, 1992; Tanner, Benner, Chesla, & Gordon, 1993; Tanner, Padrick, Westfall, & Putzier, 1987) have developed extensive research programs that seek to explain and provide insight into this very complex process. It is important to remember that Benner (1984) does not conceive of experience as a passage of time or longevity, but as
the refinement of preconceived notions and theory through encounters with many actual practical situations that add nuances or shades of differences to theory" (p. 36). Experience involves knowing and links the past with the present.

Knowing, as a conceptual component, has been elucidated by several researchers. Jenks (1993) found knowing, as a personal form of knowledge, to include knowing the patient, knowing fellow nursing staff, and knowing physicians. For the 23 professional nurses (each nurse had at least one year of experience in nursing practice) in the naturalistic study, establishing strong interpersonal relationship with patients ("knowing the patient") facilitated decision making because it allowed the nurse to see the patient as an individual with special needs. Similarly, Radwin (1995, 1996) found knowing the patient to be an important process by which expert nurses make therapeutic decisions. In her grounded theory study, knowing was viewed as having two components: understanding or knowledge of the patient and individualized interventions. Jenny and Logan (1992) alluded to "knowing the patient" in terms of individualizing ventilator weaning for their grounded theory study. Based on this type of knowing, sixteen expert critical care nurses were able to formulate a series of clinical judgments about the patient's status and potential, upon which they then based nursing interventions. Tanner, Benner, Chesla, and Gordon (1993) also discussed knowing in a phenomenological study involving 130 nurses of varying expertise practicing in adult, pediatric, and newborn intensive care units. They summarized knowing as an
awareness of the patient's typical pattern of responses as well as an awareness of the patient as a person. This form of practical knowledge is one key aspect to making a skilled judgment. These qualitative studies add to the nursing literature in that they identify and describe nurses cognitive processes in actual clinical situations. However, the studies by Jenny and Logan and Tanner, et al., fail to clearly state the criterion for subject inclusion in the study. Of all the concepts in the Nursing Expertise Research Model that relate to clinical reasoning (Appendix A), "presence" has the most support from the literature. The studies emphasize the importance of gathering and organizing information from patient generated cues and the difference experience makes in this complex process.

Multiple hypothesis generation (the deriving of meaning from observed data). Multiple hypotheses generation (usually three to five hypotheses) is a cognitive effort to confirm or refute a limited number of patient cues in an effort to attribute meaning to the data. The formulated hypotheses serve as a base upon which the nurse reaches a judgment (conclusion) (Appendix A). The following studies involve multiple hypothesis generation. Each lends credence to Crow's, Chase's, and Lamond's (1995) analysis of the cognitive component of nursing assessment: nurses appear to be using procedural rules which set conditions either for weight to be given information that is available or for how information should be combined. Utilizing verbal protocols and Protocol Analysis, Westfall, Tanner, Putzier, and Padrick (1986), Fonteyn (1991), Fonteyn and Fisher (1995), and Fowler (1997) reached similar
conclusions. Westfall et al. (1986) found that expert (practicing) and novice (student) nurses activated at least one hypothesis in each of three videotaped cases, with expert nurses activating significantly more complex hypotheses ($M = 79$ versus $M = 59$; $F(2, 40) = 3.3$, $p < .03$). Fonteyn's (1991) descriptive study shared this observation, noting that expert nurses reason via complex holistic treatment goals. This form of structuring enables the nurse to draw conclusions about patient/client data, choose nursing interventions, and rationalize choices. In her later concurrent verbalization study (Fisher and Fonteyn, 1995), Fonteyn concluded that nurses "anchor" their judgment. Anchoring forms hunches from initial clinical data and serves as the base upon which future clinical events are anticipated. Fowler (1997) found that five experienced (based on years) home health nurses used six cognitive operators (connecting, describing, evaluating, explaining, judging, and planning), similar to the findings of Fonteyn (1991), that produced judgments about incoming cues. As Fonteyn (1991) found, Fowler (1997) also noted that the operators were used conjointly, not linearly or in sequence, and that plans and judgments were the outcomes of reasoning, not nursing diagnoses.

Other qualitative studies revealed similar findings regarding hypotheses generation in patient care situations. In a qualitative (grounded theory) study involving 15 psychiatric nurses, Regan-Kubinski (1991) analyzed the use of clinical cues relevant in the process of making a psychiatric nursing judgment and found a categorization process occurring within the judgment process. Using a qualitative (naturalistic)
approach, Jacavone and Dostal (1992) found that the four nurse experts they studied knew what they were looking for based upon patterns witnessed in other patients. The expert nurses recognized situations without viewing clinical elements separately. Doona (1995) conducted a qualitative (phenomenological) study involving six experienced psychiatric nurses and found experience allowed the nurse to order thoughts and justify care (critical reflection). Crowe and Spicer (1995) conducted an exploratory study using a Multiple Sorting Task and modified Q-sort with 35 Registered General Nurses (RGN) enrolled in a Diploma in Nursing or Diploma in District Nursing Course in London. The medical-surgical nurses in the study used four global sub-categories of severity (curable, long-term chronic, long term extremely disabling, and life-threatening) to classify patients. Grossman and Wheeler (1997) conducted a qualitative (grounded theory) study involving a convenience sample of 33 expert nurses (defined as nurses with at least two years of critical care experience) in an effort to identify patterns of deterioration and recovery in medical intensive care unit (MICU) patients. Using constant comparative method to analyze recorded interviews regarding care for patients with acute gastrointestinal bleeding, heart failure/post myocardial infarction, and pulmonary edema, their results revealed that expert nurses make decisions based on multiple cues and recognize the need to establish trends and patterns versus reacting to isolated cues. The stronger a nurse's knowledge base, the more adamant the conviction about cue grouping. These results, as well as the results of the previously mentioned
studies, suggest that nursing judgments are based on a process of categorization.

Cue interpretation (the confirming or refuting of cues). Affirmation or contradiction of patient cues may be repeated by the nurse as many times as required to validate a single hypothesis or multiple hypotheses (Appendix A). The following studies involve the confirming or refuting of cues and correspond with Crow's, Chase's, and Lamond's (1995) second finding concerning the cognitive component of nursing assessment, that nurses appear to be using constructs for comparison with the patient's observed state. In addition to the findings cited previously, Regan-Kubinski (1991) found that the meaning of clinical cues for psychiatric nurses focuses on the information the cues convey about functional levels and capacities. Crow and Spicer (1995), concurred with this finding, observing that after medical/ surgical nurses classify a condition according to severity, they then view its affect on the patient (usually recovers, lasts for years, greatly affects lifestyle, and could die) and the actual functional and physical aspects of the condition. Fonteyn (1991) also presented evidence in her study of critical care nurses that expert nurses construct far more nursing focused (response perspective) versus medicine focused (illness perspective) goals by a 2:1 ratio. Her later study also revealed the heuristics of focused pattern recognition, questioning, and listing as important in cue interpretation (Fisher & Fonteyn, 1995). Pattern recognition allows the nurse to identify similarities and differences with those previously encountered; focused questioning allows the nurse to
examine the information, search for more information, and check hunches; listing allows the nurse to take an inventory of the relevant information prior to making a judgment. Fowler (1997) described six cognitive strategies (cue logic, framing, hypothesizing, reflexive comparison, testing, and prototype case reasoning) used by the subjects in her study to process multiple cues. These heuristics helped to reduce cognitive strain during processing.

In summary, although diverse theoretical perspectives and methodologies have been utilized in the study of nursing clinical reasoning, the nursing literature does reveal agreement on the following: (a) there is no single reasoning process for making clinical judgments; (b) task characteristics and contexts are major determinates of the processes used; (c) successful clinicians used both analytical and intuitive processes; (d) when being analytical, clinicians often use a repetitive process rather than a linear, step-by-step method; and (e) students and nurses new to a decision task rely on established rules and analytical processes, but as experience is gained with similar tasks, they rely more on past experiences and intuitive processes (Benner, 1984; Benner & Tanner, 1987; Benner, Tanner, Chesla, 1992; Correnti, 1992; Fonteyn, 1991; Fowler, 1997; Grobe, Drew, & Fonteyn, 1991; Rew, 1988). Research concerning nursing clinical reasoning continues to be needed to understand human cognition in complex situations.
Methods for Examining Clinical Reasoning

Because the theoretical perspective one subscribes to influences the methods of study, it is important to understand the influence of quantitative methods and qualitative methods for examining clinical reasoning in the information processing paradigm. A number of quantitative tools exist to measure critical thinking, creativity, clinical decision making, decision making, problem solving, quality of nursing care, clinical judgment, quality of nursing care, nursing performance, and clinical competency (Table 1). As with any tool, the researcher must agree with the author's definition of the constructs under consideration and the way in which the test items operationalize the construct. In addition, measuring the validity and reliability of higher order thinking concepts requires an appreciation of the subtleties and sophistication required in "highly specific, content-rich, and heavily contextualized case that one encounters in the high-stakes, time-limited world of professional practice" (Facione and Facione, 1996, p. 42). A problem exists because many of the higher order thinking instruments fail to conceptualize clinical reasoning from an IPT position. In addition, because the tools are representative of the quantitative paradigm, they exert a tight control on the subjects.

The qualitative methods of simulation, interview, and participant observation allow for rich descriptions of situations as close to real life as possible. Simulations have been the most frequent method for studying clinical reasoning, but this technique has given way to interviews and participant observation currently because validity is enhanced with real
## Table 1
### Higher Order Thinking Instruments

<table>
<thead>
<tr>
<th>Construct</th>
<th>Instrument</th>
<th>Source</th>
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<tbody>
<tr>
<td></td>
<td>California Critical Thinking Skills Test (CCTST)</td>
<td>Facione, 1990, 1992</td>
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<tr>
<td></td>
<td>California Critical Thinking Disposition Inventory (CCTDI)</td>
<td>Facione &amp; Facione, 1992</td>
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<td></td>
<td>Holistic Thinking Scoring Rubric</td>
<td>Facione &amp; Facione, 1994</td>
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<tr>
<td>Creativity</td>
<td>Torrance Tests of Creative Thinking (TTCT)</td>
<td>Torrence, 1974</td>
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<tr>
<td>Clinical Decision Making</td>
<td>Clinical Decision Making in Nursing Scale (CDMNS)</td>
<td>Jenkins, 1988</td>
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<td></td>
<td>Clinical Decision Making Inventories (CDI)</td>
<td>Rhodes, 1985</td>
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<tr>
<td>Decision Making</td>
<td>Decision Making Questionnaire</td>
<td>Pardue, 1987</td>
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<tr>
<td></td>
<td>Decision Making Quality Scale (DMQS)</td>
<td>Hollen, 1994</td>
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<tr>
<td></td>
<td>Decision Making Quality Inventory (DMQI)</td>
<td>Hollen, 1994</td>
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<tr>
<td></td>
<td>Joseph Decision Making Tool (JDMT)</td>
<td>Joseph, 1985</td>
</tr>
<tr>
<td>Problem Solving</td>
<td>Nursing Performance Simulation Instrument (NPSI)</td>
<td>Gover, 1971</td>
</tr>
<tr>
<td>Quality of Nursing Care</td>
<td>Patient Indicators of Nursing Care (PINC)</td>
<td>Majesky, Brester, &amp; Nishio, 1978</td>
</tr>
<tr>
<td>Quality of Nursing Care</td>
<td>Quality Patient Care Scale (QUALPAC)</td>
<td>Wandelt &amp; Ager, 1974</td>
</tr>
<tr>
<td>Nursing Performance</td>
<td>Six Dimension Scale of Nursing Performance (Six-D Scale)</td>
<td>Schuirian, 1978</td>
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<tr>
<td>Clinical Competency</td>
<td>Nursing Expertise Self Report Scale</td>
<td>Garland, 1996</td>
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world data. The qualitative instruments and quantitative methods that have affected the advancement of clinical reasoning as a concept will be compared and contrasted in this section.

**Quantitative instruments.** The general tools of thinking listed in Table 1 include the Watson-Glaser Critical Thinking Appraisal (WGCTA) (Watson & Glaser, 1980), the California Critical Thinking Skills Test (CCTST) (Facione, 1990, 1992), the California Critical Thinking Disposition Inventory (CCTCI) (Facione, Facione, & Sanchez, 1994), the Holistic Critical Thinking Scoring Rubric (Facione & Facione, 1994, and the Torrance Tests of Creative Thinking (TTCT) (Torrance, 1974). In the study of nursing clinical reasoning, these tools would not be optimal for a number of reasons. First, they are not specific to the concepts of nursing (man, health, nursing, environment). Second, the tools are administered in a controlled classroom or laboratory setting, not the clinical setting in which nursing is practiced. Lastly, when using any commercially constructed instrument, construct validity is of concern. Each researcher must agree with the author's definition of the constructs under consideration and the way in which the test items operationalize the construct. The field of cognition has expanded greatly in the past two decades and any test should take into account recent scholarship on the topic.

The nursing tools concerned with clinical decision making include the Clinical Decision Making in Nursing Scale (CDMNS) (Jenkins, 1988), the Clinical Decision Making Inventories (CDI) (Rhodes, 1985), the Decision Making Questionnaire (Pardue, 1987), the Decision Making

39

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Quality Scale (DMQS) (Hollen, 1994), the Decision Making Quality Inventory (DMQI) (Hollen, 1994), and the Joseph Decision Making Tool (JDMT) (1985). These tools were considered for this study because of their conceptual closeness when defining "decision making" and "clinical reasoning." It was determined, however, that the instruments would be problematic for three reasons: (a) though close, the theoretical background and conceptual definitions of decision making as stated by the authors differ from the theoretical base and conceptual definition of clinical reasoning utilized in this study; (b) the decision making tools are multiple choice/self-report instruments that demand forced choices that do not require the nurse to reason through the care required by a patient; and (c) the decision making tools focus more on the frequency and quality of decisions made, not the actually decision making process.

The nursing tools concerned with the delivery of nursing care include the Nursing Performance Simulation Instrument (NPSI) (Gover, 1971), the Patient Indicators of Nursing Care (PINC) (Majesky, Brester, & Nishio, 1978), the Performance Based Development System (PBDS) (Del Bueno, 1990), the Quality Patient Care Scale (QUALPACS) (Wandelt & Ager, 1974), and the Six Dimension Scale of Nursing Performance (Six-D Scale) (Schwirian, 1978). Each of these tools comes closer to measuring the concept of clinical reasoning, but each has its drawbacks. The NPSI (Gover, 1971) utilizes paper and pencil clinical simulations and asks respondents to perform different tasks in determining how and/or when a particular situation is to be handled. The simulations and different methods...
of inquiring about how and/or when to intervene serve as an alternate format to using multiple choice questions. The instrument’s construct (problem solving), however, is different than clinical reasoning and, because the best simulation is no match for reality, it is preferable that testing actually occur in the clinical setting.

The PINC (Majesky, Brester, & Nishio, 1978) requires observation of patients for preventable nursing care complications (infections, immobility, and fluid imbalance). The focus of this tool is patient outcome, and, in particular, preventable/nurse accountable complications. The underlying conceptual framework is compatible with the proposed research model because Johnson’s model conceptualizes one of nursing’s contributions to nursing care to be the prevention of tensions which cause disruptions in man’s internal environment. The indicators in the tool are applicable today, but additions are needed secondary to the current state of the art of nursing care. To be applicable to this particular study, however, an indicator would need to be developed that focused on the prevention of cardiopulmonary arrest.

The PBDS (Del Bueno, 1990) purports to measure the specific performance skills identified as desirable for staff nurses working in adult critical care. Several hundred 1 to 3 minute video simulations of single system problems are available to measure a nurse’s ability to: (a) identify a patient’s health risk or problem; (b) identify the interventions required to reduce the risk or correct the problem; and (c) rationalize the selected interventions. Responses are scored as acceptable, unacceptable, or
partially acceptable as compared to criterion referenced answers. Though better than paper and pencil simulations, with video simulations the nurse is limited in use of senses. In addition, this tool considers the outcome of clinical reasoning, but not the process of clinical reasoning.

The QUALPACS (Wandelt & Ager, 1974) was created to measure the quality of care received by a patient. A conceptual framework is not present but judgment, as a key concept, is defined. Nursing actions are viewed as stemming from judgment with evaluations of judgments based on the measurements of nurse actions. In a patient care situation, a nurse is scored on a five point Likert-type scale, with each rater identifying their own frame of reference when establishing the standard of measurement. Though realism is present in the nurse/patient interaction, an inter-rater reliability problem exists because the "standard" can change with each rater.

The Six-D Scale (Schwirian, 1978) is a self administered tool the author developed to assess frequency of tasks performance, quality of task performance, and adequacy of preparation. It consists of 52 items grouped into six performance subscales: (a) leadership; (b) critical care; (c) teaching/collaboration; (d) planning/ evaluation; (e) interpersonal relations and communications, and (f) professional development. The author does not mention the use of a conceptual framework but does state that the instrument was constructed to be "consistent with the nursing process model of good nursing care" (Schwirian, 1978, p. 347). Because conceptual clarity is not present and because it does not address the
process involved in performance, it's use for the exploration of clinical reasoning is questionable.

The Nursing Expertise Self Report Scale (Garland, 1996) was developed from the Benner (1984) model of clinical competence. The purpose of the scale is to "encourage participants to contrast their self perception of clinical competency with the Benner model" (Garland, 1996, p. 193). It consists of 20 statements that characterize either expert or novice practice: (a) experience; (b) priority setting; (c) involvement; and (d) intuition. Using a five point Likert-type scale, responses are weighted so that participants who strongly agree with statements that characterize expert practice receive higher scores than those who strongly disagree with statements. The scale was specifically created for a study investigating the self perception of clinical competence reported by medical-surgical nurses. This tool is concerned with the perception of expertise, not clinical reasoning and its impact upon the patient. It could be used as a corollary to a study to determine how nurses report themselves, if nurses in specialty areas view themselves more as experts, or if a relationship exists between educational preparation and self report of expertise.

Verbal reports. Qualitative methods focus on the rich description of limited episodes of a phenomenon and allow for the study of situations as close to real life as possible. Simulation, interview, and participant observation are the most frequently cited qualitative methods for obtaining clinical reasoning data. Originally developed for purposes of assessment
(Patel & Arocha, 1995), simulation has the advantage of ease of administration and patient safety, but fails to deliver the validity of real world complexities. Simulations have enhanced our understanding of cognition, but their use to evaluate the clinical reasoning of expert nurses should be limited at this time. A more effective technique for studying clinical judgment is a combination of interviews and participant observation.

Fisher and Fonteyn (1995) and Greenwood and King (1995) demonstrated that this combination is logistically possible and safe in the clinical setting during the time that care is being given and has the potential for unlocking large amounts of data that nurses use when providing care. In order for a theory of expertise to evolve, experts need to be studied in their "natural" clinical setting. Fisher and Fonteyn (1995) conducted a study using guided interviews and participant observation with the Think Aloud (TA) technique in a neurosurgical intensive care unit and cardiovascular surgery intensive care unit. They found that it was possible to study nurses' reasoning in the clinical setting without compromising or disrupting patient care or unit routine, but cautioned that because their patient population was not fully cognizant, verbalizations (or lack of verbalizations) in an aware population may be distressing to a patient.

Greenwood and King (1995) conducted their study using concurrent verbalization on an orthopedic ward. Their instructions to subjects, however, included a statement requesting selective filtering of
any potentially distressing information. Any information that was selectively filtered was thought to be placed in LTM and available for recall during retrospective verbalization. These instructions affect validity because the nurse subject is required to screen data and remember it at a later time. Ethically, the researchers were granted permission from all relevant committees, with no nurse or patient expressing discomfort with the "think aloud" process. In fact, many patients were noted to have enjoyed the extra attention.

Fowler (1997) conducted what she considered to be a concurrent verbalization study, with each of her expert home health nurses verbalizing any plans or thoughts about a case immediately before or after visiting a newly referred client (taping occurring in a private office or the nurse's car). The taping did not take place during the clients' care because such an intrusion was felt to have the possibility of changing the natural thinking of the nurse and care delivery processes. This verbal collection procedure for this study was not truly concurrent, but occurred close to the time of care delivery, enhancing the validity of the data through less reliance on LTM.

These concurrent verbalization undertakings in clinical practice settings provide food for thought. Do we use only clinical settings where patients are not cognizant? Do we sacrifice validity by giving instructions to subjects requiring selective filtering of information and analyze potentially incomplete data? Do we not ask a nurse to verbalize thoughts during care delivery to protect the patient? If the nurse verbalizes thoughts during care delivery, do we include patient response to the TA protocol as
a part of a study? Though concurrent verbalization in the clinical setting may provide richer, thicker descriptions of nurses' clinical reasoning, thoughtful consideration of the study's impact on a vulnerable population is an ethical issue with important ramifications.

Ericsson and Simon (1993) acknowledged five issues related to the use of verbal reports in their text on Protocol Analysis (PA). First, strong doubts have been expressed by researchers concerning the suitability of using subjects' verbalizations as data. Verbal reports in the past have been suspect as data because they represent verbal behavior. Verbal behavior is a discourse about a problem or situation that may or may not involve introspection and, as such, is an objective measurement of behavior worthy of study. Second, cognitive processing must occur in order to transform behavior into data. In order to make progress in understanding human cognitive processes, it is imperative that researchers concern themselves with methodological questions about data collection. Distinctions need to be made among the various forms of verbalization and literature published on these issues. Currently the nursing and medical literature on TA is sparse (Corcoran, Narayan, & Moreland, 1988; Fisher & Fonteyn, 1995; Fonteyn, 1991; Fonteyn & Fisher, 1995; Fonteyn, Kuipers, and Grobe, 1993; Grobe, Drew, & Fonteyn, 1991; Henry, LeBreck, & Holzemer, 1989; Kassirer, Kuipers, & Gory, 1982; Kuipers, Moskowitz, & Kassirer, 1988; Tanner, Padrick, Westfall, & Putzier, 1987).
Third, encoding of the verbal behavior into "hard" data is crucial. Verbatim transcripts preserve the raw data in "hard" form, with information processing models of cognitive processing providing a basis for making the encoding process explicit and objective. "Hard" data allows for scrutiny of the theoretical presuppositions that have entered into the encoding process. Fourth, there must be clarity of theoretical presuppositions. Encoding is not theory neutral. When data from a protocol is processed “. . . theory delimits a small portion of the universe of potentially observable behavior as being relevant” (Ericsson, & Simon, 1993, p. 5). This determines which behaviors are recorded and encoded. The context of a particular theory will constrain the range of possible interpretations and allow for the meaningful analysis of select verbalizations.

Finally, how thought processes are inferred from behavior must be specified because subjects' report of their own mental states and processes often raises an issue of reliability. By specifying the inferences, the issue of reliability of self report becomes moot because of the inverse relationship that exists between how much a subject is to be trusted and the amount of information that they verbalized: the more information conveyed, the more difficult it is to construct a model that is an exact duplicate, hence, the more confidence in the model that represents that particular individual.

Protocol analysis. Aside from these major issues, other concerns that have been voiced concerning TA include the large amounts of data produced and the small amount of subjects utilized. Large amounts of data
are typically produced because a grand tour type of question is asked when subjects are requested to verbalizes their thoughts. Though no studies have been published concerning the cognitive processing involved when subjects are asked focused questions, this type of questioning would limit data and aid in specifying cognitive processes. As for the smaller number of subjects utilized in TA, the reason is the emphasis of the method is discovery of "... rich data about individuals rather than easily analyzed data about a population" (Kuipers & Kassirer, 1984, p. 365).

Prior to selecting PA as a method of analysis, the researcher must clearly define the concept under study. Conceptualization should dictate the measurement method and not vice versa. Initial analysis decisions about each of the segments, objects, and assertions should be based on the data and result in clear and explicit encoding processes that are detailed, logical, and objective, thus enhancing validity and reliability. Encoding is evaluated as the agreement between different persons using agreed upon conventions (rules) and terms. The extent to which a researcher makes inferences, and the extent to which each encoding is independent of the other, consistency and reliability of judgments is affected. The final judge of the logic of the encoding and inferences made in graphing the process will be reader and peer colleague judgments.

Critique of the verbal reporting process and the structuring of cognitive processes reveals the importance of specifying the following assumptions of PA: (a) a verbal report can be viewed as a search through a problem space of hypotheses and data; (b) the problem space search
involves the application of operators that represent information that the subject is holding in STM; and (c) the information from a verbal report can be used to describe clinical reasoning (Ericsson & Simon, 1993; Fonteyn, 1991; Fine, 1997). Recognition of these assumptions strengthens application of the PA methodology because of their influence on the logic of using verbal reports to obtain information on clinical reasoning.

Ericsson and Simon’s model (1984, 1993) was used by Jones (1988, 1989) and Greenwood and King (1995) in their research involving the clinical reasoning behavior of nurses. Jones (1988, 1989), using a simulation involving the assessment of pressure sore risk in patients hospitalized in acute medical wards, analyzed data by transcribing and forming initial segments and categorizing these segments. In Stage One, the interviews were transcribed verbatim, including the researcher’s answers and comments during the data collection session. Statements were segmented according to meaning, with each segment representing a state of knowledge. As subjects progressed from one knowledge state to another, an “operator,” defined as “a mental process generating or transforming knowledge” (Jones, 1989, p. 1067), was found. A list of seven operators (e.g., collect data, choose, review data, interpret data, relate data, diagnose, and act) was constructed from three interviews. In Stage Two of the study, a problem behavior graph (PBG) was constructed to show diagrammatically a subject’s step-by-step progression through the problem. The constructed PBG yielded information about an individual’s clinical reasoning and diagnostic strategy by plotting operators against the
activities of daily living (ADL) domain.

Greenwood and King (1995) conducted a similar study involving nine pairs of orthopedic nurses (one expert and one novice) and seven patients who had recently undergone total hip replacement surgery. The nurses were instructed to “think aloud” during care delivery and to “. . . selectively filter from their verbal reports any potentially distressing information” (Greenwood & King, 1995, p. 908). The researchers found the technique used by Jones (1989) appealing, selecting similar cognitive strategies (collect, review, interpret, relate, and diagnose) to graph and concluding that PA requires improvement through a tighter operationalization of the coding categories used in their study. Their conclusion is a warranted criticism of their study in that they chose to use the encoding strategy utilized by Jones (1989), thus limiting their scope of the encountered problems. This criticism is not, however, applicable to PA in general because, if encoding occurs from the data and not a predisposition towards the data, alternative encoding strategies are possible via the creative imagination of the researcher.

Grobe, Drew, and Fonteyn (1991), Fonteyn and Grobe (1994), and Fine (1997) applied Kuipers’ PA technique refinements (1987; Kuipers & Kassirer, 1984; Kuipers et al., 1988) to the clinical reasoning of seven experienced hospital nurses, ten expert critical care nurses, and seven expert labor and delivery nurses respectively. By comparing levels of linkages between subjects, Grobe et al. (1991) found PA effective in demonstrating that experienced nurses consider problems and
interventions concurrently. This finding is of importance when considering how beginners in nursing are currently taught to handle the cognitive strain of clinical practice via the linear, step by step nursing process. Fonteyn and Grobe (1994) found that expert critical care nurses structure information when reasoning and making decisions by studying, concluding, choosing, and explaining. These four processes formed the basis for the pattern matching, listing, focused questioning, and identifying of critical indicators that subjects used to identify patient problems and distinguish between relevant and irrelevant data. This study's findings emphasized the importance of finding ways to reduce search efforts in order to accurately and efficiently identify patient problems and nursing interventions for problem resolution.

Fine (1997) conducted a similar study in which she found that expert labor and delivery nurses structure information using fourteen cognitive operators: metacognition, perceptual interpretation, conclude, patient explain, intent treatment, intent assessment, explain action, intent patient communication, intent agent communication, parenthetical, weigh, summarize, explain judgment, and compare. These operators formed the basis for testing data, pattern recognition, prototype comparison, routine listing, forward and backward reasoning, hypothesizing, and predictive reasoning. Fine's study implications focus on the methods of teaching clinical reasoning to students and increasing the reasoning skills of practitioners, but fall short of assisting in this endeavor because of the large number of operators. If operators are what the subject is holding in
STM, the magical number seven, plus or minus two (Miller, 1956), is not operative and causes the reader to question if some operators need to be collapsed into more inclusive categories.

Lastly, Fowler's (1997) study also used verbal protocol analysis as adapted from Ericsson and Simon (1993) and Fonteyn et al. (1993). In this article, however, she failed to provide the details/illustrations on how she reached her conclusions regarding the formulation of the six cognitive operators and six cognitive strategies. For studies to be appropriately compared that have selected protocol analysis as the methodology, authors need to present this aspect of the research in detail.

Because of the limited availability of quantitative tools that conceptualize clinical reasoning from an IPT position and because of the tight control exerted by the tools from a quantitative perspective, a qualitative design was selected for this study utilizing TA and PA. The TA method of data collection allows for subject description and the PA method of analysis facilitates a detailed examination of the transcript. The PA method proposed by Kuiper’s and colleagues (1987; Kuipers & Kassirer, 1984; Kuipers et al., 1988) was selected because of the depth of analysis required prior to making inferences about the data and the audit trail that would be left for other researchers to follow to judge the adequacy of the data for making the inferences.

Expertise as a Concept

Although the term “expert” has been frequently used in the nursing literature since Benner’s publication in 1984, its definition remains elusive.
Since that time nursing has struggled to define expertise and place it in context with clinical decision making, clinical inference, clinical judgment, clinical problem solving, critical thinking, and intuition. In general, what is an expert? How does one recognize an expert?

Dictionaries highlight the features of knowledge and/or skill and imply experience (this includes the Latin roots of the word) when discussing “expert” (Jasper, 1994). This is an important base on which to consider further elaboration by researchers. Chi, Glaser, and Farr summarized the following characteristics of experts' performances in their classic 1988 text:

1. Experts excel mainly in their own domains.
2. Experts perceive large meaningful patterns in their domain.
3. Experts are fast; they are faster than novices at performing the skills of their domain, and they quickly solve problems with little error.
4. Experts have superior short term and long term memory.
5. Experts see and represent a problem in their domain at a deeper (more principled) level than novices; novices tend to represent a problem at a superficial level.
6. Experts spend a great deal of time analyzing a problem qualitatively.
7. Experts have strong self-monitoring skills. (pp. xvii–xx)

At a cognitive level, expertise can be defined in terms of: (a) its development; (b) expert's knowledge structures; and (c) expert's reasoning processes (Williams, Faulkner, & Fleck, 1998). “The development of
expertise involves a progression from a superficial and literal understanding of problems (a qualitative mark of the cognition of novices) to an articulated, conceptual, and principled understanding (a qualitative mark of the cognition of experts)” (p. 83). The accumulation of skill based on experience and practice is key. As an individual progresses from novice to expert, level-like qualitative shifts occur that have the following characteristics: (a) it is rare for a level to be skipped; (b) it is rare for someone to either regress or fail to progress, unless they fall out of practice; (c) expert teachers can anticipate the errors a trainee will make depending on their skill level; and (d) with practice, a skill loses the quality of being conscious, effortful, deliberate, and linear, and takes on the quality of automatic pattern recognition. Judgments become “intuitions” in that one can rapidly and effortlessly associate experiences, make decisions, or perform actions (Williams, Faulkner, & Fleck, 1998).

Expert knowledge differs from novice knowledge in its organization, as well as its extent. Concepts are interrelated in meaningful ways and memories are concept, context, and content addressable. In terms of reasoning processes, it is unclear if expertise can be defined in terms of any special reasoning processes that experts may possess. Experts are adept at their usual or familiar tasks. Disruption can cause the expert’s superior performance to decline markedly. Experts demonstrate perceptual skill by rapid searching, discrimination, recognition, and comprehension of complex information patterns. Experts use case based reasoning, referring to illustrative or prototypical examples of past cases.
when asked to justify or explain their decisions or actions. Expert reasoning is flexible, allowing for an increased ability to form multiple alternative interpretations or representations of problems, and increased ability to revise old strategies and create new ones as problem-solving proceeds (Williams, Faulkner, & Fleck, 1998). These general statements regarding the ability of experts places the concept of expertise in a context which makes it possible to examine nursing expertise.

**Nursing expertise.** What is an expert nurse? The most comprehensive studies on nursing expertise have been conducted by Benner, Tanner, and Chesla (Benner, 1983, 1984, 1991; Benner & Tanner, 1987; Benner, Tanner, & Chesla, 1992; Tanner, Benner, Chesla & Gordon, 1993; Tanner, Padrick, Westfall, & Putzier, 1987), with their most recent study involving 130 nurses in adult and pediatric critical care settings (1996). Building on their earlier work, these researchers delineated aspects of nursing practice from each stage of development (advanced beginner, competent, proficient, and expert). The clinical world of the expert nurse centers on a clinical grasp and response-based practice with embodied know-how. The clinical grasp and response-base practice focuses on making sense of who the patient is, the patient's patterns of responses, and the immediate demands and concerns of the situation. The embodied know-how focuses on seeing "the big picture" and anticipating the unexpected. At the expert level, moral agency becomes more situated and socially embedded and is enabled by experientially learned clinical and perceptual capacities. The three key aspects of moral
agency at this level include: (a) developing the skill of involvement; (b) managing technology and preventing unnecessary technological intrusions; and (c) working with and through others. These studies describe the world of the expert nurse but do not define expertise.

Because a succinct definition has been lacking in nursing, the terms expert, expertise, and experience are often used interchangeably or defined in terms of the other, or not defined at all. This has resulted in the development of a myriad of tools for measurement that frequently lack a theoretical base (as previously discussed) and a wide variety of subjects that are deemed to be “experts.” Reflecting this concern, Table 2 describes the the sample, clinical experience required to be considered an expert, and other operationalized aspects of the definition of “expertise” as specified in the previously cited clinical reasoning studies where a level of expertise was a variable for consideration when selecting the sample. Years of clinical experience and other aspects for nomination as an expert (including the procedure for nomination) fail to be consistent or measurable among studies. This presents a second “internal” conceptual problem related to a lack of clarity of basic concepts.

The study of expertise is important when considering that experts have the ability to prevent potentially catastrophic events, such as cardiopulmonary arrest. The clinical reasoning required to prevent cardiopulmonary arrest is just one aspect that can be studied in the clinical setting that can further clarify a definition of expertise. Based on the literature, this study operationalizes the concept of expertise through a
Table 2
Selected Criteria for Nursing Expertise

<table>
<thead>
<tr>
<th>Author</th>
<th>Description of Sample</th>
<th>Clinical Experience</th>
<th>Operational Definition of Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clanfrani, 1984</td>
<td>120 graduate RNs and 60 members of local AACN chapter</td>
<td>no minimum stated</td>
<td>routine use of nursing diagnosis</td>
</tr>
<tr>
<td>Fitzmaurice, 1987</td>
<td>25 master's prepared RNs</td>
<td>current practice</td>
<td>in written and verbal communication</td>
</tr>
<tr>
<td>Westfall &amp; Putzier, 1987</td>
<td>15 BSN RNs practicing on general medical or surgical units and 28 nursing students</td>
<td>minimum of 2 years clinical nursing</td>
<td>rated by immediate supervisor as excellent nurse, able to make sound clinical judgments</td>
</tr>
<tr>
<td>Itano, 1989</td>
<td>13 nursing students and 13 practicing medical/surgical RNs</td>
<td>no minimum stated</td>
<td>identified by clinical nurse specialist; collects data within realistic time frame; prioritizes patient problems; accurate assessments in realistic time frame; clearly states assessment; plans and organizes workday</td>
</tr>
<tr>
<td>Corcoran, 1986a, 1986b</td>
<td>6 practicing expert RNs and 5 practicing novice RNs</td>
<td>6 months or less of hospice experience = novice; 18 months or more of hospice experience = expert</td>
<td>leadership position; must have published articles, presented information or offered continuing education on hospice nursing or pain control OR be labeled as an expert in hospice nursing or pain control by at least five hospice nurses</td>
</tr>
</tbody>
</table>
Table 2

Selected Criteria for Nursing Expertise

<table>
<thead>
<tr>
<th>Author</th>
<th>Description of Sample</th>
<th>Clinical Experience</th>
<th>Operational Definition of Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fonteyn, 1991</td>
<td>10 RNs with minimum of BSN and certification as CCRN</td>
<td>minimum of 5 years critical care experience</td>
<td>leadership in clinical area or lectures to professional group</td>
</tr>
<tr>
<td>Fisher &amp; Fonteyn, 1995</td>
<td>3 RNs</td>
<td>cared for &gt; 500 of the same type of patient</td>
<td>identified by nurse manager as having domain expertise</td>
</tr>
<tr>
<td>Radwin, 1995a, 1995b</td>
<td>13 BSN RNs</td>
<td>no minimum stated</td>
<td>identified by nurse manager</td>
</tr>
<tr>
<td>Jenny &amp; Logan, 1992</td>
<td>16 critical care nurses</td>
<td>no minimum stated</td>
<td>identified by peers and supervisors as having reached the expert level of skill acquisition,</td>
</tr>
<tr>
<td>Tanner, Benner, Chesla, Gordon, 1993</td>
<td>130 RNs practicing in intensive care units</td>
<td>minimum of 5 years</td>
<td>recognized by peers and supervisors as expert practitioner</td>
</tr>
<tr>
<td>Westfall, Tanner, Putzier, &amp; Patrick, 1986</td>
<td>15 BSN RNs practicing on general medical or surgical units and 28 nursing students</td>
<td>minimum of 2 years clinical nursing</td>
<td>rated by immediate supervisor as excellent nurse, able to made sound clinical judgments</td>
</tr>
<tr>
<td>Fowler, 1997</td>
<td>5 BSN RNs</td>
<td>at least 5 years in home health; at least 10 years in practice</td>
<td>based on years of experience</td>
</tr>
</tbody>
</table>
Table 2  
Selected Criteria for Nursing Expertise

<table>
<thead>
<tr>
<th>Author</th>
<th>Description of Sample</th>
<th>Clinical Experience</th>
<th>Operational Definition of Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacavone &amp;</td>
<td>8 RNs practicing in coronary</td>
<td>&lt; 1 year of experience = beginner; &gt; 5 years experience = expert</td>
<td>based on years of experience</td>
</tr>
<tr>
<td>Dostal, 1992</td>
<td>care units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doona, 1995</td>
<td>6 RNs practicing in psychiatric</td>
<td>minimum of 2 years</td>
<td>regard of others in the psychiatric nursing field for their judgment</td>
</tr>
<tr>
<td>settings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grossman &amp;</td>
<td>33 RNs practicing in medical</td>
<td>minimum of 2 years</td>
<td>based on years of experience</td>
</tr>
<tr>
<td>Wheeler, 1997</td>
<td>intensive care units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benner, Tanner,</td>
<td>130 RNs practicing in intensive</td>
<td>minimum of 5 years</td>
<td>recognized by peers and supervisors as expert practitioner</td>
</tr>
<tr>
<td>&amp; Chesla, 1992</td>
<td>care units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benner, Tanner,</td>
<td>130 RNs practicing in intensive</td>
<td>no minimum stated</td>
<td>clinical grasp and response-based practice; sees &quot;the big picture&quot;;</td>
</tr>
<tr>
<td>&amp; Chesla, 1996</td>
<td>care units</td>
<td></td>
<td>sees the unexpected; embodied know-how; involved; manages technology;</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>works with and through others</td>
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</table>
nomination process involving peers and management.

Pre-cardiopulmonary Arrest as a Concept

Cardiopulmonary resuscitation can be divided into three phases: pre-cardiopulmonary arrest (prearrest), cardiopulmonary arrest (arrest), and post cardiopulmonary arrest (post arrest). Pre-cardiopulmonary arrest variables are those factors which affect the onset of the arrest event [i.e., age, sex, vital signs (including level of consciousness, blood pressure, respirations, and heart rate and rhythm), functional status before admission, medications, laboratory values prior to arrest, procedures performed prior to arrest acute disease status, observations of deterioration of clinical condition prior to arrest, chronic disease status, mechanism of arrest (including dysrhythmias), communication breakdown between healthcare providers]. Prearrest variables hold the potential of being controlled by the healthcare team from time of admission in an effort to decrease the possibility of a cardiopulmonary arrest occurring.

Intraarrest variables are those factors which affect the actual arrest event during which the patient has no spontaneous respirations, palpable pulse, or sustainable blood pressure (i.e., time from admission to arrest, time of day of the arrest, location of the arrest, CPR participants, witnesses versus unwitnessed arrest, resuscitation delay, defibrillation delay, duration of resuscitation, medications administered during resuscitation, performance of defibrillation, performance of intubation). Intraarrest variables are controlled by the healthcare team in a very time limited manner in an effort to successfully resuscitate the patient. Post arrest
variables are those factors which occur after successful resuscitation and affect the possibility of survival to discharge and are similar to prearrest variables in that the purpose of their consideration is to prevent a second arrest.

**Morbidity scoring tools.** The following tools were developed in an effort to predict survival from resuscitation. George, Fold, Crecelius, and Campbell (1989) created the multifactorial Pre-Arrest Morbidity (PAM) index to evaluate pre-arrest morbidity in individual patients. Using a weighted point scale, 15 clinical characteristics were derived. The first five variables [hypotension (systolic blood pressure \( \leq 90 \) mm HG), azotemia (blood urea nitrogen = to or > 50 mg/dL, or serum creatinine = to or > 2.5 mg/dL), malignancy, pneumonia, and homebound lifestyle before admission] were each assigned three points on the scale because they were reported to be independent predictors of mortality by multivariate analysis from a previously published survey by Bedell, Delbanco, Cook, and Epstein (1983). Five clinical characteristics [angina pectoris, acute myocardial infarction, heart failure (New York Heart Association Class III, IV), S3 gallop, oliguria (< 300 ml/day), sepsis] received 1 point each on the scale because they too were reported to be predictive of mortality from the previously mention survey, but only by univariate analysis. An additional five variables (mechanical ventilation, recent cerebrovascular event, coma, and cirrhosis) were added to the scale because they were considered important determinants of morbidity by the authors, with each of these...
variables also being assigned a single point value (Table 3). A composite PAM score has a maximum value of 9. During the six month study of the PAM Index, the study population consisted of 91 men and 49 women ranging in age from 18 to 92 years. Of the pre-arrest variables, multivariate analysis revealed only hypotension ($p < 0.005$) and azotemia ($p < 0.003$) to be significant. As a categorical variable, age (65 years or greater) was significantly ($p < 0.03$) associated with mortality. Patients with scores of 7 or greater had a less than 15% chance of long-term survival and no patient with a score of 8 survived to discharge. The fifteen variables in this tool focus on specific signs or symptoms (hypotension, azotemia, homebound lifestyle, $S_3$ gallop, oliguria, mechanical ventilation, coma) and disease processes (malignancy, pneumonia, angina pectoris, acute myocardial infarction, heart failure, sepsis, recent cerebrovascular event, cirrhosis) that can be quantified prior to an arrest event.

Ebell (1992) used meta-analysis to identify prearrest variables associated with a decreased rate of survival following CPR of hospitalized patients to develop a modified PAM Index, the Prognosis After Resuscitation (PAR) score. Study inclusion criteria included the following: (a) published after 1980 (data gathered after 1975), (b) in-hospital resuscitation, (c) retrospective or prospective design, (d) adult patients from general wards and intensive care units, and (e) an end-point of survival to hospital discharge. In addition, the studies had to report on at least one prearrest variable (e.g., age, diagnosis, or renal function). In the 14
### Table 3

**Variables in Prearrest Tools**

<table>
<thead>
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<tbody>
<tr>
<td>hypotension</td>
<td>3 points*</td>
<td>3 points*</td>
<td>3 points</td>
<td></td>
</tr>
<tr>
<td>azotemia</td>
<td>3 points*</td>
<td>3 points*</td>
<td>2 points</td>
<td></td>
</tr>
<tr>
<td>malignancy</td>
<td>3 points</td>
<td>2 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td>metastatic</td>
<td></td>
<td>10 points*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nonmetastatic</td>
<td></td>
<td>3 points*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pneumonia</td>
<td>3 points</td>
<td>3 points*</td>
<td>2 points</td>
<td></td>
</tr>
<tr>
<td>homebound lifestyle</td>
<td>3 points</td>
<td>5 points*</td>
<td>2 points</td>
<td></td>
</tr>
<tr>
<td>angina pectoris</td>
<td>1 point</td>
<td>1 point</td>
<td>1 point</td>
<td></td>
</tr>
<tr>
<td>acute MI</td>
<td>1 point</td>
<td>- 2 points*</td>
<td>2 days after admission/1 point</td>
<td></td>
</tr>
<tr>
<td>heart failure</td>
<td>1 point</td>
<td>1 point</td>
<td>1 point</td>
<td></td>
</tr>
<tr>
<td>S3 gallop</td>
<td>1 point</td>
<td>1 point</td>
<td>1 point</td>
<td></td>
</tr>
<tr>
<td>oliguria</td>
<td>1 point</td>
<td>1 point</td>
<td>1 point</td>
<td></td>
</tr>
<tr>
<td>sepsis</td>
<td>1 point</td>
<td>5 points*</td>
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* = variables of significance
selected studies, the number of patients ranged from 48 to 470 for a total of 2,643; age ranged from 59 to 79 years; and rate of survival to discharge following CPR ranged from 6.6% to 24.3%. Using the odds ratio for each variable, the following point values were assigned to eight variables: metastatic malignancy 10 points ($p < 0.001$; Odds Ratio 44.9; CI: 9.53-211.5), nonmetastatic malignancy 3 points ($p < 0.001$; Odds Ratio 3.08; CI: 1.82-5.20), sepsis 5 points ($p < 0.001$; Odds Ratio 6.86; CI: 2.51-18.76), dependent functional status 5 points ($p < 0.001$; Odds Ratio 4.99; CI: 2.92-8.55), pneumonia 3 points ($p < 0.001$; Odds Ratio 2.86; CI: 1.43-5.72), creatinine > 130 μmol/L 3 points ($p < 0.001$; Odds Ratio 5.44; CI: 2.72-10.91), age > 70 years 2 points ($p < 0.003$; Odds Ratio 1.41; CI: 0.87-2.27), and diagnosis of acute myocardial infarction minus 2 points ($p < 0.005$; Odds Ratio 0.53; CI: 0.36-0.79). A diagnosis of myocardial infarction was associated with an increased rate of survival to discharge following CPR, thus the reason for subtracting points from the score (Table 3). Ebell applied the PAR index to a group of 218 patients, identifying 37 patients with a score greater than 8 as not surviving CPR. No other data was presented on this initial study group. The PAR, as a modified version of the PAM, focuses only the prearrest variables that significantly affected the rate of survival after an arrest event.

Dautzenberg, Broekman, Hooyer, Schönwetter, and Duursma (1993) also proposed a modification of the PAM Index in an effort to offer geriatricians assistance with difficult resuscitation decisions. They
surveyed 32 CPR studies for effectiveness of CPR in relation to immediate recovery, survival to hospital discharge, and long-term survival. Hospitalized patients with sudden, unexpected circulatory collapse or abrupt respiratory insufficiency in the setting of acute cardiovascular illness were most likely to benefit from CPR. Hospitalized patients with irreversible organ failure, widespread malignancy or other severe debilitating conditions were least likely to survive CPR. Using simple ranking (without percentages of survival or p values), the chance of death after resuscitation was ranked as follows: (a) strongly positive with hypotension and metabolic acidosis, (b) positive with nervous system disease, homebound lifestyle, cancer, pneumonia, and dementia, (c) tendency toward a positive relation with chronic cardiac disease, angina pectoris, uremia, oliguria, and age > 70 years, (c) no clear relation with acute cardiac disease and age > 45 years. The PAM scoring was modified to reflect these results: hypotension (systolic < 90 mm Hg) 3 points; uremia, malignancy, pneumonia, homebound lifestyle, recent cerebrovascular event, and dementia 2 points each; angina pectoris, acute myocardial infarction after 2 days of hospital admission, heart failure (NYHA Class III, IV), S3 gallop, oliguria, sepsis, mechanical ventilation, coma and age > 70 years 1 point each; acute myocardial infarction within 2 days of hospital admission, cirrhosis, and age > 45 years 0 points (Table 3). As with Ebell (1992), Dautzenberg, et al. (1993) recognized that a different weighting of prearrest variables was needed with the PAM to ensure appropriate measurement of variables of significance.
Knaus, Wagner, Draper, Zimmerman, Bergner, Bastos, Sirio, Murphy, Lotring, Damiano, and Harrell (1991) developed and have continued to refine the Acute Physiology, Age, Chronic Health Evaluation (APACHE) Prognostic System in an effort to predict the hospital mortality for critically ill hospitalized adults. Using major medical and surgical disease categories, acute physiologic abnormalities, age, preexisting functional limitations, major comorbidities, and treatment location immediately prior to ICU admission, the likelihood of surviving to hospital discharge can be analyzed. The scoring is complex and requires knowledge of the tool and location of the required data in the patient's medical record. An APACHE III score results from the addition of three groups of variables (physiology, age, and chronic health). The physiologic variables include vital signs, laboratory tests [arterial blood gases, A-aDO₂ gradient (for ventilated patients only), hematocrit, white blood cell count, creatinine, blood urea nitrogen, sodium, albumin, bilirubin, glucose], urine output, and neurologic signs (Glasgow Coma Scale). An APACHE III predictive equation uses the APACHE III score and reference data on major disease categories and treatment location prior to admission to provide risk estimates for mortality. Utilizing this equation in a prospective study involving 17,440 adult medical/surgical intensive care unit admissions at 40 hospitals, the authors found that the APACHE III tool was able to account for the majority of variation in observed death rates ($r^2 = 0.90, p < 0.0001$). The tool is useful to consider for this study because of
the number and type physiologic variables considered when weighting morbidity.

Each of these tools was developed from a medical perspective, taking into consideration pre-cardiopulmonary arrest signs and symptoms and disease states and their affect on mortality. Overlap may exist in each tool because the signs and symptoms may indicate a deterioration of the patient's clinical condition in relation to an acute or chronic disease process. RNs are aware of patients' medical diagnoses and consider acute and chronic disease status, but may not weight as heavily the medical diagnoses when considering pre-cardiopulmonary arrest variables. The morbidity scoring tools are important to this study because they add support to the variables of significance that will be used in the development of the interview protocol.

Cardiopulmonary Arrest Studies

Variables predicting outcome/survival. McGrath (1987) briefly commented on 42 publications that discussed in-house resuscitation results of at least 100 patients from 1961 to 1984 in an effort to assess the results of combined positive-pressure ventilation, external direct current cardioversion, and external chest compression. Of the 12,961 patients subject to resuscitative measures, McGrath found age to be a rough predictor of survival after CPR. If a patient was less than 60 years of age, their long term survival was 18.3%, compared to 12.0% if they were greater than 60 years of age. He also found that patients with ventricular fibrillation had a long term survival of 19.8%, while only 3.6% of patient's with
asystole were discharged alive. Short-term success rate (24 hours) was 38.5% with a range of 13% to 59%. Survival to hospital discharge was 14.6%, with a range of 3% to 27%.

Urberg and Ways (1987) conducted a retrospective chart review of 121 patients over a one year period to determine if certain demographic and clinical factors could predict survival from in-hospital cardiac arrest. Severity of illness was measured by blood pressure, urine output, blood urea nitrogen (BUN), creatinine, and arterial blood gases, but none of the raw data was reported in the article. Sex ($X^2 = 0.018; p = 0.89$) and age ($t = 0.69; p = 0.049$, two-tailed test) were not predictors of survival after CPR. However, the difference between living independently and homebound/nursing home was significant ($X^2 = 7.49; p = 0.024$). Of the 121 subjects, 59 lived independently prior to hospitalization, 31 were homebound prior to hospitalization, and 31 were nursing home patients prior to admission. Seventeen different primary diagnoses were found among the 121 patients with the majority being myocardial infarction (19%), arrhythmia (13%), congestive heart failure (12%), electrolyte imbalance (12%), sepsis (12%), and bleeding (8%). Only myocardial infarction and arrhythmia had more than one survivor. The authors concluded that the effect of diagnosis was not significant because of the large number of diagnoses and the small number of survivors. Over all percentages revealed a 38% initial survival after arrest but only an 11% survival to hospital discharge.
Rozenbaum and Shenkman (1988) conducted a prospective study involving 71 patients who required CPR to determine factors influencing CPR outcome. The following prearrest variables were among those under consideration: (a) age, (b) sex, (c) duration of hospitalization before CPR, (d) suspected mechanism of arrest, and (e) clinical details and diagnosis on hospital admission and the day before CPR. Advanced age greater than 65 years (n = 40; \( p < 0.25 \)) and sex (men = 42; \( p < 0.25 \)) did not affect outcome. Of the 54% who required resuscitation on their first day of hospitalization, 29% survived. Resuscitations performed later during the course of hospitalization had a 6% survival (\( p < 0.033 \)). Outcome of CPR was found to dependent upon the mechanism of arrest. Thirty percent of patients who experienced either ventricular fibrillation or ventricular tachycardia survived to discharge. All other mechanisms (asystole, complete heart block, electromechanical dissociation, or respiratory arrest) had a 12% survival rate. Acute myocardial infarction was the most common admitting diagnosis (58%) followed by acute pulmonary edema (12%). In the initial sample, 41% were successfully resuscitated, with 18% surviving to discharge.

Roberts, Landolfo, Light, and Dobson (1990) reviewed 310 CPR records to determine if eight prearrest and intraarrest variables would be predictive of mortality following cardiopulmonary arrest. The prearrest variables included age, diagnosis, mechanism of the event, and initial observed rhythm. There was no significant relationship found between age (\( M = 66 \pm 28.4 \)) and survival (\( p = 0.1964 \)). The most common medical
diagnoses were myocardial infarction (n = 100), pneumonia (n = 62), malignancy (n = 61), sepsis (n = 36), chronic renal failure (n = 22), and pulmonary embolus (n = 20). The diagnoses, however, were not mutually exclusive and were not found to be significant in relation to survival, probably because larger numbers would be required to establish the significance between diagnosis and outcome. If the mechanism of arrest was cardiac, there was an 8% survival rate; if the mechanism of arrest was respiratory, there was 26.7% survival rate ($x^2 = 22.23; p = 0.000$). There was a 1.2% survival associated with asystole/electromechanical dissociation/, 18.6% survival associated with ventricular fibrillation/ventricular tachycardia, and 19.6% survival association with supraventricular tachycardia/bradycardia/sinus rhythm ($x^2 = 33.74; p = 0.000$). A total of 37.1% of patients were successfully resuscitated, with only 9.7% surviving until discharge.

Cohn, Lefebre, Yarnold, Arron, and Martin (1993) conducted a meta-analysis of 21 studies published from 1965 to 1991 in an effort to define and quantify characteristics of hospitalized patients that predict success or failure from CPR. The selected articles had to contain raw data for survival to discharge. Fifteen predictor variables were included, 14 from the PAM index (malignancy, pneumonia, homebound lifestyle, azotemia, hypotension, angina, oliguria, sepsis, congestive heart failure class III/IV, acute myocardial infarction, coma, cirrhosis, recent cerebrovascular accident, and mechanical ventilation) plus age. Not every study contained
all 15 patient factors and two of the variables (home bound lifestyle and hypotension) did not meet the criteria for homogeneity. The analysis found azotemia ($r = -0.088; \ p < 0.0001$), cancer ($r = -0.08; \ p < 0.0002$), and age more than 60 years ($r = -0.063; \ p < 0.006$) were the strongest predictors of negative outcome, followed by sepsis ($r = -0.046; \ p < 0.02$), cerebrovascular accident ($r = -0.038; \ p < 0.04$), and congestive heart failure ($r = -0.036; \ p < 0.05$). Acute myocardial infarction ($r = 0.149; \ p < 0.0001$) and pneumonia ($r = 0.032; \ p < 0.0002$) correlated strongly with survival. Because these findings supported the authors' view that the PAM index is a valid prediction model, scores were calculated for 43 patients receiving CPR who survived to hospital discharge and 43 who did not survive to hospital discharge. The mean PAM score for patients discharged alive was 3.4 (SD = 2.0). The mean PAM score for patients who died was 5.9 (SD = 3.2). The difference between the means was statistically significant by t-test ($p < 0.001$). Calculating mortality, Cohn et al., found a 13.7% (range of 3.8% to 25%) survival rate to discharge. It is important to note that the authors stress that the PAM Index is more accurate in predicting death than survival and that the tool cannot replace clinical judgment.

Marwick, Case, Siskin, and Woodhouse (1991) used a Cox multivariate regression model to design prognostic indices to assess the probability of successful resuscitation and hospital discharge. Over a four year period, 710 cardiopulmonary arrests that occurred at a 1100 bed
teaching hospital were prospectively evaluated with regard to clinical (age, sex, underlying disease, cardiac rhythm), treatment variables (delay until CPR, delay until defibrillation, intubation, early use of epinephrine) and immediate survival. The mean age of the patients was 65 ± 15 years, with 47% being ≥ 70 years and 26% between 60 and 70 years of age. Sixty-four percent of the sample was male. Sixty-eight percent of the patients had preexisting cardiac problems. Immediate resuscitation was met with a 28% chance of initial survival and a 13% chance of survival to hospital discharge. Asystole was the most common underlying rhythm (52%), followed by ventricular fibrillation (38%). The most influential univariate determinant of outcome was cardiac rhythm. Resuscitation was successful in 47% of patients with ventricular fibrillation (p < 0.001). Other significant univariate predictors included age under 60 years (35% survival; p = 0.03), presence underlying cardiac disease (31% survival; p = 0.01), CPR delay < 2 minutes (33% survival; p < 0.001), and defibrillation delay < 10 minutes (39% survival; p < 0.001). Multiple logistic regression analysis found ventricular fibrillation (Odds Ratio 5.0; 95% CI: 3.3-7.6; p < 0.001) and prompt administration of CPR (Odds Ratio 3.5; 95% CI: 2.0-6.1; p < 0.001) to be the only positive independent prognostic factors. Age greater than 60 years (age 60 to 69 years Odds Ratio 0.5; 95% CI: 0.3-0.9; p < 0.05; age > 70 years Odds Ratio 0.5; 95% CI: 0.3-0.8; p < 0.01), intubation (Odds Ratio 0.5; 95% CI: 0.3-0.7; p < 0.001) and the use of epinephrine (Odds Ratio 0.4; 95% CI: 0.3-0.7; p < 0.001) were found to be independent
negative prognostic factors. The most influential variables (cardiac rhythm, CPR delay, defibrillation delay, and age) were selected to develop a prognostic index to assist in predicting successful outcome. The tool is to be used intraarrest (at the onset of resuscitation, after 10 minutes of resuscitation) and post arrest (after survival from resuscitation) only in an effort to predict outcome of the seminal event.

Tresch, Heahrning, Duthie, Mark, Kartes, and Aufderheide (1993) conducted a 4 year study of 196 patients in 68 nursing homes to determine if certain prearrest clinical characteristics (age, length of stay in nursing home prior to arrest, medical diagnoses, medications, circumstances surrounding the arrest, laboratory studies done 1 month prior to the arrest, and baseline functional status) affected survival from CPR. The mean age of the sample was 78.5 ± 11.8 years with a range of 31 to 107 years. Eighty-two percent of the patients were older than 70 years. Sixty-two percent of the patients were women. Prior to the cardiac arrest, the mean duration of nursing home residency was 25 months. The common medical diagnoses included: (a) coronary artery disease (52%), hypertension (43%), heart failure (42%), dementia (38%), myocardial infarction (26%), diabetes (24%), cardiovascular accident (21%), pulmonary disease (17%), cancer (10%), and angina (9%). The most commonly prescribed medications were diuretics (46%) and digoxin (38%). Forty-nine percent of the arrests were witnessed and the most common initial cardiac rhythm was asystole (51%) or electromechanical dissociation (30%). Laboratory values noted included hematocrit > 35% (46%), hemoglobin < 12 g/dL.
(39%), blood urea nitrogen >30 mg/dL (32%), serum creatinine > 2.5 mg/dL (10%). The functional status of the majority of patients as rated by three different indexes was moderately to severely impaired. Of the 196 patients, 19% were successfully resuscitated initially, with 5% surviving to hospital discharge. The most successfully treated rhythm was ventricular fibrillation (15% chance of survival; \( p < 0.005 \)). If the arrest was witnessed, the patient also had a greater chance of survival (8% chance of survival; \( p < 0.053 \)). When both of these variables were present, survival increased to 27% (\( p < 0.002 \)). No other prearrest variables were found to be significant.

Saklayen, Liss, and Markert (1995) conducted a retrospective analysis of CPR outcome at a Veterans Affairs hospital over a 2 year period on 340 patients. The prearrest variables under consideration in this study were age, cardiac rhythm at time of arrest, and disease prevalence. The mean age of initial survivors versus nonsurvivors was not significant (66.8 years versus 67 years; \( p = 0.85 \) with a t test) and remained nonsignificant despite survival duration after CPR (\( p = 0.97 \) with ANOVA). Patients with ventricular tachyarrhythmias (47%) were more likely to survive initially that patients with asystole (21%). Survival was better in patients with respiratory arrest (70% initial survival) than in those with cardiopulmonary arrest (37% initial survival). Many of the patients had more than one disease process, but there was no association between disease category and survival. The medical diagnoses were as follows: congestive heart failure (47%), severe infection (pneumonia/sepsis) (29%), chronic obstructive lung disease (23%), malignancy (21%), diabetes mellitus
(15%), acute myocardial infarction (15%), stroke (11%), acute and chronic renal failure (9%), gastrointestinal bleeding (6%), cirrhosis of the liver (4%), dementia (4%), and AIDS (4%). The article goes on to briefly report the outcome of a review of 113 reports on in-hospital CPR from around the world. In 41 of the reports, elderly patients (≥ 70 years) were reported to have poorer outcome after CPR (18% versus 12%). In 43 studies, patients with ventricular tachycardia or fibrillation had better survival (21%) than patients with asystole (5%), or electromechanical dissociation (4%). Other factors cited in the literature as associated with better survival included pure respiratory arrest, witnessed arrest, absence of multiple comorbidity, and a quick return of vital signs. Survival was poorest in patients with asystole, unwitnessed arrest and multiple comorbidities. Initially, 44% of patients survived the arrest procedure, 30% survived for 24 hours, but only 13% were alive one month after CPR.

Marik and Craft (1997) retrospectively reviewed 308 code sheets and patient charts for patients undergoing CPR during a 4 year period from 1991 to 1995 at a 350 bed university-affiliated teaching hospital to determine survival rate and to identify risk factors predictive of hospital survival. CPR was successful in 32% of patients, with 13% surviving to discharge. The most common diagnoses were acute myocardial infarction (30%), unstable angina (4%), cardiac failure (17%), pneumonia (12%), and chronic obstructive pulmonary disease (12%). Patients with an acute myocardial infarction had a significantly higher rate of survival compared with the rest of the population (p = 0.002). The only prearrest variables of
prognostic significance were age ($p = 0.01$), NYHA functional class IV/IV ($p = 0.02$), and history of stroke ($p = 0.05$). The individuals who were alive to hospital discharge were an average age of 63.3 (SD = ± 12.9); whereas the individuals who died in hospital were an average age of 71.6 (SD = ± 12.4). Ninety-five percent of the alive to hospital discharge group had heart failure (class IV/V), versus 77% of the died in hospital group. Of the individuals who were alive to hospital discharge, none experienced a stroke; whereas 22 of the individuals who died in hospital suffered a stroke. Patients with either ventricular fibrillation (22.4% survived) or ventricular tachycardia (30% survived) had better survival rates than other rhythms. It was difficult for the authors to say with certainty that any particular prearrest risk factor could predict survivors because of the unique clinical circumstances that surrounded every arrest. What was clear from the study was that patients who survived experienced sudden and unexpected arrhythmic events that were reversible.

Mullner, Sterz, Behringer, Schorkhuber, Holzer, and Laggner (1998) retrospectively studied the impact of chronic prearrest health conditions on mortality and neurological recovery in 411 survivors six months after experiencing a cardiac arrest. Of the predominately male sample (59%), 66% had one or more of the following prearrest diseases: coronary heart disease (45%), hypertension (26%), congestive heart failure (20%), diabetes mellitus (14%), chronic pulmonary disease (6%), and cerebrovascular disease (5%). Twenty-two percent also had a NYHA class of III or IV prearrest. Increasing age (Odds Ratio 1.03 per 10 year increase;
95% Cl 1.01-1.05; \( p < 0.0001 \), increasing NYHA class (Odds Ratio 1.4; 95% Cl 1.1-1.7; \( p = 0.0006 \)), ventricular fibrillation or tachycardia (Odds Ratio 0.3; 95% Cl 0.2-0.5; \( p < 0.0001 \)) and duration of arrest (Odds Ratio 1.10; 95% Cl 1.07-1.12; \( p < 0.0001 \)) were found to be independent predictors of adverse outcome among survivors of cardiac arrest. The impact of prearrest conditions were deemed to be minimal and not important enough to influence decisions on whether to withhold or withdraw therapy.

Jorgensen and Holm (1999) evaluated the influence of prearrest, arrest, and post-arrest factors on circulatory and neurological recovery in 231 patients who where initially comatose after circulatory arrest. The prearrest factors under study were age, sex, and history of chronic heart disease (cardiac dysrhythmia, angina pectoris, heart failure > 1 month prior to the arrest). The population was divided into two groups, 106 patients with electroencephalograph (EEG) activity immediately after resuscitation (Group 1) and 125 patients with no EEG activity initially (Group 2). Age, sex, or heart failure complicating the chronic heart disease prior to the arrest did not influence survival. However, patients with angina pectoris, cardiac dysrhythmias, and/or previous myocardial infarction had higher survival rates. The authors stated that cerebral outcomes were independent of prearrest factors, but the data was not shown.

**Variables predicting arrest.** Sax and Charlson (1987) conducted a prospective study of 466 patients admitted during a one month period to a New York City hospital. Patients were assessed on admission for severity
of illness using the Acute Physiology and Chronic Health Evaluation (APACHE) prognostic system and stability using the Therapeutic Intervention Scoring System (TISS). After discharge, a second group of physicians weighted the patient’s demographic and clinical characteristics to adjust for risk of death. Two predictors of arrest were found to be significant: the patient's clinical course in the hospital ($p < 0.001$) and admission with acute dyspnea ($p < 0.005$). In most patients who had an arrest or near arrest while hospitalized, there was some advance warning.

Over a four month period, Schein, Hazday, Pena, Rugen and Spring (1990) prospectively studied the records of 64 patients who experienced cardiopulmonary arrest in an effort to determine common antecedents. Fifty-seven arrests occurred on the medicine service, five occurred on the surgery service, and one each occurred on neurology and pediatrics. The mean age of patients was $51 \pm 2$ years; 44 patients (69%) were male; arrest occurred a mean of $161 \pm 26$ hours (range 4 to 1,026 hours) after hospital admission. At least one change in patient behavior or complaint was noted eight hours prior to arrest in 84% of the records, with shortness of breath (16%), tachypnea, shallow breathing, or labored respiration (28%), and alterations in mental function (42%) most commonly cited. Vital signs showed a mean respiratory rate of $29 \pm 1$ breath per minute change 4 to 6 hours prior to arrest. Patients with respiratory ($33 \pm 2$ breaths per minute) or multiple pathophysiologic alterations ($31 \pm 3$ breaths per minute) preceding arrest had higher respiratory rates that patients with cardiac

78
(21±1 breaths per minute), neurologic (22±1 breaths per minute), or other processes (21±1 breaths per minute). Laboratory values, including pH, serum glucose, blood urea nitrogen, creatinine, and hematocrit were measured 24 hours prior to the arrest, with hematocrit being the only statistically significant laboratory value (46±1% for survivors and 32±2% for nonsurvivors; p = 0.02).

Bedell, Deitz, Leeman, and Delbanco (1991) investigated whether cardiac arrests in patients who were resuscitated might have been prevented. Their sample consisted of 116 men and 87 women who were, on average, 70 years of age. Eighty-five percent of the 203 lived in a home or apartment and 55% were homebound prior to hospitalization. Upon review, 28 arrests (14%) were found to have followed an iatrogenic complication. Eighteen (64%) of the 28 cases were considered by four reviewers to be potentially preventable. The major causes of the in-hospital preventable iatrogenic cardiac arrests included medication errors (digoxin, quinidine, procainamide hydrochloride, potassium chloride, lidocaine, and haloperidol), fluid and electrolyte imbalances (hyperkalemia), procedures (interscalene injection), misinterpretation of signs and symptoms (new onset dyspnea), and inadequate response to laboratory data (hypokalemia, anemia, or hypoglycemia). Stricter attention to the patient’s history, findings on physical examination, and laboratory data was recommended for clinicians.
Fieselmann, Hendryx, Helms, and Wakefield (1993) conducted a retrospective study of 59 patients housed on non-intensive care internal medicine units to determine whether vital sign measurements could identify patients who are at risk for cardiopulmonary arrest. They compared 72 hours of pre-arrest vital sign measurements with 72 hours of vital sign measurements for patients from the same units who did not experience cardiopulmonary arrest. The mean age for the arrest group was 61.9 years (SD = 16.2; range 18 to 88) compared to 53.9 years (SD = 17.3; range 17 to 92) for the control group. This difference was significantly higher (t = 2.85; p < 0.01). Of the arrest group 50.8% were women, compared to 46.2% for the control group. Respiratory rate was found to be a significant predictor of cardiopulmonary arrest, with 54% of patients requiring CPR having had recorded at least one respiratory rate > 27 breaths per minute during the 72 hours prior to arrest (Odds Ratio 5.56; 95% CI: 2.67, 11.49). Pulse and blood pressure were found not to be predictive of arrest. Age was not associated with the elevated respiratory rate (t = 0.3; df = 148; NS). Location on high risk units, combined with elevated respiratory rate, offered greater prediction than the elevated respiratory rate by itself, especially with regard to patients admitted to the renal (sensitivity 0.75; specificity 0.78) and GI (sensitivity 1.00; specificity 1.00) units. Increased respiratory rates on these units were reflective of acidosis, hypovolemia, or sepsis.
Franklin and Mathew (1994) reviewed 150 arrests that occurred on the medical service of a 1,000 bed urban public hospital over a 20 month period to determine the frequency of premonitory signs and symptoms of a cardiac arrest and the responses of physicians and nurses to these signs and symptoms six hours before the arrest. Of the 150 arrests, 69% survived initial resuscitation and 9% survived to discharge with only 4.7% emerging with preservation of baseline cognitive and motor function. The primary signs and symptoms under consideration were abnormal vital signs (mean blood pressure of < 70 or > 130 mm Hg, heart rate < 45 or > 125 beats per minute, respiratory rate < 10 or > 30 breaths per minute), complaint of chest pain, or abnormal mental status (confusion, restlessness, or lethargy). Sixty-six percent of patients in this study who experienced cardiac arrest experienced physiologic changes (the number or mean of each variable occurrence was not reported). Of the 150 arrests occurring during this period, 51 (34%) could not be anticipated based on clinical signs or symptoms. In 25% of the remaining cases, nursing failed to notify the physician of deterioration in the patient’s condition, the primary change being altered mental status. In 75% of the remaining cases, breakdown in communication between physicians, failure to draw or evaluate arterial blood gas results, and failure to follow usual procedures for stabilizing the patient resulted in cardiac arrest. This study lends support to the impression that most in-hospital cardiac arrests are not sudden, being preceded by clinical signs or symptoms.
Rich (1999) was the first to address the issue of pre-cardiopulmonary arrest variables from a nursing perspective. In a retrospective study involving a convenience sample of 100 adult patients, Rich sought to identify pre-arrest physiologic changes and to determine whether physician notification time, physiologic variables, patient location, and the presence of an electrocardiogram (ECG) monitor pre-arrest affected resuscitation outcome. Of the seven physiologic changes that were measured (new changes in systolic blood pressure, new heart rate changes, new ECG rhythm changes, new respiratory rates, new complaints of chest pain or dyspnea, new changes in mental status, and new critical laboratory values) only changes in blood pressure (Odds Ratio: 0.37; 95% CI: 0.13, 1.02; \( p = 0.05 \)) was found to be statistically significant. Of the other environmental variables studied (presence of an ECG monitor, physician notification time, patient location, and prior ICU stay) only the presence of an ECG monitor (Odds Ratio: 5.63; 95% CI: 1.71, 18.61; \( p = 0.004 \)) before the code was found to be statistically significant in predicting resuscitation outcome. One physiologic change and/or physical complaint was present in a majority of the patients eight hours before the cardiopulmonary arrest. Physician notification times varied, dependent upon the abnormality. The quicker notification times were associated with complaints of chest pain or dyspnea.

The literature addressing prearrest variables for hospitalized patients has focused primarily on predicting outcome or survival after a catastrophic event (McGrath, 1987; Urberg & Ways, 1987; Rozenbaum &
Shenkman, 1988; Roberts, et al., 1990; Cohn, et al., 1993; Marwick, et al., 1991; Tresch, et al., 1993; Saklayen, et al., 1995; Marik & Craft, 1997; Mullner, et al., 1998; and Jorgensen & Holm, 1999). Of the seventeen studies reviewed that predicted outcome, survival, or arrest variables, nine cited deterioration of clinical condition and twelve cited dysrhythmias (ventricular fibrillation and ventricular tachycardia) as significant prearrest variables. These variables are important to this study because they add support to the items selected for inclusion in the interview protocol.

Summary

One of the important concepts this review of the literature has focused on involves the clinical reasoning processes utilized to make a nursing clinical judgment. At present, a theory does not exist to adequately explain this complex process from nursing's perspective. Nursing scholars have borrowed theories from other professions, but what must be accounted for in a theory involving nursing clinical reasoning is an understanding of the processing capacity expected of the professional nurse in real life situations. Authors need to state their theoretical perspective, need to clearly conceptualize and define the cognitive component of their study, and need to conceptualize and operationalize definitions prior to conducting research. Some of what has been written on the topic lacks a clear theoretical background and is too broad to be placed in the framework of an evolving theory. In addition, conceptualizing and defining the cognitive component prior to conducting research allows an exceedingly broad topic to be narrowed. As a result, each piece of
research involving cognition in nursing would then be able to contribute a small piece to an evolving mid-range theory. Within the clinical reasoning literature base, presence (multiple cue acquisition) has been well researched, probably because assessment is a primary nursing intervention. Multiple hypothesis generation (the deriving of meaning from observed data) and cue interpretation (the confirming or refuting of cues), on the other hand, have not been as well studied. Delineation of each of these areas, versus studying the reasoning process as a whole, would add to a theory of clinical reasoning by providing evidence that nurses use procedural rules which set conditions either for weight to be given available information or how information should be combined and that nurses appear to be using constructs for comparison with the patient’s observed state (Crow, Chase, & Lamond, 1995).

One of the effective methods for studying clinical reasoning is PA. As a qualitative method, PA seeks to uncover evidence of the cognitive processes that individuals use as they search for answers in a complex world. The qualitative emphasis is on capturing important distinctions and ignoring unimportant ones as a way of coping with incomplete knowledge (Kuipers, 1994). The PA methodology requires the collection of verbatim transcripts and an analysis that focuses on the identification and coding of objects, the connection and explanation of objects and operators, and the identification of an overall structure of a cognitive process such as clinical reasoning. Given an acceptance of the method’s assumptions, the resultant visual representation has the potential of unlocking the cognitive
processes essential in clinical reasoning, making conclusions about reasoning and its impact on clinical judgment, selection of nursing interventions, and patient outcome possible.

Expertise is a difficult concept to elucidate because it must be placed in a context. Nursing expertise requires a clinical grasp and response-based practice with embodied know-how (Benner, Tanner, Chesla, 1996). Expert nurses are thought to be adept at anticipating and intervening to prevent potentially fatal complications from advancing to stages that often cannot be reversed by the best medical and technological interventions available (Benner, 1984). This anticipation is paramount when considering the possibility of preventing a cardiopulmonary arrest.

Past studies have focused on variables predicting outcome or survival from cardiopulmonary arrest and variables predicting the onset of a cardiopulmonary arrest. Based on the poor outcome of CPR, a change in the perspective of the problem is needed from one of morbidity and mortality after cardiopulmonary arrest, to one of prevention of cardiopulmonary arrest. Little has been studied about the role nursing has in the prevention of cardiopulmonary arrest. Clinical reasoning is a key ingredient in the study of this prevention component because it is the early warning system that initiates effective and efficient nursing interventions. All of these components, clinical reasoning, PA, expertise, and pre-cardiopulmonary arrest, are important for understanding the purpose of this study.
Chapter 3

Methods

The focus of this chapter is to describe the research method and design used to conduct the study. It begins with a description of a pilot study that was conducted using similar methodology and continues with a detailed description of the primary study, including instrument development, sample selection, consent, sample characteristics, the procedures for data collection, data analysis, data quality, and criteria for trustworthiness of the study.

Qualitative Research

Qualitative research describes life experiences and gives them meaning. It venerates the uniqueness of individuals, their perceptions, and their actions. Phenomenological research methods, a specific qualitative approach, describe an experience (in this case, pre-cardiopulmonary arrest) as it is lived by the study participants and interpreted by the researcher (Munhall & Boyd, 1999). The study’s outcomes are based on the researcher’s perceptions and interpretations. This type of method is appropriate to discover the meaning of complex experiences (Burns & Grove, 2001).

This qualitative phenomenologic study used think aloud (retrospective verbal reporting) and Protocol Analysis (PA) to provide an in-depth description of the clinical reasoning of 15 expert acute care RNs in a content, context, and task specific situation (pre-cardiopulmonary arrest).
Data were collected from subjects using think aloud (TA) as they verbalized their thoughts concerning how their presence and attention prevented a patient from experiencing cardiopulmonary arrest. Protocol analysis (PA) provided the method for description and structuring of the information subjects attended to while reasoning. In this chapter, the results of an initial pilot study utilizing TA and PA will be presented, followed by a discourse delineating the methods used for the larger study: sample selection and characteristics, procedures followed for data collection, and steps in data analysis.

Pilot Study

The methods for data collection and analysis were selected following a pilot study conducted in the Spring of 1998 to determine the utility of think aloud and PA in describing clinical reasoning from a nurse’s recall of a pre-cardiopulmonary arrest event. The amount of data available from this single verbatim transcript reflected the technique’s utility for describing the processes involved in nurses clinical reasoning to prevent cardiopulmonary arrest.

Using the three analysis steps (Referring Phrase Analysis, Assertional Analysis, and Script Analysis) as refined by Kuipers (1987, 1994; Kuipers & Kassirer, 1984; Kuipers et al., 1988), the following is an example from the pilot study report of an experienced critical care RN who is reasoning about what she does to prevent a cardiopulmonary arrest. Each step is described next using the pilot data as examples.
Data analysis: Referring phrase analysis (RPA). In this phase of analysis, text data of the transcript are segmented into phrases (Table 4). Verbs and verb phrases are identified with their objects (in bold). RPA provides information about what objects are being attended to during the reasoning process based on verbs with their objects having referring phrase(s). Selected objects derived from RPA included monitors, status, consciousness, and changes. The verb terms (e.g., watching and looking) are especially important because they later are used in the identification of operators in the subsequent step of assertional analysis.

Data analysis: Assertional analysis (AA). An example of AA from the pilot data is presented in Table 5. There are four assertions about watching, looking, changing/losing, and impinging/threatening. Transcript statements reveal the objects of the assertions in bold type and the asterisk (*) labels the conditional assertions. Assertions use verbs and verb phrases to link objects. Upon completion of AA, the researcher has defined and presented examples for each of the major verbs and verb phrases and their objects as well as each type of linkage (i.e., assertion) identified in the transcript. The data revealed watching, looking, impinging, terms in parentheses are examples of assertions changing, losing, and threatening as the major verbs used by the nurse to describe what she does to prevent a cardiac and/or respiratory arrest (Table 6). "Watching" and "looking" by direct and indirect means are primary assertions identified. "Changing" and "losing" are used for noting variations in the patient's consciousness, blood pressures, heart rhythm, lung sounds, and
Table 4

Referring Phrases (Pilot Study)

<table>
<thead>
<tr>
<th>Line</th>
<th>Phrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2</td>
<td>constantly watching their monitors</td>
</tr>
<tr>
<td>L4</td>
<td>Watching their monitors,</td>
</tr>
<tr>
<td>L5</td>
<td>watching for changes in their vital signs.</td>
</tr>
<tr>
<td>L6</td>
<td>um</td>
</tr>
<tr>
<td>L7</td>
<td>[... changes in their neuro status</td>
</tr>
<tr>
<td>L8</td>
<td>[... if they lose their level of consciousness or anything.</td>
</tr>
<tr>
<td>L9</td>
<td>You're always looking for anything that is changing in the patient,</td>
</tr>
<tr>
<td>L10</td>
<td>that could be impinging on something else.</td>
</tr>
<tr>
<td>L11</td>
<td>Um, you know</td>
</tr>
<tr>
<td>L12</td>
<td>if you have any changes in their blood pressures.</td>
</tr>
<tr>
<td>L13</td>
<td>um</td>
</tr>
<tr>
<td>L14</td>
<td>if you have a change in their heart rhythm</td>
</tr>
<tr>
<td>L15</td>
<td>even a change in their lung sounds,</td>
</tr>
<tr>
<td>L16</td>
<td>if you're losing lung sounds on one side or the other</td>
</tr>
<tr>
<td>L17</td>
<td>you're threatening something somewhere.</td>
</tr>
<tr>
<td>L18</td>
<td>Even watching their pulses in their feet.</td>
</tr>
<tr>
<td>L19</td>
<td>If you're losing pulses in one part of your body that have been</td>
</tr>
<tr>
<td></td>
<td>there previously . . .</td>
</tr>
<tr>
<td>L20</td>
<td>It's a constant 24 hour watching for every system of that patient</td>
</tr>
<tr>
<td>L21</td>
<td>to prevent something from happening.</td>
</tr>
</tbody>
</table>

Key: **Italics** = referring phrase(s)  **Bold** = object of a verb, verb phrase, or gerund  **Underlined Text** = verb(s) or verb phrase(s) (including gerunds)  [... ] = implied verb repeated from previous line
<table>
<thead>
<tr>
<th>Assertions (Pilot Study)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Watching/Looking</strong></td>
</tr>
<tr>
<td>L2  (constantly watching their monitors)</td>
</tr>
<tr>
<td>L5  (watching for changes in their vital signs)</td>
</tr>
<tr>
<td>L9  (You’re always looking for anything that is changing in the patient,)</td>
</tr>
<tr>
<td>L20 (It’s a constant 24 hour watch for every system of that patient)</td>
</tr>
<tr>
<td><em><em>Changing</em>/Losing</em>*</td>
</tr>
<tr>
<td>L8  (if they lose their level of consciousness or anything.)*</td>
</tr>
<tr>
<td>L12 (if you have any changes in their blood pressures,)*</td>
</tr>
<tr>
<td>L14 (if you have a change in their heart rhythm)*</td>
</tr>
<tr>
<td>L16 (if you’re losing lung sounds on one side or the other)*</td>
</tr>
<tr>
<td>L19 (If you’re losing pulses in one part of your body that have been there previously . . . )*</td>
</tr>
<tr>
<td><strong>Impinging/Threatening</strong></td>
</tr>
<tr>
<td>L10 (that could be impinging on something else.)</td>
</tr>
<tr>
<td>L17 (you’re threatening something somewhere).</td>
</tr>
<tr>
<td>L21 (to prevent something from happening).</td>
</tr>
</tbody>
</table>

* = conditional assertions (if-then, stipulates a proviso)
Table 6
Conceptual Objects Derived from RPA and AA (Pilot Study)

<table>
<thead>
<tr>
<th>Watching</th>
<th>L2, L4, L5, L18, L20</th>
</tr>
</thead>
<tbody>
<tr>
<td>monitors</td>
<td>L2, L4</td>
</tr>
<tr>
<td>signs</td>
<td>L5</td>
</tr>
<tr>
<td>status</td>
<td>L7</td>
</tr>
<tr>
<td>lose</td>
<td>L8</td>
</tr>
<tr>
<td>consciousness</td>
<td>L8</td>
</tr>
<tr>
<td>anything</td>
<td>L8</td>
</tr>
<tr>
<td>pulses</td>
<td>L18</td>
</tr>
<tr>
<td>system</td>
<td>L20</td>
</tr>
<tr>
<td>patient</td>
<td>L20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Looking</th>
<th>L9</th>
</tr>
</thead>
<tbody>
<tr>
<td>anything</td>
<td>L9</td>
</tr>
<tr>
<td>changing</td>
<td>L9</td>
</tr>
<tr>
<td>patient</td>
<td>L9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Changing</th>
<th>L12, L14, L15</th>
</tr>
</thead>
<tbody>
<tr>
<td>pressures</td>
<td>L12</td>
</tr>
<tr>
<td>rhythm</td>
<td>L14</td>
</tr>
<tr>
<td>sounds</td>
<td>L15,</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Losing</th>
<th>L16</th>
</tr>
</thead>
<tbody>
<tr>
<td>sounds</td>
<td>L16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impinging</th>
<th>L10</th>
</tr>
</thead>
<tbody>
<tr>
<td>something</td>
<td>L10</td>
</tr>
<tr>
<td>pulses</td>
<td>L19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threatening</th>
<th>L17</th>
</tr>
</thead>
<tbody>
<tr>
<td>something</td>
<td>L17</td>
</tr>
</tbody>
</table>

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pulses. “Changing” and “losing” as assertions are primarily conditional “if-then” statements. “Impinging” and “threatening” assertions are used with more vague nouns, such as “something,” to represent an ominous, menacing, foreboding event that the nurse must note to prevent “from happening.” These verb phrases and their objects constitute a range of observing assertions.

This pilot transcript contains primarily conditional and observing assertions. Conditional assertions connect by stipulating a proviso and are noted in the transcript by their “If . . . then” format. Although Fine (1997) differentiated three different conditional assertions: a) simple conditionals (“Do . . . if . . .” or “If . . . then . . .”); b) complex conditionals (“If . . . then . . . .else”); and c) nested conditionals (“If . . . if . . . then . . . then . . .”), only one type is evident in this transcript. The conditional assertions found in this brief interview allowed the nurse to think about possible abnormal conditions that could adversely affect patient outcome (Table 5, Changing/Losing, lines 8, 12, 14, 16, 19). The observing range of assertions seem to help with specification of what is observed and possible effects of those conditional states. For example, “that could be impinging on . . .” and “you’re threatening something . . .” compel the nurse to consider the consequences of the problem.

Data analysis: Script analysis (SA). In the final analysis step, a visual representation of subjects’ reasoning processes, including explanation strategies (cognitive operators plotted against cognitive strategies), is developed and a visual strategy emerges (Kuipers, et al. 92
1988). An example of SA from this pilot interview is graphically represented in Figure 2 (Appendix B). Upon close examination of the RPA and AA, the major operators representing this short segment of the transcript include: a) searching, b) variation, and c) foreboding. Based upon the interview data, searching is defined as a constant “watching” and “looking” for physiologic changes in a patient directly (watching pulses) and indirectly (watching monitors), with the goal of detecting “anything that is changing in the patient.” Variation represents the more specific searching, especially for changes in terms of pressures, rhythm, sounds, and pulses. Foreboding is the recognition about “something” could impinge or threaten.

By identifying, defining, and graphing these operators (searching, variation, and foreboding) and their objects, it is possible to depict graphically the nurse’s thought processes using all the verbalizations (Appendix B). From what this subject stated: she reported what she would be “watching/ looking” for in the acutely ill patient, focusing on the patient’s changing physiology that she can assess with a variety methods. She then reasoned through the situation and summarized her perspective on the scenario (L 9 You’re always looking for anything that is changing in the patient, L10 that could be impinging on something else. L 20 It’s a constant 24 hour watch for every system of that patient), and finally states the goal of the patient/nurse interaction (L 21 to prevent something from happening). Explicit or implicit goal identification by subjects is an important part of script analysis because it represents evaluation of
previous statements in context.

**Results.** The techniques of TA and PA were found to be acceptable methods to collect and analyze data concerning the clinical reasoning processes of this one expert acute care nurse as she detailed her experience concerning a pre-cardiopulmonary arrest event. This pilot study underscored the importance of initial analysis decisions about each of the segments, objects, and assertions being based on the data with encoding that is detailed, logical, systematic, and objective. The encoding process should be unambiguous enough for others to follow using agreed upon conventions (rules) and terms. The extent to which other researchers can make inferences and the extent to which each encoding is independent of the other, affect the consistency and reliability of the judgments. The final logic of the encoding and inferences are made explicit in graphing the process (in SA) and is subject to reader and peer colleague judgments.

**Main Study**

The qualitative investigation into the clinical reasoning of expert acute care Registered Nurses (RNs) in pre-cardiopulmonary events was conducted with a convenience sample of 15 expert acute care RNs. Data for this study were collected during May and June of 2000. RNs were recruited from two small urban hospitals in central Texas. The selected hospitals routinely care for patients requiring aggressive nursing care for medical/surgical conditions. The study proposal was approved by The University of Texas at Austin School of Nursing Departmental Review.
Committee (Appendix C). After approval was granted, the study proposal was submitted and approval was obtained from the research committees at two small urban hospitals in central Texas for recruitment of the 15 expert acute care RNs (Appendices D and E).

RN subjects were recruited from intensive care (ICU)/coronary care (CCU), progressive care/subacute care/telemetry, and post-anesthesia care (PACU) at two central Texas hospitals. These particular divisions were selected for inclusion in the study because patients admitted to these units are at high risk for experiencing cardiopulmonary arrest. The expert RNs who seek employment in these areas frequently go beyond basic educational program requirements (associate, diploma, or baccalaureate) and seek additional learning opportunities [basic and advanced ECG interpretation (including 12 and 18 lead), Advanced Cardiac Life Support, and Trauma Nursing Core Course] to meet the challenges of this technologically complex environment. A nomination process was used to identify expert RNs who demonstrate this knowledge in practice.

**Instrument development.** The Pre-cardiopulmonary Arrest Signs and Symptoms Questionnaire (Appendix F) used in Stage Three of the data collection session was administered to five critical care RNs who volunteered to serve as members of a content expert panel. The panel participants' ages ranged from 36 to 49 with a mean of 41.8 years. The total number of years the experts have been employed in the acute care setting ranged from 9 to 25 with a mean of 16.8 years. Three of the experts were employed by the local school of nursing, one of the experts was
employed by a local hospital as a nurse manager, and one of the experts was completing the requirements for a PhD in nursing. Three of these experts held critical care certification. Four were Master’s prepared and one had earned a Baccalaureate in Nursing. Two of the experts continued their education beyond the Master’s degree, one received a PhD in Education and one was in the process of completing PhD in Nursing requirements. Each nurse considered herself to be an expert nurse, citing experience in the field as a primary reason for their expertise.

Content validity of the Pre-Cardiopulmonary Arrest Signs and Symptoms Questionnaire was established and compared to the literature in an effort to develop effective probe questions. For Part I of the questionnaire, experts were asked what pre-cardiopulmonary arrest signs and symptoms may be exhibited by the neurological system, the cardiovascular system, the respiratory system, the gastrointestinal system, and the renal system. The following signs and symptoms were stated by at least a simple majority (three out of five) of the experts.

**Neurological.** Alterations in intracranial pressure (ICP) including: (a) changes in level of consciousness (LOC) [anxiousness, irritability, restlessness, slowed thinking, lethargy, confusion (visual or auditory hallucinations), somnolence, stupor]; (b) changes in pupils; and (c) changes in breathing pattern.

**Cardiovascular.** (a) alterations in blood pressure, specifically hypotension; (b) changes in heart rate/pulse; and (c) dysrhythmias.
**Respiratory.** Changes in breathing pattern including: (a) rate; (b) rhythm; (c) depth; (d) effort; (e) decreases in oxygen saturation; and (f) cyanosis.

**Gastrointestinal.** No majority consensus achieved.

**Renal.** Decreases in urine output.

In Part II of the questionnaire, the experts were asked to select and rank the top ten priority signs or symptoms from their listings without regard for the body system being assessed. Rankings and means for characteristics identified by ≥ 3 experts utilizing the clinical characteristics from Part I were obtained (Table 7). Rankings of the signs and symptoms from most important to least important were as follows: dysrhythmias (M = 3.25), alterations in blood pressure (hypotension) (M = 3.33), changes in respirations (M = 3.9), alterations in ICP (M = 4), decreases in oxygen saturation (M = 5.33), cyanosis (M = 5.33), and decreases in urine output (M = 6.5).

Part III of the questionnaire asked experts to list other factors that might be considered in an effort to identify patients in an emergent pre-cardiopulmonary arrest state. Again utilizing a simple majority, four out of the five experts stated history and acute disease status, and three out of the five experts stated chronic illness and nutrition status.

Using the review of literature and the Pre-Cardiopulmonary Arrest Signs and Symptoms Questionnaire results, probe questions (Appendix G) were developed for Stage Three of the data collection sessions to ensure
Table 7
Clinical Characteristics Prioritized by Expert Panel

<table>
<thead>
<tr>
<th>Priority Identified</th>
<th>Clinical Characteristics</th>
<th>Ranking of Expert 1</th>
<th>Ranking of Expert 2</th>
<th>Ranking of Expert 3</th>
<th>Ranking of Expert 4</th>
<th>Ranking of Expert 5</th>
<th>Mean for Characteristics Named by &gt; 2 experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased ICP</td>
<td></td>
<td>6</td>
<td>1</td>
<td>6</td>
<td>--</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Decreased BP</td>
<td></td>
<td>2</td>
<td>--</td>
<td>3</td>
<td>--</td>
<td>5</td>
<td>3.33</td>
</tr>
<tr>
<td>Heart rate/pulse</td>
<td></td>
<td>3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Dysrhythmias</td>
<td></td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>--</td>
<td>4</td>
<td>3.25</td>
</tr>
<tr>
<td>Respirations</td>
<td></td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3.9</td>
</tr>
<tr>
<td>Oxygen saturation</td>
<td></td>
<td>4</td>
<td>--</td>
<td>4</td>
<td>--</td>
<td>8</td>
<td>5.33</td>
</tr>
<tr>
<td>Cyanosis</td>
<td></td>
<td>--</td>
<td>--</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>5.33</td>
</tr>
<tr>
<td>Urine output</td>
<td></td>
<td>8</td>
<td>10</td>
<td>--</td>
<td>10</td>
<td>6</td>
<td>6.5</td>
</tr>
</tbody>
</table>
that most areas had been covered concerning the subject's recollection of
the pre-cardiopulmonary arrest event.

**Sample selection.** To identify RN subjects deemed to be "experts,"
the researcher provided each RN employed full-time (minimum of 40 hours
per week) or part-time (minimum of 20 hours per week) in each of these
settings at the two hospitals with a Expert Nurse Nomination Consent Form
(Appendix H). This form stated the operational definition of expert nurse
and asked for the names of two RN colleagues who fit the definition.

The peer nomination forms were placed in envelopes, labeled with
the names of the RNs working on each of the identified units, and placed in
a conspicuous spot to ensure nurses could easily identify and retrieve the
form. After reading and completing the form, the RN was asked to remove
the bottom half and place it in a secure box. Prior to placing the forms, the
researcher had a discussion with the charge nurse of each unit to
determine the best place to put the envelopes and box to enhance the
probability that the staff would complete them. Ninety-three forms were
distributed between the two hospitals: 26 to ICU/CCU day shift; 26 to
ICU/CCU night shift; 14 to PACU; 7 to telemetry day shift; and 20 to
telemetry night shift. Of the 93 forms that were distributed, twenty-five
(27%) were returned.

The researcher also provided the head nurses/nurse managers in
the areas listed above with the operational definition of expert nurse and
asked them to list the names of all RNs on their unit who fit the definition
(Appendix I). The head nurse/nurse manager nomination forms were
placed in envelopes along with a stamped envelope with the researcher's name and address. Each envelope was personally handed to the unit's supervisors. The head nurses/nurse managers opened the envelopes, read the forms, and clarification of the study was offered by the researcher if it was sought. Eight of the head nurse/nurse manager nomination forms were distributed and eight nomination forms were mailed to the researcher (100% return).

This dual peer and management nomination process was the only basis for subject selection in this study. Studies in the literature operationalize the definition of expert by staff nomination only (Table 2, note highlighted sections) (Corcoran, 1986a, 1986b), supervisor nomination only (Fischer & Fonteyn, 1995; Radwin, 1995a, 1995b; Tanner et al., 1987; Westfall et al., 1986), or a combination of both (Benner et al., 1992; Doona, 1995; Jenny & Logan, 1992; Tanner et al, 1993). The dual nomination process (peer and head nurse/nurse manager) was utilized because it offered the broadest possible way to capture peer and management opinions.

In an effort to decrease experimenter effect (Burns & Grove, 2001; Polit & Hungler, 1995; Nieswiadomy, 1998) because the researcher is an instructor of nursing at the local community college, RNs who work the 7 am to 7 pm shift on the telemetry unit to which the PI is currently assigned were excluded from the study. In addition, RNs identified as experts by the nomination process for whom the researcher had been a clinical instructor were excluded from the study. These exclusions from the sample enhance...
external validity by reducing the influence of the researcher on the participants' answers.

This study did not use speciality certification and years of clinical experience for subject inclusion criteria. Although specialty certification is desirable as a credential indicative of obtaining a level of expertise in a particular field, such certification is not mandatory to practice in a specialty area in Texas. In addition, because many institutions do not monetarily assist RNs in maintaining and retaining the certification, its value is often questioned by individual nurses. Many expert RNs in this geographic area simply designate themselves with the RN title only.

Expertise as defined by years of experience in a field also presents a dilemma in practice and research. Multiple exposures to multiple patients over time adds to a nurse's theoretical and experiential knowledge base, but exactly how much experience is needed to establish expertise is quite unclear. In their later work, Benner et al. (1996) simply note that the shift to expert nursing practice is marked by a qualitative change with intuitive links between the issues in the situation and ways of responding. The ways of responding are key to expertise because they guide nursing interventions. Those individuals who are experts may have correspondingly high numbers of years in the nursing profession, having seen and integrated many experiences. However, not everyone with high numbers of years in the nursing profession will be an expert if they have failed to integrate the experiences into meaningful ways of responding.
To be recognized as an “expert” for inclusion in the study, each RN had to be identified by a minimum of two peers and the unit’s head nurse/nurse manager as an expert according to the previously stated definition \( n = 14 \) of the total 15. If greater than five nominations were received via peer nomination without head nurse/nurse manager endorsement, that individual was also approached and invited to participate in the study \( n = 1 \) of the total 15. Intensive care/coronary care was represented by 5 RNs (10.4% of ICU/CCU RN population), progressive care/subacute care/telemetry by 6 RNs (4.5% of progressive care/subacute care/telemetry population), and post-anesthesia care by 4 RNs (3.5% of PACU population).

**Consent.** Procedures to protect the rights of human subjects were followed throughout the study. Subjects were asked to read and sign a consent form (Appendix J) prior to participation in the study. Questions concerning the study were answered by the researcher and a copy of the signed informed consent form given to the subjects. The study procedures presented no known risks or discomfort to subjects who participated, other than the inconvenience of time. An individual benefit to each nurse who participated in the study was the knowledge that they were recognized by their peers as expert acute care RNs.

Confidentiality of study participants was maintained by using coded numbers on expert nurse nomination forms and pseudonyms when labeling audiotapes and transcribing tapes. Names of individuals or institutions were not used when reporting results. One list of names, code 102.
numbers, and pseudonyms, as well as the audio tapes, are secured in a locked place under the researcher's control. The tapes will be destroyed after five years.

Sample characteristics. At the end of the interview, the subjects were asked to complete a demographic information sheet (Appendix K). This convenience sample consisted of 15 RNs who were currently practicing in intensive care/coronary care, progressive care/subacute care/telemetry, or post-anesthesia care a minimum of 20 hours per week and who were nominated by their peers and/or nursing management as experts. Table 8 provides a summary of the subjects' ages, gender, employment status, average years as an RN, average years in current work setting, average years in a related work setting, certification status, and nursing education. The mean age for the group was 39 (range 29 to 47; 5 subjects chose not to report their age). The mean years as an RN for the group was 18.2 (range 3 to 32) with an average of 6.1 years in the current work setting (range 1 to 12). With respect to basic nursing education, forty percent (6) of the sample was Associate Degree prepared, 20% (3) of the sample was Diploma prepared, and 40% (6) of the sample was Baccalaureate prepared. Only one nurse reported furthering basic nursing preparation, continuing on to receive a PhD. Only 4 (27%) of the 15 RNs were certified by a specialty organization.

When asked if they thought of themselves as "expert," 11 (73%) responded with in the affirmative, while 2 (13%) responded with saying they felt themselves to be "experienced." The youngest and least
Table 8
Description of the Sample

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age</td>
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experienced subjects (in terms of years on practice) responded in the negative. When asked “Why they would or would not consider themselves to be expert nurses?”, subjects’ responses are important to consider because they reflect on “experience” as being a common denominator.

Subjects responded to the question “Do you consider yourself to be an expert nurse? Yes/No Briefly, why or why not” in the following way:

- Subject 1 (Yes) : “Broad experience in nursing.”
- Subject 2 (Experienced) : “Long term nursing.”
- Subject 3 (Yes) : “I am still working in patient care areas and I still enjoy taking care of the sick. I like complex nursing situations and enjoy using my knowledge, skills and instincts to improve my nursing care.”
- Subject 4 (Yes) : “By experience.”
- Subject 5 (No) : “Because there is always more to learn.”
- Subject 6 (Yes) : “I consider myself an expert—but only in cardiovascular [nursing]. My entire career has been in CT [cardiothoracic]/CV [cardiovascular] and my educational focus has been in that field. I strive to better myself through conferences and educational opportunities and keep up with the latest developments”
- Subject 7 (Yes) : “experienced—intuitive—broad knowledge base—holistic”
- Subject 8 (Yes) : No response
- Subject 9 (Yes): “Because I’ve been doing this successfully for 23 years.”

105
Subject 10 (Yes): “25 years experience.”

Subject 11 (Yes): No response

Subject 12 (Yes): “No one dies on my shift that I am not aware of ahead of time.”

Subject 13 (Experienced): Expert would not be the word I would use, instead I would use the word experienced. The word expert does not seem to fit me in how I feel about myself. . . .

Subject 14 (No): “Because I’m always learning. I feel like I am an experienced nurse, but not an expert.”

Subject 15 (Yes): “Long term experience, comfort level in caring for critically ill patients.”

As a result of this question, subjects 2 and 13 did not answer with a “yes” or “no” to the question, but qualified themselves as “experienced.” Subjects 5 and 14 considered themselves to not be experts, emphasizing the need to learn more. Expertise was seen by the other eleven participants as being refined with experience. Long term exposure to multiple situations was acknowledged as a key component to becoming an expert.

Procedures for data collection. A research protocol checklist was used (Appendix L) to ensure consistency in identification of expert acute care RNs on each selected unit and in data collection procedures for each subject. Once identified, the expert RNs were approached by the researcher and informed that they had been identified by their peers and nursing management as experts. An appointment time for data collection was scheduled. The first 15 nurses nominated and approached consented
to be subjects in the study.

Data collection was scheduled at times convenient to subjects (e.g., during nurses’ shift at the facility) in as quiet and private an area as could be found on or near the nursing unit (e.g., offices, vacant patient rooms, nurses' lounges, medication rooms). By collecting data at the work place it was more likely that the nurse was in a mind set for providing nursing care. However, two sessions were briefly interrupted, one by a physician and one by a nurse, to ask a question about a patient for whom the subject had primary care responsibility. When this occurred, the tape recorder was stopped and then restarted to maintain confidentiality. The researcher recapped the last statement subjects made and the data collection quickly resumed.

Standard procedures, using a written protocol (Appendix L), were developed to ensure that all data would be collected in a similar manner across all subjects. The procedures were piloted with two RNs (not included in the sample), testing the protocol for its ability to elicit think aloud verbalizations. The recommended editorial changes made by the two RNs clarified questions and were added to the question and answer portion of the session. Their recommendations are noted below in italics. An audio tape recorder with built-in microphone was placed on a table close enough to the subject for clear reception. The subject and researcher were seated in chairs across a table or parallel to a table to simulate a normal conversational setting.
Stage One. The introductory question of Stage One of the interview acquainted the participant with the specific content and context to be explored in the 30 minute session. To begin the session, subjects were told the specific purpose of the research project ("As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care patients need to prevent cardiopulmonary arrest."). They were also asked if they "believe it is possible to prevent cardiopulmonary arrest?" If the answer was "Yes," the data collection session proceeded to Stage Two. If the answer was "No," the researcher asked "Why not?" and concluded the interview by thanking the participant for their time. The later was not required for this study.

Stage Two. Subjects were next instructed to recall how their presence and attention prevented a patient from experiencing cardiopulmonary arrest while thinking aloud about the following: "Tell me all about a clinical situation when you prevented a patient from arresting--in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented an arrest from occurring." Once a subject began recalling the situation, if the she paused for > 5 seconds, the researcher asked the subject "Now that you have recalled the event, are there any other details you wish to include but did not mention?"

Stage Three. Once subjects stated that was all or that they were finished, they were next asked probe questions (Appendix G) to ensure that specific areas were covered concerning their recollection of the pre-
cardiopulmonary arrest event. The questions on the Pre-cardiopulmonary Arrest Signs and Symptoms Questionnaire (Appendix F) were developed from review of literature and with the aid of an expert panel of five critical care RNs as described previously. Table 9 delineates the variables of significance from cardiopulmonary arrest studies. The variables included: (a) abnormal lab data, (b) altered level of consciousness, (c) age, (d) communication breakdown, (e) dependent lifestyle, (f) deterioration of clinical condition, (g) dyspnea, (h) dysrhythmia, (i) hypotension, (j) medication errors, and (k) procedures. Each of these variables was included in a probe question. Questions were asked only if subjects did not cover the topic in Stage Two. During the interview, the researcher checked off the potential probes stated by subjects during Stage Three, and used the remaining questions to complete recollection of the event. The probe questions began with “Did you consider . . . ? or Did you notice?” in an effort to remind subjects of any of these data they may have contemplated when preventing the cardiopulmonary arrest.

Stage Four. To conclude the session and obtain additional data about prevention of cardiopulmonary arrest, the researcher also asked “What would you tell a less experienced nurse about preventing cardiopulmonary arrest?” These four stages of data collection allowed for data extraction at different levels of abstraction. First, participants acknowledged that it was possible to prevent cardiopulmonary arrest. Second, participants recounted a pre-cardiopulmonary arrest scenario. Third, probe questions augmented the recall of data considered and
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| Tool used in evaluation                     |                          |                |                   |                |             |
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| Modified PAM (Ebell)                        |                          |                |                   |                |             |
| Modified PAM (Dautzenberg)                  |                          |                |                   |                |             |
| APACHE                                      |                          |                |                   |                |             |
| Meta-analysis                               |                          |                |                   |                |             |
| Chart review                                |                          | x              |                   |                |             |
| considered disease states                   |                          |                |                   |                | x           |
interventions or things done that were relevant to the prevention of the cardiopulmonary arrest. Lastly, subjects disclosed what they would tell a less experienced nurse about preventing cardiopulmonary arrest. All of the questions focus on the subjects’ recall about prevention of cardiopulmonary arrest, but extract the data differently.

A field notebook was kept for notes from each data collection session. Subjects were informed that after data analysis was complete, they would be contacted for an optional review of the analysis of their particular transcript. Despite the announcements placed in each hospital stating that the researcher would meet subjects at their convenience, no participants came forward to review their data. A member check is an important technique for establishing credibility in the qualitative research process in that it allows participants to inspect the data, categories, interpretations and conclusions of the researcher. In other words, it allows participants the opportunity to acknowledge the researcher's reconstructions as true representations of their own reality (Lincoln & Guba, 1985). This additional check was not available secondary to lack of subject participation.

Data analysis: Stage One. Fourteen of the study's subjects responded affirmatively to the question “Do you believe it is possible to prevent cardiopulmonary arrest?” One subject initially responded negatively but continued the interview saying that there are instances where nurses can “think about” the patient and “notify the doctor” but the outcome may remain unchanged. For this nurse, English is a second
language. As a result, the interview was continued because it was felt that further communication would allow her to elaborate and clarify thoughts further.

Data analysis: Stage Two (Think aloud session). Transcription of the think aloud portion of the data collection sessions was done by the researcher because of familiarity with the terminology used by the subjects. Each audio tape was transcribed in its entirety (i.e., every utterance of either the researcher or the subject was transcribed) to ensure completeness. Stages One (if the subject elaborated) and Two of the audio taped transcripts were analyzed using Protocol Analysis (PA). PA is a cognitive science method that has been used to explore the processes of clinical reasoning. It was initially used by Newell and Simon (1972), described in more detail by Ericsson and Simon (1984, 1993), and further refined by Kuipers and his colleagues (Kuipers & Kassirer, 1984; Kuipers 1987, 1994; Kuipers, Moskowitz & Kassirer, 1988). The purpose of PA is to identify the data and information used to complete an assigned task and to structure the information visually into concepts and their interrelationships. The methodological principles underlying PA use an information processing model (Newell & Simon, 1972) of the verbalization process (Ericsson & Simon, 1984, 1993) and are based on the idea that verbalizations are interpreted as searches through a problem space of hypotheses and data that reside in short term memory and long term memory (Patel & Arocha, 1995). Verbalizations link recognition of a situation with STM and LTM and are a type of recordable behavior that
represent a subject's reasoning processes (Ericsson & Simon, 1993). PA, as refined by Kuipers and his colleagues (1987, 1994; Kuipers & Kassirer, 1984; Kuipers, Moskowitz, & Kassirer, 1988), consists of referring phrase analysis (RPA), assertional analysis (AA), and script analysis (SA).

**Referring phrase analysis.** The universe that RPA purports to denote constitutes the ontology (theory about the nature) of the domain being discussed (Kuipers et al., 1988; Fonteyn & Grobe, 1994). An important assumption of RPA is "that any concept or relation that is expressed verbally in an explanation must be expressible in the cognitive knowledge representation" (Kuipers et al., 1988, p. 190). In RPA, a referring phrase is a word or phrase that refers to an object, usually a concept, and may be a noun, noun phrase, pronoun, action, or modifier. Referring phrases are identified using the concept of reference. RPA results in a list of objects that are the cues being attended to during the initial step of reasoning (Kuipers 1987, 1994; Kuipers & Kassirer, 1984; Kuipers, Moskowitz, & Kassirer, 1988).

In this first step of analysis, lines of text were segmented into phrases (Appendices M.1 through M.15). When segmenting the transcript, four rules were consistently followed: (a) if a new or different thought was initiated by the subject, a new line was started; (b) if the subject paused, a new line was started; (c) if the subject was thinking aloud in an attempt to remember a particular case (i.e., "when the night shift got there . . . so I wish I had been working day shift . . . one of those little hospitals . . .") or changed the subject, the phrases were italicized and not utilized in the
assertional analysis. Also, if a set of words is commonly accepted in the health professions, all words were kept together as a single unit (e.g., jugular venous distention, acute myocardial infarction, heart attack, congestive heart failure). From these fifteen transcripts, words were identified as verbs (underlined text), objects (in bold), or referents (in italics) and a list of verbs, their objects, and referents was compiled (Appendices N.1 through N.15). Verbs are action words, objects are nouns, and referents are words associated with either the verbs or the objects. A word may only be a verb, object, or referent, making the categories mutually exclusive. Identification of the objects, verbs, and referents was evaluated by a researcher with experience in this method of PA (Kuipers 1987, 1994; Kuipers & Kassirer, 1984; Kuipers, Moskowitz, & Kassirer, 1988).

**Assertional analysis.** The next step of the analysis, AA, is used to identify ways subjects are thought to form relationships between the identified objects. Assertions, reflected from the use of verb phrases, connect objects and link these objects. Not all objects are linked to other objects; only the terms used to link objects form the data of AA. The objects and their relationships constitute the epistemology (the nature and the grounds of the knowledge) of the domain being discussed (Kuipers, et al., 1988; Fonteyn & Grobe, 1994). As a result of AA, the major verbs and verb phrases are identified and type of linkages (i.e., assertions) present are discussed.
In this second phase of the analysis (AA), a listing of the major verbs and verb phrases and their objects was developed for each subject. (Appendices O.1 through O.2). From this information a master list of operators and their definitions, verbs, verb phrases, and objects was created representing the sample (Appendix P). In this study, a major focus is on the verbs as representing the direction of reasoning by the RN. The objects of the verb “to be” were selected as representative of all objects in the study because of their number and variability mirroring the other verbs. A secondary analysis on the data is recommended for closer examination and categorization of all objects at a later time.

From this master list, types of linkages were identified. These linkages included the following: (a) observational (search for data); (b) indicative (suggest significance); (c) conditional (stipulate a proviso); (d) decisional/action (provides reason for behavior); and (e) interpretive (explain). Table 10 provides examples of the five types of assertions. These linkages were evaluated by a researcher with experience in this method of PA (Kuipers 1987, 1994; Kuipers & Kassirer, 1984; Kuipers, Moskowitz, & Kassirer, 1988).

**Script analysis:** The final step in PA, SA, serves to identify the overall structure of subjects’ reasoning process. During SA, the investigator accounts for each phrase in every subject’s transcript as a way of validating the script analysis. Operators are created and defined using the linkages from AA and are examined in more depth during SA for patterns of usage. Studies of nurses’ clinical reasoning have defined
Table 10

**Assertional Analysis: Example Linkages Extracted from Major Verbs/Verb Phrases**

---

**Observational (search for data)**

- Observe/Observed/Observing/Observation
- Recognizing
- Identifying/Identified
- Came/Come(s)/Came in/Came out/Came back
- Presented
- Moves/Had moved/Transferred

**Indicative (suggest significance)**

- Stop/Stopped (heart, bigeminy, irregularities)
- Goes/Goes/Going/Went (HR, SVT, BP, Junctional rhythm, abdominal cavity, nuts, through it, PVC’s, mag level, in)
- Signs and symptoms stated in forms of the verb “to be”

**Conditional (stipulate a proviso)**

- Would be/Would have
- Could be/Could have
- Might
- Depending
Table 10
Assertional Analysis: Example Linkages Extracted from Major Verbs/Verb Phrases (continued)

Decisional/Action (provides reason for behavior)

Be able to/Are able to
Can be prepared/Can prevent/Is, are preventable/Prevent/
Prevention/Preventative
Is nothing we can do/Nothing we could have done
Is not normal
Results were horrible

Interpretive (explain)
Compensate/Compensated
Saved
Pull through
Distressed
Died/Didn't make it/Is dead
Decompensated
between four and fourteen major operators contributing to an understanding of an overall reasoning process (Jones, 1989; Grobe, Drew, & Fonteyn, 1991; Fonteyn, 1991; Fonteyn & Grobe, 1994; Fowler, 1994; Greenwood & King, 1995; Fine, 1997). A visual representation of subjects' reasoning is developed as a result of this final stage of PA (Kuipers, et al., 1988).

Four major operators (Appendix Q) were identified to account for the clinical reasoning used by the subjects when thinking aloud about the care required by a patient to prevent cardiopulmonary arrest from occurring: (a) scenario set; (b) intervene; (c) decision/rationale; and (d) outcome. Scenario set has four subcategories: (a) search; (b) variations; (c) location; and (d) probability. Intervene also has four subcategories: (a) Level I—general acts; (b) Level II—more specific acts; (c) Level III—very specific acts; and (d) communicate. Decision/rationale has three subcategories: (a) positive; (b) negative; and (c) needs. Outcome has two subcategories, positive and negative. Verbs were placed under the selected categories and subcategories (Appendices R through U) and the presence and/or absence of data assessed for each subject. In reviewing all of the operators identified in the proposed structure of clinical reasoning, it became apparent that several subjects had 50% or greater of the operators missing (Table 11). In scenario set and intervene, the operator was considered missing if 50% or greater of the subcategories were lacking. This difference is significant and will be further discussed in Chapter 4. As with the other sections of the analysis, SA was reviewed by
### Table 11
Missing Operators by Subject

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</tbody>
</table>

| Number of Constructs Missing | 1 | 0 | 0 | 1 | 1 | 0 | 2 | 3 | 3 | 2 | 2 | 0 | 0 | 1 | 1 |

X denotes construct missing from subject’s transcript.
a researcher with experience in this method of PA.

Data analysis: Stage Three (Probe questions). Each probe question from the protocol checklist (Appendix L) was examined to determine if it had been addressed during Stage Two of the session (“Tell me all about a clinical situation when you prevented a patient from arresting—in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.”) or with a positive or negative response to a direct question during stage three of the interview (Table 12). Some parameters may not have been assessed by the subject or questioned by the researcher. In summary, the following signs and symptoms received ten or greater positive responses either during the TA session or as a result of a probe question: (a) level of consciousness; (b) breathing pattern; (c) blood pressure; (d) heart rate/pulse; (e) respirations; (f) history; (g) medical diagnosis; (h) other illnesses; (i) procedures; (j) lab values; (k) medications; and (l) age. Quantifying the data from the probe questions may be misleading because different scenarios present different qualities for reasoning. Fully two-thirds of the subjects considered these signs and symptoms significant to either mention spontaneously during the TA portion of the session or in response to a direct question. This data will also be discussed in Chapter 4.

Data analysis: Stage Four. In the fourth, and final, stage of data collection, subjects’ responses regarding familiarity or utilization of the PAM (Pre-Arrest Morbidity Index) or APACHE (Acute Physiology and

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# Table 12

## Probe Question Results by Subject

<table>
<thead>
<tr>
<th>Probe Questions</th>
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<td>+</td>
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<td>-</td>
<td>?</td>
<td>?</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<td>X</td>
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Key: X = spontaneous answer (during Think Aloud); ? = question not asked; + = probe question with positive response; - = probe question with negative response; Unk = not assessed by subject
## Table 12
### Probe Question Results by Subject

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</table>

**Key:** X = spontaneous answer (during Think Aloud); ? = question not asked; + = probe question with positive response; - = probe question with negative response; Unk = not assessed by subject
Chronic Health Evaluation Prognostic System) was sparse. Only one subject had heard of the PAM (#15) and only three subjects (#6, #7, and #15) had heard of the APACHE. Two of the subjects had utilized the APACHE in the clinical setting. When asked if a systematic assessment that could quantify pre-arrest variables would be helpful in practice, thirteen subjects responded affirmatively, with the major benefit cited being for new nurses to help them organize and prioritize care.

**Data Quality**

The most common method of verbal report compilation is “think aloud.” TA elicits information about subjects reasoning by verbalization of thoughts. Concurrent verbalization involves the collection of data at the same time cognitive processing occurs. When feasible, concurrent verbalization is preferred because context and processing are simultaneous. Retrospective verbalization involves recall, occurring out of context with the cognitive process. The type of verbalization chosen impacts validity and is dependent upon the type of data required for the study as well as the logistics involved in the collection of the data (Ericsson & Simon, 1993; Patel & Arocha, 1995).

The purpose of the verbalization is to have subjects articulate what they are attending to while generating an answer, not describing or explaining what they are doing. When subjects verbalize the thoughts entering their attention as part of a task, the sequence of thoughts may be changed by having them think aloud. If subjects are asked to describe or explain a thought, sequencing is even more likely to be interrupted.
Because experienced nurses frequently orient novice nurses in the clinical practice setting, their verbalizations have the potential of becoming a combination of patient cues and rationalization for a selected nursing intervention. If the nurse is interrupted and asked why she chose a particular line of reasoning, sequencing is interrupted and validity threatened. This potential problem accents the importance of clear and concise instructions prior to data collection in order to obtain data reflective of specific cognitive processes (Ericsson & Simon, 1993; Patel & Arocha, 1995).

Concurrent verbalization in an acute care setting when cardiopulmonary arrest is imminent is not recommended at this time for two reasons: first, and foremost, the patient population is vulnerable. In the minutes before a cardiopulmonary arrest, the nurse is required to implement a number of interventions that require efficiency. Concurrent verbalization could be very distracting to the nurse's actions during the pre-cardiopulmonary arrest phase. Second, it is very difficult to predict who might experience cardiopulmonary arrest. Nurses assess patients on a routine basis and assign meaning to exhibited signs and symptoms, but the nurse may not link the signs and symptoms to impending cardiopulmonary arrest. Retrospective verbal reporting was utilized at this time because of these severe real-time constraints.

When asked to verbalize from recalled events, however, several threats to validity and biases must be recognized as possible. First, because there is a time lapse between thought and reporting, subjects may
elaborate the information at the time of reporting, including information that was acquired previously or subsequently to the event. Second, because there is a time lapse between thought and reporting, accuracy of the reported information may be suspect. Third, if a probe is not a sufficient retrieval cue for relevant aspects of the memory, the subject must expend substantial time and energy to provide a complete recall and may be disinclined to do so (Ericsson & Simon, 1993). The study addressed these concerns by selecting subjects who currently work in high risk acute care patient care areas, thus increasing the probability that each participant will be able to recall having recently prevented a cardiopulmonary arrest from occurring. The probes that were developed from the review of literature and with the aid of the expert panel in an effort to elicit information with little mental strain.

Verbal reports have been used to study nurses' clinical reasoning outside clinical practice settings using simulations, questionnaires, and interviews. Validity remains a concern because it is not possible to simulate or for subjects to remember all the cues. The collection of data in the clinical arena has not been encouraged because of the perceived risks to patient care and the logistics of recording when patient care is being delivered (Fisher & Fonteyn, 1995). Greater control can be exerted in an external setting, but the realism of actual patient care cannot be simulated. The retrospective verbal report utilizes the thick description of actual patient care scenarios to enhance validity.
Three criteria must be satisfied by verbal data if they are to be used to infer underlying cognitive processes: relevance, consistency, and memory (Ericsson & Simon, 1993). Verbalizations should be relevant to the task. Relevant data were elicited from the subject by focusing on how the nurse's presence and attention at the bedside prevented a patient from experiencing cardiopulmonary arrest. Consistency requires that the verbalizations are logically homogeneous with preceding verbalizations (Ericsson & Simon, 1993). Because the verbalizations in this study were content, context, and task specific, the sequence of verbalizations constructed from memory should be related. Therefore, data attended to during task performance were likely remembered and vocalized (Ericsson & Simon, 1993).

**Trustworthiness of the Data**

**Credibility.** Credibility refers to activities that enhance the truthfulness of the findings and interpretations. Techniques that enhance credibility include, but are not limited to, prolonged engagement, persistent observation, triangulation, and member checks. Prolonged engagement requires that sufficient time be allotted to achieve the purpose and that the investigator be involved long enough to detect distortions and build trust. Triangulation uses different sources or different methods to obtain the data. Member checks provide the respondent an opportunity to reflect on the adequacy of the data interpretation. If the reconstructions of the data are true representations of reality, then the subjects must be given the opportunity to react to them (Lincoln & Guba, 1985).
The PI is a Registered Nurse with 20 years experience in acute care settings, as a Staff Nurse, Critical Care Clinical Nurse Specialist, and educator. The researcher has been mentored by expert acute care Registered Nurses and has herself been a mentor. This extensive, prolonged engagement in the critical care environment in multiple roles is one of the reasons for this scholarly inquiry into the clinical reasoning of expert critical care nurses.

The four stages of data collection allowed for a mixture of methods and lengthened the time of engagement with subjects, setting a more conversational tone for the data collection sessions. In Stage Two, subjects were allowed to verbalize data after a grand tour type of question. In Stage Three, direct questions elicited data that subjects may have thought about during the pre-cardiopulmonary arrest event but did not mention during Stage Two. Stage 4 assessed subjects’ knowledge of pre-arrest tools and their utilization in the clinical setting. The multiple methods made the data collections sessions long enough to obtain the requisite information.

A member check was attempted after the preliminary data had been analyzed. Subjects were given the opportunity to review the analysis of their individual transcript, however subjects did not respond to the invitation to do so. During the course of data analysis, the dissertation chair was consulted for her expertise in the analysis. These sessions provided an opportunity to explore and make explicit the substantive and methodological aspects of the inquiry.
Transferability. Verbatim transcription of the audiotapes served as the data, providing “thick description,” and are available for audit. The context of the situation being explored is not unique; it is shared by thousands of nurses. It is, however, up to the reader to determine the degree of applicability of the findings to their situation.

Dependability/Confirmability. Dependability and confirmability depend upon an audit trail, records that validate the process that was taken to obtain the product (Lincoln & Guba, 1985). The process of inquiry can be audited using the following pieces of information: (a) audiotapes; (b) field notes; (c) transcripts; (d) journals (methodological issues, logistical issues, memos, reflexive); and (e) the final report. The product of the inquiry will be supported by the data to strengthen internal coherency.

Summary

This chapter presented the sample that was recruited for the study, presented the protocols and methods that were used to collect (TA) and analyze (PA) the data to describe the clinical reasoning processes of expert acute care Registered Nurses in pre-cardiopulmonary arrest situations, and addressed validity concerns. In addition, informed consent procedures were outlined delineating the researcher’s role in protection of subject rights including confidentiality.
Chapter 4
Presentation, Analysis, and Interpretation of Data

The purposes of this study were to: (a) identify the clinical reasoning processes of expert acute care nurses in pre-cardiopulmonary arrest events using empiric indicators, and (b) make inferences about the expert acute care nurse's clinical reasoning processes during pre-cardiopulmonary arrest events. The analysis of the transcripts obtained from subjects through protocol analysis (PA) provided the primary means for obtaining information on clinical reasoning. As stated previously, a basic assumption for PA is that verbalizations link recognition of a situation with STM and LTM and are a type of recordable behavior that represent a subject's reasoning processes (Ericsson & Simon, 1993). In this study, words were first identified as verbs, objects, or referents and a list of verbs, objects, and their referents was compiled (Appendices M.1 through M.15 and N.1 through N.15). Next, a list of concepts was constructed using the major verbs, their objects and referents (Appendices O.1 through O.15). Lastly, operators were constructed, defined, and diagramed (Appendices P and Q). This chapter presents the study findings as they relate to the three research questions.

Research Question One

What data do expert acute care Registered Nurses attend to when reasoning about the care required by patients thought to be in danger of experiencing a cardiopulmonary arrest?
Analysis of the data revealed subject's patterns of presenting information during Stage Two of the data collection session. This pattern involved their presenting a scenario for the researcher to follow where the nurse was providing or supervising patient care. Initially the subjects searched for a situation. Once isolated, they described the patients' cues as they related to disease progression or signs and symptoms (Appendix R). Although the listing under the subcategory variations is lengthy, it is not problematic because, in the clinical setting, nurses care for many patients with different medical diagnoses that share similar symptomatology. The listing assumes importance because it reveals the many possible variations of disease progression and signs and symptoms that may lead to cardiopulmonary arrest even among this small sample. Next, the nurses intervened (Appendix S) to prevent the cardiopulmonary arrest, provided rationales for decisions (Appendix T), and eventually related patient outcomes (Appendix U).

The process of creating the operators follows. From assertional analysis (AA), nine concepts initially emerged: (a) assessment; (b) disease progression; (c) signs and symptoms; (d) location; (e) probability; (f) intervene; (g) communication; (h) decision/rationale; (i) and outcome. These nine concepts were examined to determine their similarities and differences. After discussion with the researcher's supervising professor, it was determined that the concepts assessment, disease progression, signs and symptoms, location, and probability were all subcategories of the operator scenario set. Scenario set was the most referenced operator
After a second analysis and comparison with the results of the previously mentioned Pilot Study, it was felt that the initial subcategory assessment was actually search and the subcategories disease progression and signs and symptoms could be subsumed under the subcategory of variations.

The concept *intervene* was also thought to be an operator and have four important subcategories: (a) general acts; (b) more specific acts; (c) very specific acts; and (d) communication to physicians and family. Intervene was the second most referenced operator by the sample (70). The concept *decision/rationale* became the third operator and was divided into positive, negative, and needs subcategories. *Outcome* was identified as the last operator and was divided into positive and negative subcategories.

*Scenario set* was chosen as an operator because subjects first related the condition of the patient and the context of the encounter to the researcher before discussing clinical care. Subjects searched for data, reflecting on (a) the variations possible in light of the patient’s disease progression and signs and symptoms; (b) the patient’s location in the hospital; and (c) the patient’s probability of experiencing a cardiopulmonary arrest. *Intervene* was chosen as an operator because subjects related acts, ranging from general to very specific, that they performed or assisted with in an effort to prevent a cardiopulmonary arrest.
Decision/rationale was chosen as an operator, with subjects stating positive reasons to act, negative reasons to act, or patient needs to be tended to in order to enhance patient outcomes. Outcome was chosen as an operator, with subjects relating either positive or negative results of their clinical care.

The operators and their subcategories reflect the major verbs and verb phrases and their objects. Appendices R through U show the entire set of verbs and verb phrases from each transcript and their identified operator. Appendix P contains a similar breakdown of all of the major verbs and verb phrases identified in the fifteen transcripts, but additionally provides investigator definitions for the four operators and thirteen subcategories that resulted during script analysis. These definitions will be discussed under Research Question Three.

Research Question Two

What are the similarities and differences in the clinical reasoning of expert acute care nurses in these pre-cardiopulmonary arrest events?

As a result of protocol analysis, verbs, objects, and referents were identified from each transcript and analyzed for their similarities and differences. At first glance, this data appears overwhelming because each RN used different words to tell her story (Appendices R through U). Different objects received attention because numerous pathophysiologic processes can potentially result in cardiopulmonary arrest. The results, however, are a plethora of words that express a few similar ideas as the operators illustrated in Figure 3 (Appendix Q).
If the created Structure of Clinical Reasoning (Appendix Q) serves as a base from which to examine subjects, the sample can easily be divided into two groups: Group A (subjects 7, 8, 9, 10, 11, and 12) attained 50% or less of the identified operators; Group B (subjects 1, 2, 3, 4, 5, 6, 13, 14, and 15) attained 75% or greater of the identified operators. Group A will be closely examined at this time for possible reasons for failing to site examples of the identified operators during Stage Two of the data collection session. The characteristics of these subjects and the circumstances of their interviews are described next. Though males and females were interviewed, all subjects will be referred to as “she” to protect the anonymity of each participant.

Group A. Subject 7’s interview occurred in a room on the unit without interruptions. Though she consented to be a subject in the study, her answers were short and any verbal elaboration had to elicit by the researcher. Her demographic data reveal that she works full-time and has 22 years experience as an RN, 10 years in related settings and 12 years in ICU (her current assignment). Though she is a nurse manager, it is expected that she provide direct patient care on an “as needed” and “on call” basis for her unit depending upon the staffing and patient census of her unit. She is an associate degree prepared RN and is certified as a Critical Care Registered Nurse (CCRN). Table 11 reveals that Subject 7 is missing the following operators: (a) Scenario Set (missing subcategories search and location) and (b) Intervene (missing subcategories level 1, level 3, and communicate). Two possible explanations exist for the lack of
sufficient verbal detail in this subject’s interview about the patient encounter: First, as a nurse manager, the subject may have experienced evaluation apprehension (Burns & Grove, 2001) by knowing the researcher and her critical care background; second, although the subject agreed to be a participant in the study, her body language conveyed disinterest (Field Notes, May 15, 2000).

Subject 8’s interview occurred in a quiet area on the unit also, without interruptions. She appeared anxious and seemed afraid she would not give the “right” answers. For example, the tape recorder was stopped twice at her request. The first time it was stopped to clarify the definition of “prevention” and to allow her time to think of a clinical situation. The second time the tape was stopped because the subject wanted assurance that she would remain anonymous and that neither she nor the patient would be identified in the transcript as the matter she would be discussing was “sensitive” in nature because of an error or omission by another nurse. Assurances were given and the ethical standards required of researchers were discussed. The nurse was given the opportunity to withdraw from the study. Her demographic data reveal that she works full-time and has 32 years experience as an RN, 30 years on medical/surgical floors and 2 years on telemetry (her current assignment). She is currently a charge nurse on the floor and may or may not provide direct patient care depending on the available staff for the shift. She is a diploma prepared RN and is not certified in any nursing specialty. Table 11 reveals that Subject 8 is missing the following operators: (a) Intervene (missing
subcategories level 1, level 2, and level 3); (b) decision/rationale; and (c) outcome. As with the previous subject, two possible explanations exist for the lack of sufficient verbal detail in this subject’s interview about the patient encounter: First, as a charge nurse, the subject may have experienced evaluation apprehension (Burns & Grove, 2001) by knowing the researcher and her critical care background; second, the subject’s contact with nursing research has been limited, causing her to be concerned about the confidentiality of the data she was about to share (Field Notes, May 17, 2000).

Subject 9’s interview occurred in the PACU in the early am prior to completion of the first operating room case for the day. She was late and had forgotten about the appointment but wanted to proceed because this time of day was probably the best time for her to participate. The demographic data reveal that this nurse works full-time and has 23 years experience as an RN, 20.5 years in settings similar to PACU (critical care) and 2.5 years in PACU (her current assignment). She is a diploma prepared RN and is certified as an emergency nurse (CEN). Table 11 reveals that Subject 9 is missing the following operators: (a) scenario set (missing subcategories search and probability) (b) decision/rationale, and (c) outcome. Because she had forgotten about the appointment and because of the time limitation prior to the first patient for the day arriving in the unit (Field Notes, May 17, 2000), her ability to relate the information in a way to ensure inclusion of all of the designated operators may have been compromised.
Subject 10's interview occurred in a quiet area on the unit also, without interruptions. She appeared confident during the interview but the TA data revealed little information. The demographic data reveal that she works full-time and has 25 years experience as an RN, 23.5 years on medical/surgical floors and 1.5 years on telemetry (her current assignment). She is currently a charge nurse on the floor and may or may not provide direct patient care depending on the available staff for the shift. She is a baccalaureate degree prepared RN and not certified in any nursing specialty. Table 11 reveals that Subject 10 is missing the following operators: (a) scenario set (missing subcategories search and probability); (b) intervene (missing the subcategories level 1 and level 2); and (c) decision/rationale. The lack of sufficient verbal detail in this subject's interview about the patient encounter may have been secondary to evaluation apprehension (Burns & Grove, 2001) by knowing the researcher and her critical care background.

Subject 11's interview occurred at the end of her shift and was in the medication room on the unit, as this was the only available area at that time where confidential information could be shared. There were interruptions as one nurse went in and out trying to find a particular medication. Initially Subject 11 acted as if inclusion in the study was bothersome, but as she read the consent form she became more interested in participating (Field Notes, June 16, 2000). The demographic data reveal that this nurse works full-time and has 32 years experience as an RN, 30 years in related settings and 2 years on telemetry (her current assignment). This nurse is
baccalaureate degree prepared and is certified in orthopedic nursing. Table 11 reveals that Subject 11 is missing the following operators: (a) scenario set (missing the subcategories location and probability) and (b) intervene (missing the subcategories level 1 and level 3). The environment in which the data were collected may have impaired the subject's ability to relate the information in a way to ensure inclusion of all of the designated operators.

Subject 12’s interview was in the late evening in the ICU/CCU. The environment was very quiet, but because there were only two nurses on duty, the interview was conducted at the far end of the nurses station, away from patients, in a subdued tone. The second staff member was in sight and the opening and closing of the ICU/CCU doors is audible on the tape as various ancillary staff members enter and exit the ICU. The interview paused once when the phone rang once to ensure that it was answered by the second nurse. The demographic data reveal that this nurse works full time and has 9 years experience as an RN, 5 years on medical/surgical floors and and 4 years in a combined ICU/CCU setting (her current assignment). This nurse is an associate degree prepared RN and is not certified in any nursing specialty. Table 11 reveals that Subject 12 is missing the following operators: (a) intervene (missing the subcategories level 1, level 3, and communicate) and (b) decision/ rationale. The environment in which the data was collected may have impaired the subject's ability to relate the information in way to ensure inclusion of all of the designated operators.
Because 50% or more of the constructed operators were missing from the data of subjects 7, 8, 9, 10, 11, and 12, they are being placed in Group A for further purposes of analysis. These subjects may not have been experts in their current area of practice or other intervening variables as stated previously may have prevented them from verbalizing the required data for the clinical reasoning structure.

**Group B.** Subjects 1, 2, 3, 4, 5, 6, 13, 14, and 15 attained 75% or greater of the identified operators. Subject 1’s interview occurred in the early morning in a quiet area on the unit without interruptions before patients had begun to arrive from the Operating Suite. The demographic data reveal that she works part-time (at least 20 hours a week) and has 24 years experience as an RN, 16 years in settings similar to PACU and 8 years in PACU. The nurse is an associate degree prepared RN and is not certified in any nursing specialty. Table 11 reveals that Subject 1 is missing the operator Intervene (subcategories level 2 and level 3).

Subject 2’s interview occurred in the same environment as Subject 1’s interview, again without interruptions. The demographic data reveal that she works full-time and has 25 years experience as an RN, 24 years in settings similar to PACU and 1 year in PACU as a charge nurse. The nurse is an associate degree prepared RN and is not certified in any nursing specialty. Table 11 reveals that Subject 2’s data included all of the four designated operators.
Subject 3's interview occurred without interruptions in the early morning prior to patients arriving from the Operating Suite for the day in a room away from, but close to, the unit. Her demographic data reveal 26 years experience as an RN, 6 years in medical/surgical settings, and 20 years in critical care (ICU/PACU/ER). She is employed part-time in the institution's nursing float pool and is assigned to ICU/PACU/ or the Emergency Department, depending upon the hospital's staffing needs. The nurse is a diploma prepared RN and is not certified in any nursing specialty. Table 11 reveals that Subject 3's data included all of the four designated operators.

Subject 4's interview occurred without interruptions during a planned break in a room away from, but close to, the unit. The demographic data reveal that she works full-time and has 13 years experience as an RN, 5 years in surgical and pediatric settings and 8 years in ICU. The nurse is a baccalaureate degree prepared RN and is not certified in any nursing specialty. Table 11 reveals that Subject 4 is missing the operator Intervene (subcategories level 1 and level 2).

Subject 5's interview also occurred without interruptions during a planned break in a room away from, but close to, the unit. The demographic data reveal that she works full-time and has four years experience as an RN, 2 years on medical/surgical units and 2 years on telemetry units. The nurse is a baccalaureate degree prepared RN and is not certified in any nursing specialty. Table 11 reveals that Subject 5 is missing the operator scenario set (subcategories location and probability).
Subject 6 wanted to come to the hospital on a day off to be interviewed. The interview occurred in a private area away from nursing units without interruption. The demographic data reveal that this nurse works full-time and has 8 years experience as an RN, all occurring in the ICU/CCU setting. She is a baccalaureate degree prepared RN and was once certified as a CCRN, but has since let the certification lapse. Table 11 reveals that Subject 6’s data included all of the four designated operators.

Subject 13’s interview occurred in the late evening in the ECG monitoring station on her unit. The nurse had volunteered to substitute as the monitor technician for this “extra” shift to provide coverage for an individual on leave. The room was quiet and there were no interruptions while she kept an eye on the rhythms and conversed with the researcher. The demographic data reveal that she works full-time and has nine years experience as an RN, all on her currently assigned telemetry unit. She is an associate degree prepared RN and is not certified in any nursing specialty. Table 11 reveals that Subject 13’s data included all of the four designated operators.

Subject 14’s interview occurred in the late evening during a planned break in the ECG monitoring station on her unit. The room was quiet but there was one interruption by a physician desiring information on a patient for whom she was caring for that night. The demographic data reveal that she works full-time has only three years experience as an RN, all occurring on her currently assigned telemetry unit. She is an associate degree
prepared RN and is not certified in any nursing specialty. Her interview elicited two separate events, therefore Table 11 denotes 14A for the first event and 14B for the second event. Table 11 reveals that Subject 14’s data included all of the four designated operators for the first event and was missing the operator intervene (subcategories level 1 and level 2) for the second event.

Subject 15’s interview occurred without interruption in her office away from nursing units. The demographic data reveal that she works full-time and has 18 years experience as an RN, 10 years in related settings (medical/surgical) and 8 years in the ICU/CCU setting. The nurse is a baccalaureate degree prepared RN who also holds a Master’s Degree in Nursing and a PhD outside of nursing. She is certified as a CCRN and additionally licensed as a Clinical Nurse Specialist by the Board of Nurse Examiners for the State of Texas. Table 11 reveals that Subject 15 is missing the operator outcome.

Having attained at least 75% of the constructed operators and, hence, a majority of the clinical reasoning structure, subjects 1, 2, 3, 4, 5, 6, 13, 14, and 15 will be placed in Group B and will be considered “experts” for further purposes of analysis. Table 13 reflects the demographic differences between these two groups as well as numbers of subjects affected by extraneous variables (evaluation apprehension and interruptions). One characteristic is of significance to note: Group A has more years as an RN (23.82 versus 14.2), but Group B has more years in the current work environment (7.44 versus 4).
Table 13
Comparison of Groups A and B

<table>
<thead>
<tr>
<th>Sample</th>
<th>Group A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Age</td>
<td>39</td>
</tr>
<tr>
<td>(5 not reporting)</td>
<td>(2 not reporting)</td>
</tr>
<tr>
<td>Employment status</td>
<td>2 Part Time</td>
</tr>
<tr>
<td></td>
<td>6 Full Time</td>
</tr>
<tr>
<td>Average years as RN</td>
<td>18.2</td>
</tr>
<tr>
<td>Average years in current work environment</td>
<td>6.1</td>
</tr>
</tbody>
</table>

| Average years in related work setting | 12.1 | 19.83 |

| Certification | 11 not certified | 3 not certified |
| | 2 CCRN | 1 CCRN |
| | 1 CEN | 1 CEN |
| | 1 Orthopedic | 1 Orthopedic |

| Basic nursing degree | 6 ADN | 2 ADN |
| | 3 Diploma | 2 Diploma |
| | 6 BSN | 2 BSN |

| Highest degree | 6 ADN | 2 ADN |
| | 3 Diploma | 2 Diploma |
| | 5 BSN | 2 BSN |
| | 1 PhD (non-nursing) |

| Consider self as expert | 10 yes | 5 yes |
| | 3 "experienced" | 1 "experienced" |
| | 2 no |

| Extraneous variables | Evaluation apprehension | 3 |
| Interruptions | 2 |

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The information was next examined for similarities and differences between these two groups. SA was used to synthesize the original concepts into four operators and their sub-categories in an effort to identify the overall structure of the subjects' reasoning processes. The result of SA was the identification of four major operators: (a) scenario set; (b) intervene; (c) decision/rationale and; (c) outcome. The resultant structure (Appendix Q) depicts the operators, subcategories, and selected examples of subjects' terms representative of the operators and their subcategories.

With the subjects divided into Group A and Group B, a frequency count was done to determine the number of times a subcategory was used by each subject for the designated operator. Table 14 reflects differences between Group A and B, with Group B using more than twice the number of subcategories for the operators scenario set (14.3 versus 5.5), intervene (5.4 versus 2.66), and decision/rationale (2.4 versus 0.66). In addition, the total use of subcategories was 2.67 times greater for Group B and the number of lines in the transcripts was 2.61 times greater for Group B.

Table 15 reflects the differences between Group A and B with regard to assertions. Group B, on average, used more assertions for all categories, but especially decisional/action (2.5 versus 0.67), connotative (3.2 versus 1.17), and indicative (10.2 versus 3.83). In addition, the total number of assertions used by Group B was 2.24 times greater than Group A.
### Table 14
Operator Use by Group

<table>
<thead>
<tr>
<th>Subject</th>
<th>Scenario</th>
<th>Set</th>
<th>Intervene</th>
<th>Decision/Rationale</th>
<th>Outcome</th>
<th>Total</th>
<th># of lines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>20</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>5.5</td>
<td>2.66</td>
<td>0.66</td>
<td>1.83</td>
<td>8.83</td>
<td>23.33</td>
<td></td>
</tr>
</tbody>
</table>

| **Group B** | | | | | | | |
| 1 | 11 | 3 | 3 | 1 | 18 | 61 |
| 2 | 7 | 4 | 1 | 2 | 14 | 36 |
| 3 | 21 | 5 | 2 | 1 | 29 | 72 |
| 4 | 16 | 4 | 3 | 1 | 24 | 70 |
| 5 | 14 | 6 | 4 | 4 | 28 | 49 |
| 6 | 18 | 6 | 3 | 1 | 28 | 96 |
| 13 | 6 | 6 | 1 | 1 | 14 | 36 |
| 14A | 14 | 7 | 3 | 1 | 25 | 62 |
| 14B | 19 | 8 | 3 | 3 | 33 | 67 |
| 15 | 17 | 5 | 1 | 0 | 23 | 60 |
| **Average** | 14.3 | 5.4 | 2.4 | 1.5 | 23.6 | 60.9 |
### Table 15
Assertion Use by Group

<table>
<thead>
<tr>
<th>Subject</th>
<th>Group</th>
<th>Connotative</th>
<th>Indicative</th>
<th>Conditional</th>
<th>Decision/Action</th>
<th>Interpretive</th>
<th>Total # of Assertions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
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<td>4</td>
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<td>Average</td>
<td>1.17</td>
<td>3.83</td>
<td>0.67</td>
<td>0.67</td>
<td>1.83</td>
<td>8.17</td>
</tr>
<tr>
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<td>B</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>4</td>
<td>17</td>
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<td></td>
<td>2</td>
<td>12</td>
<td>0</td>
<td>4</td>
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<td>22</td>
</tr>
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<td></td>
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<td>3</td>
<td>1</td>
<td>22</td>
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<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>13</td>
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<td>7</td>
<td>7</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>14A</td>
<td></td>
<td>4</td>
<td>14</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>14B</td>
<td></td>
<td>3</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>3</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>3.2</td>
<td>10.2</td>
<td>0.9</td>
<td>2.5</td>
<td>1.5</td>
<td>18.3</td>
</tr>
</tbody>
</table>
The comments each subject made about themselves concerning their being an expert nurse are also interesting to consider in view of which group they were placed:

Group A

Subject 7: “experienced--intuitive--broad knowledge base--holistic”
Subject 8: no answer
Subject 9: “Because I’ve been doing this successfully for 23 years.”
Subject 10: “25 years experience.”
Subject 11: no answer
Subject 12: “No one dies on my shift that I am not aware of ahead of time.”

Group B

Subject 1: “Broad experience in nursing.”
Subject 2: “Long term nursing.”
Subject 3: “I am still working in patient care areas and I still enjoy taking care of the sick. I like complex nursing situations and enjoy using my knowledge, skills and instincts to improve my nursing care.”
Subject 4: “By experience.”
Subject 5: “Because there is always more to learn.”
Subject 6: “I consider myself an expert--but only in cardiovascular [nursing]. My entire career has be in CT [cardiothoracic]/CV [cardiovascular] and my educational focus has been in that field. I strive to better myself through conferences and educational
opportunities and keep up with the latest developments. . . .

Subject 13: Expert would not be the word I would use, instead I would use the word experienced. The word expert does not seem to fit me in how I feel about myself. . . ."

Subject 14: “Because I’m always learning. I feel like I am an experienced nurse, but not an expert.”

Subject 15: “Long term experience, comfort level in caring for critically ill patients.”

The subjects in Group B were more verbal and gave more rationale than simply “experience.”

Research Question Three

What inferences can be made about expert acute care nurses' clinical reasoning processes in identifying and deciding to intervene in these pre-cardiopulmonary events?

Assertional analysis places the data in perspective by forming relationships between the objects (identifying concepts) and by the linking the objects (identifying assertions). Nine concepts were initially formed and five linkages identified. The initial nine concepts were as follows: (a) assessment; (b) disease progression; (c) signs and symptoms; (d) location; (e) probability; (f) intervene; (g) communication; (h) decision/rationale; (i) and outcome. These concepts were further analyzed (Appendix P) in an effort to construct an information structure of subjects’ verbalized thoughts. After a second analysis and comparison with the result of the previously mentioned Pilot Study, it was felt that the concept assessment was actually
search and the concepts disease progression and signs and symptoms could be subsumed under the concept variations. The concept search was defined as “previously processed cues that represent direct or indirect changes in a patient’s physiologic status” and 11 verbs or verb phrases placed in this category. The concept variations was defined as “specific searching by the nurse for patient cues that relate to disease progression or signs and symptoms.” This concept was further broken down into disease progression [defined as “positive (wellness) or negative (illness) state of health”] with 12 verbs or verb phrases placed in this category) and signs and symptoms (from the forms of the verb “to be”) (defined as “objective or subjective changes in bodily functions indicative of disease or phases of a disease”) with 63 objects listed in this category. The concept location was defined as a “place where nursing care is delivered” and 6 verbs or verb phrases and 4 objects placed in this category. The concept probability was defined as the “likelihood of a cardiopulmonary arrest occurring” and 8 verbs or verb phrases were placed in this category. After discussion, it was determined that these concepts were utilized by the RN as a scenario set. Scenario set became the first operator with the subcategories search, variations, location, and probability. Scenario set was then defined as “a description of a patient outlining data that is inclusive of a variety of patient cues as well as location of the patient and probability of a cardiopulmonary arrest event occurring.” Scenario set, as an operator, was felt to represent subjects’ thought processes concerning the patient’s history prior to the cardiopulmonary arrest event.
The concept intervene was defined as "to act in an effort to modify disease progression" and 25 verbs or verb phrases were placed in this category. The concept communicate was defined as "to convey information to family or physicians" and 10 verbs or verb phrases were placed in this category. After discussion it was determined that intervene was an operator which could be further subdivided into four categories: (a) general (level 1) acts, with 6 verbs; (b) more specific (level 2) acts, with 7 verbs; (c) very specific (level 3) acts, with 12 verbs; and (d) communicate (to physicians and/or family), with 10 verbs. General acts were defined as "non-specific actions"; more specific acts were defined as "detailed actions"; and very specific acts were defined as "illustrative or graphic actions." Intervene, as an operator, was felt to represent subjects' thought processes about the acts performed to prevent a cardiopulmonary arrest from occurring.

The concept decision/rationale was defined as "to reach a conclusion based upon a reason" and 20 verbs or verb phrases were placed in this category. After discussion, decision/rationale was found to be an operator and was subdivided into three categories: (a) positive (defined as evaluation of interventions as favorable to patient outcome) with 6 verbs; (b) negative (defined as evaluation of interventions as unfavorable to patient outcome) with 10 verbs; and (c) needs (defined as requirements to meet patient physiologic demands) with 4 verbs. Decision/rationale, as an operator, was felt to represent subjects' reasoning behind the action.
The concept outcome was defined as "patient result, usually survival or death" and 20 verbs or verb phrases were placed in this category. After discussion, outcome was found to be an operator and subdivided into two categories: (a) positive (defined as favorable consequences of interventions) with 10 verbs and (b) negative (defined as unfavorable consequences of interventions) with 10 verbs. As an operator, outcome was felt to represent the subjects’ perception of how the patient responded to the interventions.

The selected operators and sub-categories reflect the verbs or verb phrases, objects and their referents and help to identify the types of linkages in the transcripts. The five linkage types found in this transcript include: (a) observational; (b) indicative; (c) conditional; (d) decisional/action; and (e) interpretive. Tables 16 through 20 provide examples of these five types of assertions made by the subjects whose transcripts included all of the operators (Subjects 2, 3, 6, 13, and 14A). The Structure of Clinical Reasoning (Appendix Q) relates each of the assertions to the operators. The assertions show how subjects structured their thoughts by forming relationships between the operators and their subcategories, though they are not necessarily organized in an exact chronological format, and help to identify the types of linkages in the transcripts.

Observational assertions (Table 16) link patient history with health variations and are thought to be present when the nurse is setting the scene by searching for data about the patient. The observational
### Table 16
#### Assertional Analysis: Examples of Observational Assertions

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Line #</th>
<th>Operator/Subcategory</th>
<th>Verbatim Data in Transcript</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>L 3-L7</td>
<td>ScenarioSet/Search</td>
<td>mainly by <em>recognizing</em> ah...change in patient condition whether it be arrhythmias or even patterns of the emotional status of the patient or several key signs to work with them</td>
</tr>
<tr>
<td>3</td>
<td>L4</td>
<td>Scenario Set/Search</td>
<td>the situations that come most quickly to mind is <em>identifying</em> changes in ECG, blocks and um...</td>
</tr>
<tr>
<td>6</td>
<td>L76</td>
<td>Scenario Set/Location</td>
<td>And, in fact he's still in the <em>ICU</em></td>
</tr>
<tr>
<td>13</td>
<td>L4</td>
<td>Scenario Set/Location</td>
<td>um, a person <em>came out</em> of the unit after open heart surgery</td>
</tr>
<tr>
<td>14A</td>
<td>L50</td>
<td>Scenario Set/Location</td>
<td>The patient ended up <em>going</em> to cath lab that night I believe and...</td>
</tr>
</tbody>
</table>
assertions are listed under the search and location subcategories of the operator scenario set (Appendices Q and R). The most frequently mentioned verbs were “see” (n = 5) and “look” (n = 4).

Indicative assertions (Table 17) suggest significance and are present when the nurse is setting the scene by presenting information on the progression of the disease process and variable signs and symptoms. Each of the indicative assertions are listed under the variations subcategory of the operator scenario set (Appendices Q and R). Despite the large number of signs and symptoms detailed in this category, none of the referents in this category were mentioned by a majority of subjects. Arrhythmias (inclusive of the stated subcategories) were referred to by 6 subjects and breathing/respirations were referred to by 4 subjects.

Conditional assertions (Table 18) stipulate a proviso and are present when the nurse analyzes the probability for cardiopulmonary arrest. Each of the conditional assertions are listed under the probability subcategory of the operator scenario set (Appendices Q and R). “Would be/would have” and “Could be/could have” were each referred to by 3 subjects.

Decisional/action assertions (Table 19) provide reasons for behavior and are present when the nurse decides interventions based upon the patient history provided in the scenario set. Each of the decisional/action assertions are listed under the operator decision/rationale (Appendices Q and T). A form of the verb “prevent” was mentioned by 3 subjects. Interpretive assertions (Table 20) explain and
Table 17
Assertional Analysis: Examples of Indicative Assertions

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Line #</th>
<th>Operator/Subcategory</th>
<th>Verbatim Data in Transcript</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>L23</td>
<td>Scenario Set/Variations</td>
<td>her heart just <em>stopped</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Disease Progression)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>L60</td>
<td>Scenario Set/Variations</td>
<td>She <em>would block</em> right down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Disease Progression)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>L31-32</td>
<td>Scenario Set/Variations</td>
<td>and you're <em>having</em> six to eight, you're having six to eight PVCs a minute and your magnesium is 1.2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Signs and Symptoms)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>L7</td>
<td>Scenario Set/Variations</td>
<td>And he wasn't responsive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Signs and Symptoms)</td>
<td></td>
</tr>
<tr>
<td>14A</td>
<td>L25-27</td>
<td>Scenario Set/Variations</td>
<td>and the troponin <em>was um... well over 4</em> and the CKMB and the CK <em>were</em> through the roof.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Signs and Symptoms)</td>
<td></td>
</tr>
</tbody>
</table>
Table 18
Assertional Analysis: Examples of Conditional Assertions

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Line #</th>
<th>Operator/Subcategory</th>
<th>Verbatim Data in Transcript</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>L 31</td>
<td>Scenario Set/Probability</td>
<td>and she could have stayed on the floor like that</td>
</tr>
<tr>
<td>6</td>
<td>L 14-16</td>
<td>Scenario Set/Probability</td>
<td>even in, you know, getting into things like um . . . PE, getting into the realm of hypotensive events, getting into the realm of</td>
</tr>
<tr>
<td>13</td>
<td>L 25</td>
<td>Scenario Set/Probability</td>
<td>if it [v tach] was going to happen again</td>
</tr>
</tbody>
</table>
Table 19
Assertional Analysis: Examples of Decisional/Action Assertions

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Line #</th>
<th>Operator/Subcategory</th>
<th>Verbatim Data in Transcript</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>L 26</td>
<td>Decision/Rationale</td>
<td>and decided not to do much overall</td>
</tr>
<tr>
<td>3</td>
<td>L 9</td>
<td>Decision/Rationale</td>
<td>and not consistent so that you start to develop a feeling of something's going wrong.</td>
</tr>
<tr>
<td>6</td>
<td>L 33</td>
<td>Decision/Rationale</td>
<td>you know, there are things that you need to be doing</td>
</tr>
<tr>
<td>13</td>
<td>L 18</td>
<td>Decision/Rationale</td>
<td>She [the on call doctor] really wouldn't give it [the reasoning]</td>
</tr>
<tr>
<td>14A</td>
<td>L 30</td>
<td>Decision/Rationale</td>
<td>and told her that we would not be receiving this patient</td>
</tr>
<tr>
<td></td>
<td>L 45</td>
<td>Decision/Rationale</td>
<td>I will not accept this patient to telemetry</td>
</tr>
<tr>
<td>Subject #</td>
<td>Line #</td>
<td>Operator/Subcategory</td>
<td>Verbatim Data in Transcript</td>
</tr>
<tr>
<td>-----------</td>
<td>--------</td>
<td>----------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>2</td>
<td>L 9</td>
<td>Outcome</td>
<td>but they didn't make it though</td>
</tr>
<tr>
<td></td>
<td>L 35</td>
<td>Outcome</td>
<td>but I think after the procedure it distressed her too much and she . . .</td>
</tr>
<tr>
<td>3</td>
<td>L 30</td>
<td>Outcome</td>
<td>Yea, he was not alive</td>
</tr>
<tr>
<td>6</td>
<td>L 79</td>
<td>Outcome</td>
<td>It was all preventative measures by the nursing staff which allowed him to pull through those really awful events</td>
</tr>
<tr>
<td>13</td>
<td>L 11</td>
<td>Outcome</td>
<td>He was able to come out of it with just a simple intervention as that.</td>
</tr>
<tr>
<td>14A</td>
<td>L 53</td>
<td>Outcome</td>
<td>and he died.</td>
</tr>
</tbody>
</table>
are present when the nurse relates patient outcome and are listed under the operator outcome (Appendices Q and U). "Died/Didn't make it/ls dead" were referred to by 3 subjects.

In summary, subjects set the scene during which they looked for variations which cued them to a possible cardiopulmonary arrest. They intervened and rationalized the effectiveness of the interventions in light of the patient’s outcome. Setting the scene was the most referenced operator and took the most time for the subjects’ to convey to the researcher. No verbs or objects were consistently used or considered by a majority of the subjects. The operators do lend support to the premise that expert RNs think conceptually in order to individualize care.

Data from Probe Questions

Probe questions were asked during Stage Three of the interview to ensure that specific areas were covered concerning recollection of the pre-cardiopulmonary arrest event. The questions on the Pre-cardiopulmonary Arrest Signs and Symptoms Questionnaire (Appendix F) were developed from the Review of Literature and with the aid of an expert panel of five critical care RNs as described below. The variables studied from the Review of Literature included abnormal lab data, altered level of consciousness, age, communication breakdown, dependent lifestyle, deterioration of clinical condition, dyspnea, dysrhythmia, hypotension, medication errors, and procedures.
The variables included in the Probe Questions from the Panel of Experts included altered level of consciousness, changes in pupils, changes in breathing pattern, hypotension, changes in heart rate/pulse, dysrhythmias, respirations, oxygen saturation, cyanosis, and urine output. Using the data from the Think Aloud and probe questions, the following signs and symptoms received ten or greater positive responses from subjects: (a) level of consciousness; (b) breathing pattern; (c) blood pressure; (d) heart rate/pulse; (e) respirations; (f) history; (g) medical diagnosis; (h) other illnesses; (i) procedures; (j) lab values; (k) medications; and (l) age. Fully, two-thirds of the study subjects considered these signs and symptoms significant to either mention spontaneously or in response to a direct question.

When comparing these three data sources (Table 21), only altered level of consciousness, dyspnea (respirations), and hypotension was mentioned by all three. Abnormal lab data, age, dysrhythmias, procedures, breathing pattern, and heart rate/pulse were mentioned by two of the three data sources. Deterioration of clinical condition was mentioned in the literature as a variable of importance, having no specific disease progression or signs and symptoms referenced. This same concept is present as the subcategory "Variations" under the operator scenario set. This subcategory allows for different scenarios that present different qualities for consideration by the nurse. Analysis of Table 21 provides another interesting matter for discussion because of the difference between the literature and the study experts and the literature and the
Table 21
Comparison of Variables of Importance
Between Literature, Panel of Experts, and Sample

<table>
<thead>
<tr>
<th>Source of Variable</th>
<th>Variable</th>
<th>Literature</th>
<th>Panel of Experts</th>
<th>Sample</th>
<th>Study Experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature</td>
<td>Abnormal lab data</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X (8)</td>
</tr>
<tr>
<td>Literature</td>
<td>Altered LOC**</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X (7)</td>
</tr>
<tr>
<td>Literature</td>
<td>Age</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X (8)</td>
</tr>
<tr>
<td>Literature</td>
<td>Communication breakdown</td>
<td>X</td>
<td></td>
<td></td>
<td>Communication*</td>
</tr>
<tr>
<td>Literature</td>
<td>Dependent Lifestyle</td>
<td>X</td>
<td></td>
<td></td>
<td>Variation*</td>
</tr>
<tr>
<td>Literature</td>
<td>Deterioration of</td>
<td>X</td>
<td></td>
<td></td>
<td>Disease Progression*</td>
</tr>
<tr>
<td>Literature</td>
<td>Clinical condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literature/Exp Panel</td>
<td>Dyspnea (respirations)**</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X (8)</td>
</tr>
<tr>
<td>Literature/Exp Panel</td>
<td>Dysrhythmias</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X (7)</td>
</tr>
<tr>
<td>Literature/Exp Panel</td>
<td>Hypotension**</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X (8)</td>
</tr>
<tr>
<td>Literature</td>
<td>Medication Errors</td>
<td>X</td>
<td></td>
<td></td>
<td>X (9)</td>
</tr>
<tr>
<td>Literature</td>
<td>Procedures</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X (8)</td>
</tr>
<tr>
<td>Expert Panel</td>
<td>Changes in pupils</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Expert Panel</td>
<td>Breathing pattern</td>
<td></td>
<td></td>
<td>X</td>
<td>X (9)</td>
</tr>
<tr>
<td>Expert Panel</td>
<td>Heart rate/pulse</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Expert Panel</td>
<td>Oxygen saturation</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Expert Panel</td>
<td>Cyanosis (color)</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Expert Panel</td>
<td>Urine output</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Researcher</td>
<td>Medical diagnosis</td>
<td></td>
<td></td>
<td>X</td>
<td>X (8)</td>
</tr>
<tr>
<td>Researcher</td>
<td>Other illnesses</td>
<td></td>
<td></td>
<td>X</td>
<td>X (6)</td>
</tr>
<tr>
<td>Researcher</td>
<td>Medications</td>
<td></td>
<td></td>
<td>X</td>
<td>X (9)</td>
</tr>
<tr>
<td>Researcher</td>
<td>History</td>
<td></td>
<td></td>
<td>X</td>
<td>X (7)</td>
</tr>
<tr>
<td>X = present ** = primary variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = operator subcategory
panel of experts. The literature and the study experts agree on 9 variables (abnormal lab data, altered level of consciousness, age, communication, clinical condition, dyspnea, dysrhythmias, hypotension, and procedures) while the literature and the panel of experts agree on only 4 variables (altered level of consciousness, dyspnea, dysrhythmias, and hypotension). This discrepancy may be significant and have implications for the selection of an expert sample and expert panel. Is it possible to have an expert Registered Nurse who is not practicing full time at the bedside? Is an important aspect of expertise lost the further away a Registered Nurse practices from the patient? These questions will need to be considered in the selection of expert Registered Nurses in future studies.

Summary

The Think Aloud method and Protocol Analysis were used to describe and make inferences about the clinical reasoning processes of a group of expert acute care Registered Nurses during pre-cardiopulmonary arrest events. The steps utilized in the research method (Referring Phrase Analysis, Assertional Analysis, and Script Analysis) are tedious, but such a method offers a complete account of a transcript, as each word and phrase is accounted for in the process. The Structure of Clinical Reasoning (Appendix Q) that was constructed from the information attended to during the interviews in this study is a result of the final step of Protocol Analysis. The investigator inferences from the operators and assertions lend support to this structure.
Chapter 5
Conclusions, Implications, and Recommendations

This chapter summarizes study findings and presents conclusions drawn from those findings. Implications for nursing theory, practice, education, and research are also delineated. The recommendations for future research concludes the chapter.

Three major concepts were important in this study: (a) clinical reasoning; (b) expertise; and (c) pre-cardiopulmonary arrest events. The study of clinical reasoning is important because the practice of nursing requires the processing of large amounts of clinical information. When accurate and efficient clinical reasoning processes are used by Registered Nurses (RNs), then patient outcomes have a greater probability of being positively affected. Expert nurses are thought to be adept at anticipating and intervening to prevent potentially fatal patient complications from advancing to stages that often cannot be reversed by the best medical and technological interventions available (Benner, 1984). Study of nurses' clinical reasoning about pre-cardiopulmonary arrest events is important because once cardiopulmonary arrest occurs, only 15% of individuals who receive cardiopulmonary resuscitation will survive to be discharged from the hospital (McGrath, 1987; Tunstall-Pedoe et al. 1992; Cohn et al. 1993; Schneider, et al. 1993; and American Heart Association, 2001). This statistic reflects the frequently irreversible nature of cardiopulmonary arrest as well as the severity of accompanying underlying illness(es) in the patient population. It was believed that study of nurses' clinical reasoning...
at this point in care delivery could provide insight into the clinical reasoning underlying the care provided every day in critical care units.

Conclusions

The findings presented in Chapter 4 furnished the data to answer the three research questions. The data begin to illustrate the clinical reasoning of expert acute care RNs in pre-cardiopulmonary arrest events. The experts are represented by the subsample Group B (n = 9) as previously discussed in Chapter 4.

Research Question One

What data do expert acute care Registered Nurses attend to when reasoning about the care required by patients thought to be in danger of experiencing a cardiopulmonary arrest?

Operators. The data that expert acute care Registered Nurse subjects attended to when reasoning about the care required by a patient thought to be in danger of experiencing a cardiopulmonary arrest cluster around the operators scenario set, intervene, decision/rationale, and outcome. The expert data, as represented by subsample Group B in this study and extracted from Table 22, is as follows:

<table>
<thead>
<tr>
<th>Operator</th>
<th>Average Use</th>
<th>Range of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario Set</td>
<td>14.3</td>
<td>6-21</td>
</tr>
<tr>
<td>Intervene</td>
<td>5.4</td>
<td>3-8</td>
</tr>
<tr>
<td>Decision/Rationale</td>
<td>2.4</td>
<td>1-4</td>
</tr>
<tr>
<td>Outcome</td>
<td>1.5</td>
<td>0-3</td>
</tr>
</tbody>
</table>

Overall, operator use averaged 23.6, with a range of 14 to 33.
<table>
<thead>
<tr>
<th>Subject Considered Expert?</th>
<th>Group X, Y, Current Work Environment</th>
<th>Yrs in Highest Level Ed</th>
<th>Scenario Set</th>
<th>Inter-Vene Decision/Outcome Rationale</th>
<th>Total Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Y)</td>
<td>X</td>
<td>8 ADN</td>
<td>11</td>
<td>3 3 1</td>
<td>61</td>
</tr>
<tr>
<td>2 (Exper'd)</td>
<td>Y</td>
<td>1 ADN</td>
<td>7</td>
<td>4 1 2</td>
<td>36</td>
</tr>
<tr>
<td>3 (Y)</td>
<td>X</td>
<td>20 Diploma</td>
<td>21</td>
<td>5 2 1</td>
<td>72</td>
</tr>
<tr>
<td>4 (Y)</td>
<td>X</td>
<td>8 BSN</td>
<td>16</td>
<td>4 3 1</td>
<td>70</td>
</tr>
<tr>
<td>5 (N)</td>
<td>Z</td>
<td>2 BSN</td>
<td>14</td>
<td>6 4 4</td>
<td>49</td>
</tr>
<tr>
<td>6 (Y)</td>
<td>X</td>
<td>8 BSN</td>
<td>18</td>
<td>6 3 1</td>
<td>96</td>
</tr>
<tr>
<td>13 (Exper'd)</td>
<td>Y</td>
<td>9 ADN</td>
<td>6</td>
<td>6 1 1</td>
<td>36</td>
</tr>
<tr>
<td>14A (N)</td>
<td>Z</td>
<td>3 ADN</td>
<td>14</td>
<td>7 3 1</td>
<td>62</td>
</tr>
<tr>
<td>14B (N)</td>
<td>Z</td>
<td>3 BSN</td>
<td>19</td>
<td>8 3 3</td>
<td>67</td>
</tr>
<tr>
<td>15 (Y)*</td>
<td>X</td>
<td>8 PhD</td>
<td>17</td>
<td>5 1 0</td>
<td>60</td>
</tr>
<tr>
<td>Average</td>
<td>7.44</td>
<td>14.3 5.4 2.4 1.5</td>
<td>23.6</td>
<td>60.9</td>
<td></td>
</tr>
</tbody>
</table>

* = Certified
By examining each selected operator and its subcategories, a pattern of clinical reasoning during pre-cardiopulmonary arrest events can be observed. **Scenario set** was selected as the first operator, representing the subcategories: (a) search; (b) variations; (c) location; and (d) probability. The overwhelming number of times the operator scenario set was used by all subjects originally selected for the study in comparison with other operators indicates that it is important for a sufficient number of cues to be present to enable accurate identification of a pre-cardiopulmonary arrest situation. Scenario set represents the subjects' reasoning about the patients' history. Subjects search for variations in patients' norms. The variations searched for represent significant permutations in the patient's disease progression as well as significant deviations in the patient's signs and symptoms. This study's objects were purposefully limited to the subcategory variations within the operator Scenario Set because of their number and because they mirror the objects of the other verbs in this category. The last two subcategories of this operator delineate how the nurses' views of the clinical picture of the patient are augmented by the location of the patient within the institution (ICU, CCU, Telemetry) and by the probability of a cardiopulmonary arrest occurring.

When searching for data about a patient to illustrate reasoning, the most common verbs used by the experts included derivations of “to look” (n = 4) and “to see” (n = 5) (Appendix R). A derivative of the verb “to go” was the most common verb used by the experts when discussing disease.

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progression and variations. The objects of this verb included: (a) heart rate; (b) supraventricular tachycardia; (c) blood pressure; (d) junctional rhythm; (e) abdominal cavity; (f) nuts; (g) through it; (h) premature ventricular tachycardia; (i) magnesium level; and (j) in (Appendix R). Multiple derivatives of the verb “to be” were used by experts when discussing signs and symptom variations, with the most common objects cited being: (a) arrhythmias (n = 5); (b) breathing/respirations (n = 4); and (c) changes in blood pressure (n = 4). Although different objects received attention, experts identified from 3 to 15 objects of the verb “to be”, averaging 8.3, supporting Miller’s (1956) classic prediction that information is stored in short term memory in meaningful chunks of five to nine (7 plus or minus 2) (Appendix R). A meaningful pattern for the operator Scenario Set may consist of the presence of at least of 8 objects.

Reaching consensus on the quality of cues needed to establish a meaningful pattern in the clinical reasoning of pre-cardiopulmonary arrest events may be more difficult. As noted in Table 21, the literature, the panel of five experts, and the sample of fifteen subjects agreed that: (a) altered level of consciousness; (b) dyspnea; and (c) hypotension are the variables of importance in pre-cardiopulmonary arrest events. The presence of any of these three variables demands the nurse’s immediate attention and subsequent rapid intervention. Abnormal lab data, age, dysrhythmias, procedures, breathing pattern, and heart rate/pulse are important variables, but may or may not require immediate intervention to prevent cardiopulmonary arrest. It appears that the more subtle the object, the
more confirmatory objects may be required to corroborate pre-cardiopulmonary arrest.

**Intervene** was identified as the second operator. Subjects related three levels of interventional acts (general acts, more specific acts, or very specific acts) performed in an effort to prevent a cardiopulmonary arrest. The decision to intervene was made by the RN in response to any number of variations from the patient's norm. "Treated/was being treated" was the most frequently mentioned general act ($n = 3$). Derivations of the verb "to get" and "to start" were the most frequently mentioned more specific acts ($n = 3$) and were followed with specifics about what "to get" or what "to start" (e.g., a medication). There was no consistent act mentioned by the experts, as this varied with the patient need at the moment [e.g., intubation, cardioversion, or cardiac catheterization (balloon and stent)]. The level of intervention varied among subjects, with all three levels present in only four experts. Communication, as a separate subcategory within the operator intervene, was considered an important intervention for the experts in that they expressed a need "to call" ($n = 6$) the physician when significant variations were noted (Appendix S). Through communication, more specific and very specific interventions became available for use and/or the physicians were notified that their presence was needed at the bedside.
**Decision/rationale** was identified as the third operator, with the expert subjects stating positive decisions/rationales for care (n = 6), negative decisions/ rationales for care (n = 5), and/or patient needs to be tended to (n = 4). This operator represents the expert nurses' statements about the need for intervention. This operator was used an average of 2.4 times, with a range of 1 to 4. When comparing Group A (less expert) with Group B (expert), what appears important about this operator is not whether a decision or rationale positively or negatively impacted the patient or that the decision or rationale focused on a particular need. Rather, it is simply important that a decision was made and/or a rationale supplied concerning delivery of care. A decision or rationale, based upon the data supplied in the Scenario Set, seemed to give the nurse impetus to intervene.

**Outcome**, identified as the last operator, was reflected by subjects relating either positive or negative results of patient interactions. The discussion of patient outcome represents a consequence of the interventions and seemed to conclude clinical reasoning for the particular event. The verb and verb phrases selected by the expert RNs were 44% positive (n = 4), 22% negative (n = 2), 22% combination of positive and negative (n = 2), or 11% absent (n = 1). As with the operator decision/ rationale, the type of outcome is unimportant when comparing Group A with Group B. Rather, the presence of an outcome is important because it represents closure of the pre-cardiopulmonary arrest event.
Assertions. Assertions were used by the RN expert subjects (Group B) an average of 18.3 times, with a range of 8 to 26. Indicative assertions were used an average of 10.2 times with a range of 4 to 17; observational assertions were used an average of 3.2 times with a range of 1 to 7; decision/rationale assertions were used an average of 2.5 times with a range of 1 to 4; interpretive assertions were used an average of 1.5 times with a range of 0 to 4; conditional assertions were used an average of 0.9 times with a range of 0 to 2 (Table 23).

As stated previously, indicative assertions suggest significance. The indicative assertions far outnumber the other assertions because they link the numerous patient variations with the operator Scenario Set in this study. The objects from the subcategory “variations” of the operator Scenario Set delineate, for the nurse, the disease progression and signs and symptoms indicative of pre-cardiopulmonary arrest. The most frequent objects mentioned were derived from the verb “to be” and included arrhythmias (n = 5), breathing/respirations (n = 4), and changes in blood pressure (n = 4). This important assertion provides linkage within the operator scenario set and its four subcategories and may serve as linkage between the other three operators (Appendix Q).

Research Question Two

What are the similarities and differences in the clinical reasoning of expert acute care nurses in these pre-cardiopulmonary arrest events?
### Table 23
**Expert (Group B) Variables/Use of Assertions**

<table>
<thead>
<tr>
<th>Subject Considered Expert?</th>
<th>Group</th>
<th>Yrs in Highest Indic</th>
<th>Cond</th>
<th>Dec/Rat</th>
<th>Interp</th>
<th>Total # of Assertions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X, Y, Z Current Work Level Ed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>8</td>
<td>ADN</td>
<td>4</td>
<td>6 1 3 1 15</td>
</tr>
<tr>
<td>1 (Y)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (Exper'd)</td>
<td>Y</td>
<td>1</td>
<td>ADN</td>
<td>2</td>
<td>4 1 1 2 10</td>
<td></td>
</tr>
<tr>
<td>3 (Y)</td>
<td>X</td>
<td>20</td>
<td>Diploma</td>
<td>4</td>
<td>17 0 2 1 24</td>
<td></td>
</tr>
<tr>
<td>4 (Y)</td>
<td>X</td>
<td>8</td>
<td>BSN</td>
<td>1</td>
<td>14 1 3 1 20</td>
<td></td>
</tr>
<tr>
<td>5 (N)</td>
<td>Z</td>
<td>2</td>
<td>BSN</td>
<td>2</td>
<td>12 0 4 4 22</td>
<td></td>
</tr>
<tr>
<td>6 (Y)</td>
<td>X</td>
<td>8</td>
<td>BSN</td>
<td>4</td>
<td>12 2 3 1 22</td>
<td></td>
</tr>
<tr>
<td>13 (Exper'd)</td>
<td>Y</td>
<td>9</td>
<td>ADN</td>
<td>1</td>
<td>4 1 1 1 8</td>
<td></td>
</tr>
<tr>
<td>14A (N)</td>
<td>Z</td>
<td>3</td>
<td>ADN</td>
<td>7</td>
<td>7 0 3 1 18</td>
<td></td>
</tr>
<tr>
<td>14B (N)</td>
<td>Z</td>
<td>3</td>
<td>ADN</td>
<td>4</td>
<td>14 1 4 3 26</td>
<td></td>
</tr>
<tr>
<td>15 (Y)*</td>
<td>X</td>
<td>8</td>
<td>PhD</td>
<td>3</td>
<td>12 2 1 0 18</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>7.44</td>
<td>3.2</td>
<td>10.2</td>
<td>0.9</td>
<td>2.5 1.5 18.3</td>
<td></td>
</tr>
</tbody>
</table>

* = Certified
To examine this question, Group B will be divided into three groups based upon the subjects' perception of themselves as experts. Of this subsample \((n = 9)\), five members considered themselves to be experts (Group X); two members considered themselves to be "experienced" (Group Y); and two members did not consider themselves to be experts. The very small size of each of these groups is acknowledged and extreme caution is advised when generalizing the findings. However, this grouping provides interesting similarities and differences for inspection.

This division, based upon subjects' self perception, supports the importance of acknowledging years in practice. Although the range of years in practice varied from 1 to 20 years for the expert group, the years in practice for Group X was 10.4, Group Y was 5, and Group Z was 2.5 (Table 24). Together with the self perception of expertise, these numbers appear to reflect that specialty areas require more exposure to a multitude of situations that are content, context, and task specific. These Registered Nurses seemed to recognize that this expertise takes time to develop and is non-transferable despite similarities in the work environment.

This division also supports the amount of verbal contribution of experts. Group X had 71.8 lines in their transcripts, Group Y had 36 lines in their transcripts, and Group Z had 59.33 lines in their transcripts (Table 24). Together with the self perception of expertise, these numbers seem to reflect an increase in the verbal ability of the experts in Group X to relate the conditions that dictate the presence of an imminent cardiopulmonary arrest.
### Table 24
Average Use of Operators by Experts (Group B)
Types of Operators by Subject

<table>
<thead>
<tr>
<th>Group</th>
<th>Years in Practice</th>
<th>Scenario Set</th>
<th>Intervene</th>
<th>Decision/Rationale</th>
<th>Outcome</th>
<th>Total</th>
<th># of Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group X 10.4 16.6</td>
<td>4.6 2.4 0.8</td>
<td>24.4 71.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 1 ADN</td>
<td>2G/1C</td>
<td>2+/1 needs</td>
<td>1+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 3 Dip</td>
<td>1G/1S/3C</td>
<td>1+/1 needs</td>
<td>1-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 4 Bacc</td>
<td>1S/3VS</td>
<td>2+/1-</td>
<td>1+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 6 Bacc</td>
<td>1G/3S/2VS</td>
<td>2+/1 needs</td>
<td>1+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 15 PhD</td>
<td>1S/1VS/3C</td>
<td>1-</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Y 5 6.5</td>
<td>10.5 3.5 4</td>
<td>14 36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 5 Bacc</td>
<td>1G/3S/1VS/1C</td>
<td>4-</td>
<td>1+/3-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 14 ADN</td>
<td>1G/1S/4VS/9C</td>
<td>1+/4/-1 needs</td>
<td>1+/3-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Z 2.5 15.6</td>
<td>5 1 1.5</td>
<td>28.67 59.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 2 ADN</td>
<td>2G/1S/1C</td>
<td>1+</td>
<td>2-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 13 ADN</td>
<td>3S/1VS/2C</td>
<td>1-</td>
<td>1+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

G = General
S = Specific
VS = Very Specific
C = Communicate
In addition, Group X used the operator scenario set (Table 24) more
than Groups Y or Z and indicative and conditional assertions (Table 25)
more than Group Y or Z. Group Z, however, very closely approximated
Group X in all categories of operator and assertion use as noted below.

**Operator Use**

<table>
<thead>
<tr>
<th></th>
<th>Group X</th>
<th>Group Z</th>
<th>Group Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario Set</td>
<td>16.6</td>
<td>15.6</td>
<td>6.5 ▼</td>
</tr>
<tr>
<td>Intervene</td>
<td>4.6</td>
<td>5</td>
<td>10.5 ▲</td>
</tr>
<tr>
<td>Decision/Rationale</td>
<td>2.4</td>
<td>1</td>
<td>3.5 ▲</td>
</tr>
<tr>
<td>Outcome</td>
<td>0.8</td>
<td>1.5</td>
<td>4 ▲</td>
</tr>
</tbody>
</table>

The data reveal that Groups X and Z had close to three times the
data available in the operator Scenario Set as Group Y. Group Y had
twice the amount of data available in the operator Intervene in comparison
with Groups X and Z. Further breakdown of this category into general acts,
specific acts, and very specific acts for each group failed to yield significant
differences (Table 24). Group Y had 3.5 times the amount of data available
in the operator Decision/Rationale in comparison with Group Z and Group
X had 2.4 times the amount of data available in the operator Decision/
Rationale in comparison with Group Z. Further examination of this
category reveals that Group X had more positive decisions/rationales that
either Groups Y or Z. Group Y had 4 times the amount of data available in
the operator Outcome in comparison with Group X and Group Z had 2
times the amount of data available in the operator Outcome in comparison
with Group X. Further evaluation of this category reveals that Group X had
<table>
<thead>
<tr>
<th>Group</th>
<th>Years in Practice</th>
<th>Observational</th>
<th>Indicative</th>
<th>Conditional</th>
<th>Decisional/Interpretive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group X</td>
<td>10.4</td>
<td>3.2</td>
<td>12.2</td>
<td>1.2</td>
<td>2.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Subject 1</td>
<td>ADN</td>
<td>1</td>
<td>+</td>
<td>2+/1 needs</td>
<td>1+</td>
<td></td>
</tr>
<tr>
<td>Subject 3</td>
<td>Dip</td>
<td>0</td>
<td>1+/1 needs</td>
<td>1-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 4</td>
<td>Bacc</td>
<td>1</td>
<td>2+/1-</td>
<td>1+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 6</td>
<td>Bacc</td>
<td>2</td>
<td>2+/1 needs</td>
<td>1+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 15</td>
<td>PhD</td>
<td>2</td>
<td>1-</td>
<td>none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Y</td>
<td>5</td>
<td>1.5</td>
<td>4</td>
<td>0.5</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>Subject 5</td>
<td>Bacc</td>
<td>0</td>
<td>4-</td>
<td>1+/3-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 14</td>
<td>ADN</td>
<td>1</td>
<td>1+/4/-1 needs</td>
<td>1+/3-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Z</td>
<td>2.5</td>
<td>4.33</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Subject 2</td>
<td>ADN</td>
<td>1</td>
<td>1+</td>
<td>2-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 13</td>
<td>ADN</td>
<td>1</td>
<td>1-</td>
<td>1+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ = positive
- = negative
more positive outcomes than Groups Y or Z.

<table>
<thead>
<tr>
<th>Assertion Use</th>
<th>Group X</th>
<th>Group Z</th>
<th>Group Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observational</td>
<td>3.2</td>
<td>4.33</td>
<td>1.5</td>
</tr>
<tr>
<td>Indicative</td>
<td>12.2</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Conditional</td>
<td>1.2</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Decision/Rational</td>
<td>2.4</td>
<td>1</td>
<td>3.5</td>
</tr>
<tr>
<td>Interpretive</td>
<td>0.8</td>
<td>1.5</td>
<td>4</td>
</tr>
</tbody>
</table>

The data reveal that Groups X and Z had two times as many observational and conditional assertions as Group Y and three times as many indicative assertions as Group Y. Group Z had two-thirds fewer decision/rationale assertions as Group Y and Group X had one-third fewer decision/rationale assertions as Group Y. This may indicate more efficiency with decision making. Further breakdown of this category reveals that Group X had more positive decisions/rationales that either Groups Y or Z. Group X had 4 times fewer interpretive assertions than Group Y and Group X had 2.5 times fewer interpretive assertions than Group Y. Further breakdown of this category reveals that Group X had more positive interpretive assertions than Groups Y or Z. Again, the very small numbers in each group urge caution for generalizations. However, the data does present interesting similarities and differences concerning the linkages within the expert group based upon self perception of expertise.
Research Question Three

What inferences can be made about expert acute care nurses clinical reasoning processes in identifying and deciding to intervene in these pre-cardiopulmonary arrest events?

Within the limited number of subjects of Group B (n = 9), a pattern of thinking emerges. The individuals in Group B who perceive themselves as “experts” (Group X, Tables 24 and 25) and the individuals in Group B who do NOT perceive themselves as experts (Group Z, Tables 24 and 25) curiously mimic each other with regard to operator and assertion use and are different from the individuals in Group B (Group Y, Tables 24 and 25) who consider themselves “experienced.” For Group Y, being “experienced” is not the same as being “expert.” Despite their years of experience, Group Y perceives a missing element to their being called “experts” and the proposed structure does not seem to reveal this element. It might be that Group X has truly reached an expert level of practice; Group Y perceives experience as the way to reach the expert level of practice; and Group X is in active pursuit of expertise through the clinical reasoning process.

Operators. Operator use in the expert group also presents interesting data for analysis. Groups X and Z were significantly more verbal and utilized the operator Scenario Set considerably more times than Group Y. Using this operator 15 to 16 times during the data collection session seems to indicate an ability to perceive and prioritize patient variations when searching for an evolving pre-cardiopulmonary arrest.
pattern. Experts "observe," "look," "see," and "listen" for a number of signs and symptoms in order to evaluate disease progression.

The other designated operators are also of interest to examine, but for a different reason. The operators intervene, decision/rationale, and outcome were less frequently used by Groups X and Z, but more frequently by Group Y. On average, Groups X and Z used the operator Intervene 5 times, half as frequently as Group Y. Once a pattern was recognized and confirmed by Groups X and Z as representing pre-cardiopulmonary arrest, subjects selected and implemented interventions that they perceived as having a higher probability of positively affecting patient outcome. Groups X and Z also gave fewer Decision/ rationales than Group Y, indicating perhaps their ease with decision making. However, it is important to note that Group X's decisions were perceived as being more positive (e.g., derivations of "to be able," "to prepare," "to prevent," "to decide" and statements concerning "have feeling" and "develop feeling") than negative (e.g., "nothing" and "not"), indicating a proactive versus reactive stance with regard to the situation or pattern of pre-cardiopulmonary arrest (Appendix T). The operator Outcome is similar, in that Groups X and Z described positive outcomes (e.g., "compensate," "save," "pull through," and "is all right") (Appendix U). Based on this data, the experts seemed to have the expectation that because of their presence and selected interventions, complications would be prevented and purposeful recovery would occur. This supports Hanneman's (1996) premise that expert "presence" with patients allows for the evaluation of selected chunks of data and decisive
action (early and aggressive interventions).

Assertions. There were five types of assertions used in the transcripts that determine how relationships were being formed between the concepts in the text: observational (search for data), indicative (suggest significance), conditional (stipulate a proviso), decisional/action (provide reasons for behavior), and interpretive (explanation). Groups X and Z had more observational (2 times greater), indicative (3 times greater), and conditional (2 times greater) assertions than Group Y. These findings complement the previous discussion of operator use in that Groups X and Z were actively forming linkages in their search for a pattern with regard to observations of the patient (observational assertions), the meaning of the observations to the patient (indicative assertions), and the probability of the patient experiencing a cardiopulmonary arrest (conditional assertions). It is the indicative assertions that are felt to represent nurses’ search for a pattern because they link the largest amount of data (variations) with the operator Scenario Set. Taking this defined pattern, nurses’ reasoning can then link to all other operators. Without this linkage, progression through the created Structure of Clinical Reasoning (Appendix Q) is not possible. Conditional assertions seem to allow subjects to predict consequences of their action or inaction by providing a futuristic frame of reference.

Groups X and Z had fewer decisional/action assertions and interpretive assertions than Group Y. As previously noted, this possibly indicates their ease with decision making and perhaps their confidence
with an explanation for outcome. As with the operators, it is important to note that Groups X’s decisional/action assertions were more positive than negative, indicating an optimistic outlook for affecting patient outcomes. Overall, it can be noted that Group X seemed to have more targeted and efficient thinking; Group Y had minimal data for consideration; and Group Z had more diffuse thinking. A summary of the important findings from this expert group includes the following:

1. Experts predominately used the operator Scenario Set. This is indicative of their searching for an evolving pre-cardiopulmonary arrest pattern.

2. Using the verb “to be,” experts established a meaningful pattern within the operator Scenario Set using an average of 8 objects (Appendix R).

3. Altered level of consciousness, dyspnea, and hypotension are priority objects that seem to outweigh all others signs and symptoms in pre-cardiopulmonary arrest events.

4. Abnormal lab data, age, dysrhythmias, procedures, breathing pattern, and heart rate/pulse are confirmatory objects used to corroborate pre-cardiopulmonary arrest.

5. The operator decision/rational is important because it reflects that a decision was made and/or a rational supplied concerning delivery of care. Experts’ decisions are more positive, indicating a more proactive stance with regard to the inevitability of cardiopulmonary arrest.
6. The operator outcome seems to represent closure of the pre-cardiopulmonary event. Experts outcomes are more positive.

7. Experts predominately used indicative assertions to link the largest amount of data within the operator Scenario Set. Indicative assertions represent the nurses' search for a pattern that can link all other operators.

8. Experts have more positive than negative decisional/action assertions.

9. Expertise takes time to develop within a specific area of practice and is nontransferable despite similarities in the work environment.

10. The definition of expert acute care Registered Nurse may need to be limited to individuals who maintain a full time practice providing direct patient care in the critical care environment. This definition would exclude nurse managers and nurse educators.

11. Expertise may be attained by through continual refinement of clinical reasoning processes in the practice environment or by constant exposure to different situations in the practice environment. This indicates that there may be two paths to becoming an acknowledged expert.

12. Self perception of expertise may be one indicator that expertise in a nursing has been attained.
Implications

Theory

Figure 1 (Appendix A) diagrams Clinical Reasoning as consisting of the following: (a) presence (multiple cue acquisition); (b) multiple hypothesis generation; and (c) cue interpretation. Based on the findings from this study, the concept “Presence (Multiple Cue Acquisition)” was supported through the operator Scenario Set as subjects presented information about patients that were thought to be in danger of experiencing cardiopulmonary arrest. Scenario Set was the most frequently used operator ($M = 14.3$), had the most subcategories (search, variations, location, and probability), and reflected objects that subjects considered important when considering patients’ disease progression and signs and symptoms ($M = 8.3$). The concept “Presence” will remain a part of the Nursing Expertise Research Model.

The operator Decision/Rationale supports the concept “Cue Interpretation” in the model. This operator was found to be important because it was used by all of the experts (Group B) and was missing in 4 of the non-experts (Group A). In addition, the experts within Group B (especially Group X) were more proactive with regard to the inevitability of cardiopulmonary arrest, wanting “to prepare” or “to prevent” its happening. Decision/ Rationale use by experts seems to clarify the need to intervene by providing a decision to intervene and/or the rationale behind the intervention. The concept “Cue Interpretation” will remain a part of the Nursing Expertise Research Model but will be further detailed by placing...
The concept “Multiple Hypothesis Generation” was narrowly supported by the data in the form of conditional assertions. Though this type of assertion was identified, subjects did not seem to generate multiple hypotheses about what was occurring with the patient. This limitation may be due to the researcher limiting subject recall exclusively to pre-cardiopulmonary arrest events. This concept will remain a part of the model for further testing.

The concept “Patient/Client Outcome” from the model was supported by subjects’ expectations that their presence and interventions would prevent complications from developing further to an arrest. The experts within Group B (Group X) were more positive that the patient would “compensate,” “pull through,” or be “all right.” Death had a negative connotation for study participants and was viewed as a failure to prevent complications from progressing. Although the concept “Outcome” was not a concept that was under direct study, it will be changed in the model to reflect failure to prevent complications and death (Appendix V).

In addition, although the operator Intervene was identified during this study, the concept “Nursing Interventions” was not a concept under direct study. This concept, however, was found to be used less frequently by experts, indicating that once a pattern was identified and linkages made, interventions were selected and implemented with a higher probability of positively affecting outcome. At this time, the concept “Nursing Interventions” will remain unchanged in the model because
further testing is needed to determine the importance of specifying types of acts and their impact on patient/client outcome.

Research

**Methodological issues.** Defining and operationalizing the concept of expertise is difficult. This study attempted to identify expert RNs for inclusion in a sample through a dual nomination process. To select RN subjects deemed to be "experts," the researcher provided each RN employed to work full-time (minimum of 40 hours per week) or part-time (minimum of 20 hours per week) in acute care settings at two urban hospitals with a peer nomination form. This form stated the operational definition of expert nurse and asked for the names of two RN colleagues who fit the definition. The researcher also provided each head nurse/nurse manager in the selected areas with the same definition of expert nurse and asked them to list the names of all RNs on their unit who fit the definition. Previous studies have selected experts by staff nomination only (Corcoran, 1986a, 1986b), supervisor nomination only (Fischer & Fonteyn, 1995; Radwin, 1995a, 1995b; Tanner et al., 1987; Westfall et al., 1986), and a combination of both (Benner et al., 1992; Doona, 1995; Jenny & Logan, 1992; Tanner et al., 1993). The dual nomination process (peer and head nurse/nurse manager) was used because it offered a way to capture staff and management opinion and ultimately provided a pool of nominees. This process was well received by management, but viewed with suspicion by the staff nurses. There are a number of possible explanations for the staff uncertainty. The work required by RNs in the acute care setting is very...
demanding and the rewards more frequently internal (caring) versus external (recognition). Nomination of one nurse over another may cause dissent among a particularly cohesive group because the talents each member brings is viewed as contributing to the synergy of the group as a whole. Nomination of another nurse over oneself may also cause internal conflict within the nurse because of limited individual recognition programs in the workplace. Again, the work of each individual is seen as contributing to the whole, with no one person being more important than another. In addition, because the staff at the selected institutions are not frequently asked to participate in nursing research, they may have been concerned with confidentiality issues. This concern may dissipate with more frequent exposure to nursing research.

The nomination process did not use speciality certification, years of clinical experience, or education for subject inclusion criteria. Specialty certification is frequently one moniker of expertise, but requires internal motivation by the nurse to obtain because because many institutions do not monetarily assist RNs in maintaining and retaining the credential. Although there was no difference in the specialty certification of RNs between Group A and Group B, future studies may wish to include this variable, selecting equal numbers of participants with and without certification for comparison. There are studies underway to examine the effect professional certification may have on practice as well as the practitioners' need for self recognition (Cary, 2001).
Multiple exposures to multiple patients over time adds to a nurse's theoretical and experiential knowledge base, but exactly how much experience is needed to establish expertise is quite unclear. In their later work, Benner et al. (1996) simply note that the shift to expert nursing practice is marked by a qualitative change with intuitive links between the issues in the situation and ways of responding. In this study, subjects did not have to be engaged in practice a minimum number of years to be included in the sample. Group A had more years experience in nursing (23.82 years versus 14.2 years), but Group B had more years experience in the current work environment (7.44 years versus 4 years). This supports the premise that expertise takes time to develop because of exposure to specific experiences being context, content, and task specific. Time is important in the development of nurses who are actively seeking expert status via continual refinement of clinical reasoning skills in the practice environment, but it is also important in the development of nurses who become experts by virtue of the fact that they have had constant exposure to different situations in the practice environment. Time works in favor of both groups. Future studies should consider time within a specialty as essential demographic data as well as time spent in direct patient care contact. No conclusion can be reached as to the magical number of years that is appropriate for determination of expertise within a specialty. However, to increase the probability of sampling experts, it is recommended that the sample be limited to individuals who maintain a full time practice providing direct patient care in the specialty environment.
Education was the third variable not used for group inclusion. Group A’s educational level was of 33% associate degree (n = 2), 33% diploma (n = 2), and 33% baccalaureate degree (n = 2). Group B’s educational level was 44% associate degree (n = 4), 11% diploma (n = 1), and 44% baccalaureate degree (n = 4). Although there were equal numbers of associate degree nurses and baccalaureate degree nurses in Group A and Group B, future studies may wish to include this variable, selecting equal numbers of participants from each educational level for comparison because outcome competencies may vary, especially verbal expression.

An important characteristic within the expert group (Group B) to mention at this time was self perception of expertise. As stated previously, five of the nine members of the expert group considered themselves to be experts (Group X); two of the nine members considered themselves to be “experienced” (Group Y); and two of the nine members did not consider themselves to be experts (Group Z). This division supports the importance of years in practice (10.5, 5, and 2.5 respectively per group) and the more verbal nature of experts (71.8, 36, and 59.33 lines per group respectively) and adds a new dimension to the concept of expertise because of an identifiable pattern of operator and assertion use by Group X. Their operator and assertion use reveals the following: (a) experts perceive and prioritize patient variations by actively forming relationships in search of patterns; (b) once experts confirm the presence of a pattern, they determine the probability of the patient experiencing a cardiopulmonary arrest; (c)
experts select and implement interventions with a higher probability of positively affecting patient outcome; and (d) experts are more proactive with regard to the inevitability of cardiopulmonary arrest. The operators provide the concepts and the assertions provide the linkages within the transcripts that make these inferences feasible. Additional research concerning the concept of expertise should be aimed at supporting these premises in a larger more homogeneous sample of expert Registered Nurses. Future studies should also include a tool to quantify and validate subjects' self perception of expertise, as this attribute influenced operator and assertion use and could be an important indicator that the expert level of practice has been attained by the subject.

In this study, the Stage Two think aloud (TA) method of data collection provided more than ample data for analysis, with Stages Three and Four providing confirmatory data. For future studies, an important focus will be to eliminate subjects' reasons not to talk by having a more reliable means of selecting experts. However, the concept expertise continues to remains elusive with regard to a precise definition.

Practice

Of the fifteen subjects in this study, only nine (Group B) attained 75% or greater of the operators thought to complete the structure of clinical reasoning in pre-cardiopulmonary arrest (Appendix Q). The clinical reasoning data of these experts cluster around the operators and requires the presence of assertions to link data. The operators organize the data into meaningful chunks of information. When asked to recall a pre-
cardiopulmonary arrest event, experts first had to recall the circumstances surrounding the event. In the clinical setting, organizing the clinical data into a meaningful pattern represents a minimum of 50% of the RN role. The predominant use of the operator Scenario Set confirms this premise and as well as the importance of the subcategories search and variations within this operator. Assertions represent a reasoning about the data being attended to by the RN. The experts predominately used indicative assertions (suggest significance) to link the evolving patterns in scenario set (variations) with the other operators. The primary variables in the pattern included altered level of consciousness, dyspnea, and hypotension. These variations are labeled primary because all four data sources considered the items to be significant [two-thirds of the study subjects (N = 15), two-thirds of the study experts (n = 9), a majority of the panel of experts (N = 5), and the literature (Table 21)]. The secondary variables in the pattern included abnormal lab data, age, dysrhythmias, procedures, breathing pattern, and heart rate/pulse. These variations are labeled secondary because three of the previously mentioned data sources considered the items to be significant: two-thirds of the study subjects (N = 15), two-thirds of the study experts (n = 9), a majority panel of experts (N = 5), or the literature (Table 21). Based on these findings, the proposed Structure of Clinical Reasoning (Appendix U) supports the validity of clinical reasoning prior to a cardiopulmonary arrest event.
The primary variations are "red flags" for nurses to consider in the clinical setting, but the weighting of the more subtle secondary variations can be problematic for less expert nurses. Hospitals utilize flow sheets on which to record data, but linking that data in a meaningful pattern is key. It is important for practicing nurses to learn that experts found these primary and secondary variables important. But, it is more important for less expert nurses to learn the process of identifying evolving patterns, making proactive decisions, choosing more effective interventions, and expecting positive outcomes. The process of establishing the linkages and identification of a pattern is more important than identification of individual patient variations. This is probably why a tool listing specific pre-cardiopulmonary arrest variables may be of only limited assistance to expert nurses.

Years of experience within the current work environment was found to be important in this study because it reflects repeated exposure to similar situations and allows experts to optimize their processing of data. However, hospitals today frequently find their acute care units staffed with individuals relatively new to the practice of nursing. Tool development may be possible to emphasize primary and secondary variations, but it may be more important for institutions to rearrange existing flow sheets to place the primary and secondary variations together to make it easier for the nurse to formulate a picture of a patient in trouble needing intervention before a cardiopulmonary arrest occurs.
In practice, communication is an important concept. The literature cited communication breakdown as a problem with prevention of cardiopulmonary arrest. In this study, communication was cited as a subcategory of intervene, with over two-thirds of the study sample ($n = 15$) and two-thirds of the study experts ($n = 9$) mentioning some form of communication with the physician (Appendix S). Communication with the physician allows the nurse to validate a decision(s) and intervene more effectively in the acute care setting. Communication, or lack of communication, with the physician could impede a decision about an action and, as a result, allow a pre-cardiopulmonary event to progress to cardiopulmonary arrest. Communication and its impact on the prevention of cardiopulmonary arrest is worth further exploration.

The literature also cited medication errors as a concern in the prevention of cardiopulmonary arrest. In this study, medications were mentioned by 93% ($n = 15$) of the study sample and 100% ($n = 9$) of the study experts as important when considering the care required by the patient to prevent cardiopulmonary arrest (Table 12). This concept and its impact on the prevention of cardiopulmonary arrest is worth further exploration. In summary, it is important for nursing students and less experienced Registered Nurses to identify evolving patterns and link operators in order to make decisions and influence outcome. Pattern recognition comes with experience and is best mentored in the clinical setting.
Education

The question for education is “How do we hasten the process of Registered Nurses acquiring expertise?” As stated previously, clinical reasoning is viewed as a process and series of judgments, with both of these concepts relating to the nursing process (reasoning equating with assessment; judgment equating with nursing diagnosis). The nursing process is taught to nursing students across the nation as a method for reasoning through clinical problems. Expert Registered Nurses, however, seem to reason more conceptually, linking data to form meaningful patterns.

The operators Scenario Set, Intervene, Decision/Rationale, and Outcome identify the stages of the clinical reasoning processes of expert acute care nurses in pre-cardiopulmonary arrest events. There are elements of the nursing process present in each of the operators. The operator Scenario Set, like assessment in the nursing process, represents reasoning about patients’ histories and includes a search for objects that represent variations in disease progression as well as variations in signs and symptoms. It is, however, the observational, indicative, and conditional assertions that link the data within the operator Scenario Set, providing a basis for determining a pattern. It is the teaching and learning of these linkages in the clinical setting that has the potential power to enhance development of expertise. The patient may present with subtle or catastrophic signs and symptoms, but until connections are made concerning their importance, they remain, for beginners, just isolated signs.
and symptoms. Mentors, be they teachers or colleagues, should point out the most important and very specific variations they consider and discuss these patterns with less expert nurses.

The operator Decision/Rationale, like nursing diagnosis, represents a decision to intervene and provides a rationale for this care. This brief evaluation period seems to be an important aspect of clinical reasoning. In this retrospective data collection process, the experts evaluated their care for effectiveness and efficiency with regard to the patient outcome. The experts made more positive decisions and took a more proactive stance with regard to the inevitability of cardiopulmonary arrest. The decisional/action assertion is important in relation to this operator because of the experts' linkage with outcome: experts expected their decisions and actions to favorably impact patient outcome. For educators, the act of making a decision cannot be underestimated. Experts should have less experienced nurses verbalize their decisions. When mentoring new nurses, experts should describe their decisions and rationales to intervene or not intervene. Delays in making decisions could be as damaging as incorrect conclusions. By verbalizing their decisions, the experts help the less expert nurses to understand their decision making processes.

The operator Intervene represents the subjects' thought processes about the acts performed to prevent cardiopulmonary arrest and mirrors the implementation phase of the nursing process. Expert actions ranged from general to very specific. Educators require student nurses to submit care plans detailing independent and dependent nursing interventions in
sufficient depth to show a grasp of what nursing "does" in the clinical setting. Detail at the novice stage is important, but faculty mentoring different reasoning strategies in the clinical setting reduces the chance of less experienced nurses thinking there is one way, and only one way, to accomplish a task. In addition, because experts select fewer, more targeted interventions, mentoring by faculty and clinical experts in the clinical setting exposes less experienced nurses to more effective and efficient interventions in specific situations.

The last operator, Outcome, is a consequence of interventions and mirrors the evaluation phase of the nursing process. The presence of an outcome seems to be important because it denotes that the expert made the best decisions and implemented the most effective interventions. Expert outcomes are more positive, once again indicating a more positive stance with regard to the inevitability of cardiopulmonary arrest. The interpretive assertions (explanation) link the operators decision/rationales and outcomes, assisting the expert to explain patient outcome and think about alternatives the next time a similar scenario is encountered. Clinical nurse experts need to continually emphasize the importance of linking information to formulate a cohesive picture of the patient.

Nursing process is taught across all nursing educational programs and movement toward expertise can be affected by emphasizing the linkages between the data, not just the data itself. Outcome competencies, however, vary between BSN and ADN programs. One major difference between the ADN and BSN programs is time. An ADN program is meant to
be completed in a 2 year period of full-time study, while a BSN program requires 4 years of full-time study for completion. Though the nursing content in a BSN program is typically during the last two years, the first two years of prerequisites and exposure to the university setting allow students, despite their age, to experience an environment where intellectual discourse is valued. This time may be one of the critical factors in the development of a beginning level of critical thinking and for the development of verbal expression.

A second major difference between programs is curriculum content. Both programs emphasize the provision of direct care to clients and their families, but BSN programs additionally focuses on leadership roles, community health nursing, and nursing research. These concepts may be introduced in courses at the ADN level, but more hours are devoted to their study at the BSN level. More content on concepts important to nursing may affect a beginning level of critical thinking and the development of verbal expression; more content and a broader world perspective could affect the think aloud data collection process; more experience across a broader range of concepts could affect the think aloud data collection process.

College affects students, but to what degree there is a difference between ADN and BSN is not clear in this study.

At this time, undergraduate schools of nursing prepare nurse generalists. This means that students are exposed to “common” situations and events related to the health of individuals across the lifespan. What is lacking, however, is a uniform listing of “common” situations that every
student must have in the clinical setting. Such a listing may further the clinical reasoning of students as “generalists” and assist in their selection of a speciality of interest upon graduation. Upon graduation and selection of a clinical area, graduates require further mentoring by expert nurses in specialty settings to learn to select the most effective and efficient interventions for situations commonly encountered in the that setting. This mentoring needs to continue for longer than the standard six week orientation in order for graduate nurses to begin to comprehend the complexity of interventions in the context of the specialty setting. For this reason, internships with didactic and clinical components offer new graduates the best opportunity to process and apply information in a manner that fosters the selection of the most effective and efficient nursing interventions.

Communication with physicians and other team members should also be encouraged with less expert nurses because it opens alternative interventions and enhances interpersonal communication between professionals. Mentoring by faculty and staff in the clinical setting with physicians provides a basis for open communication and aids in removing the fear of talking with a physician or calling a physician about a patient. In summary, one way to hasten the process of Registered Nurses acquiring expertise in the prevention of cardiopulmonary arrest rests with the early identification of patterns and the processing of linkages to disrupt a detrimental pattern. The linkages between the operators provide a pathway to expertise.
Recommendations for Future Research

The following recommendations are based on the findings of this study:

1. The Nursing Expertise Research Model should be further developed and refined through future research.

2. Peer and Management nomination facilitated the selection of experts for this study by providing a pool of nominees, but future studies should utilize additional variables to select expert Registered Nurses including: (a) specialty certification; (b) the designation of at least a minimum number of years in the specialty area; (c) the selection of full time direct patient care providers (exclude managers and educators); and (d) evidence of having been mentored by experts.

3. Further studies should include a method to quantify and validate subjects' self perceptions of expertise.

4. Further studies utilizing the Structure of Clinical Reasoning (Appendix Q) are needed, perhaps focusing on concurrent events that involve nursing responses.

5. Further studies focusing on the operators decision/rationale and outcome should be conducted to determine their effect on preventing cardiopulmonary arrest.

6. Further studies focusing on indicative and decisional/action assertions should be conducted to determine their effect on preventing cardiopulmonary arrest.
7. Further studies should be done to compare outcomes for patients of less expert Registered Nurses with expert Registered Nurses (Group A versus Group B as well as Group X versus Group Y).

Summary

In this research study the clinical reasoning of fifteen expert acute care Registered Nurses in pre-cardiopulmonary arrest events was examined using the think aloud method and a three step method of protocol analysis. Conclusions and recommendations were made concerning theory development, the selection of experts, the utilization of the operators and the assertions in practice settings, and the relationship of the operators and assertions to the nursing process and their application to affect the educational process of nursing students and new graduates.

The study findings yielded a rich description of the clinical reasoning processes of expert acute care Registered Nurses in pre-cardiopulmonary arrest events with an emphasis on processing linkages in order to identify a pattern. Important knowledge added to the field of study, particularly with regard to the concept of expertise, includes: (a) self perception of expertise may be one indicator that expertise in nursing has been attained; (b) expertise may be attained through continual refinement of clinical reasoning processes in the practice environment or by constant exposure to different situations in the practice environment; and (c) the definition of expert acute care Registered Nurse may need to be limited to individuals who maintain a practice providing direct patient care in the critical care environment, thus excluding nurse managers and nurse
educators.
Appendices
Appendix A

Nursing Expertise Research Model

Figure 2. Nursing Expertise Research Model
Figure 2: Visual Representation of the Operators “Searching,” “Variation,” and “Foreboding.”
Title of Study: A Descriptive Analysis of the Clinical Reasoning of Expert Acute Care Nurses in post-cardiopulmonary Arrest Events

Principal Investigator(s): Alve Ashcraft
(Ne Unless type or print) (Department) (Tel. No.)

Faculty Sponsor(s): Susan Grobe, PhD, RN
(Name - type or print) (Department) (Tel. No.)

Estimated period of human subject involvement: Starting date: 2-15-00 Ending date: 8-30-00

Reason for conducting research: Professional Dissertation Thesis Class Assignment Other (specify)

Source of funding (if applicable): None

Criteria for Exemption from IRB Review:

Exemptions pertain to legal adults in noncompromised situations only. Situations which do not qualify for an exemption concern prisoners, pregnant women, fetuses, persons confined in mental hospitals, state schools, nursing homes, or other facilities where the individual's freedom of movement might be restricted. Any research in which the subjects or their legal representatives sign a Consent Form cannot qualify as exempt and must undergo full board review. Any research in which the subjects are filmed or videotaped cannot qualify as exempt and must undergo full board review. However, some benign studies in which subjects are audiotaped may qualify for exemption. NOTE: Interviews and surveys with children are never exempt. The Institutional Review Board reviews all research involving children.

A Cover/Information Letter addressed to respondents must accompany any survey or questionnaire. The Cover/Information Letter must include the following: (Refer also to "Cover/Information Letter Checklist" and "Sample Cover/Information Letter for Exempt Proposals")

1. a statement that the project is research being conducted in partial fulfillment of the requirements for a course, master's thesis, dissertation, etc.,
2. purpose of the study,
3. a statement that subjects' responses will be kept anonymous or confidential (explain extent of confidentiality if subjects' names are requested),
4. if audiotaping, a statement that subject is being audiotaped (explain how tapes will be stored or disposed of during and after the study),
5. a statement that subjects do not have to answer every question,
6. a statement that class standing, grades, present or future association with The University of Texas at Austin (or other institution, individual), status on an athletic team, if applicable, will not be affected by refusal to participate or by withdrawal from the study,
7. a statement that participation is voluntary.
Attached are:

- Synopsis of Proposal
- Cover/Information Letter (3 copies)
- Questionnaire/Survey to be used
- Telephone Text (including introductory remarks as in a Cover/Information Letter - see cover)
- Permission from external institution, on their letterhead (if applicable)
- Proposal or Selected Elements in the case of lengthy documents, e.g., dissertations:
  a. Problem/statement of purpose/hypotheses and/or research questions.
  b. Description of:
     (1) Population/Sample
     (2) Variables for which data/measurements/observations will be collected
  c. Copy of data collection procedures and measurement tools

I have reviewed the above information and fully intend to comply with the letter and spirit of The University's Assurance and policies. I further acknowledge my responsibility to report any significant changes in the protocol and to obtain written approval for these changes, in accordance with the procedures, prior to making these changes.

[X] (Signature of Principal Investigator(s)/Student(s)) [1/22/00] (Date signed)

Indicate the exemption category number claimed under 45 CFR 46.101(b): 2

I have reviewed the above information and recommend this study for exemption:

[X] [X] (Signature/Date) (Signature/Date)

If funding is being sought, send this application (one set only - with original signatures, proposal, and attachments applicable to the study) to the Office of Sponsored Projects, Main Building, Room 303, F3900.

If no funding is involved, send this application (one set only - with original signatures, proposal, and attachments applicable to the study) to the Office of Sponsored Projects, Main Building, Room 303, F3900; it will remain on file for three years.
January 26, 2000

TO: Alyce Ashraft, MSN, RN

RE: Proposal: “A Descriptive Analysis of the Clinical Reasoning of Expert Acute Care Nurses in Pre-arrest Situations.”

The above referenced protocol and informed consent has been:

- X Approved
- Conditionally approved (see remarks below)
- Tabled for future consideration
- Disapproved (see remarks below)
- Not Considered
- Closed
- Reviewed and approved for an additional year


Sincerely,

Daniel L. Buche, FACHE
Chairperson
Institutional Review Board
February 3, 2000

Alyce S. Ashcraft, MSN, RN, CS, CCRN
College Station, TX 77845

Dear Ms. Ashcraft,

Thank you for the opportunity to participate in your research. It will not be necessary to present your proposal to a committee.

Please let us know when you want to interview the nurses, and we will assist you.

Maxine Creek, MS, RN
Chief Nursing Officer
College Station Medical Center
Appendix F
Expert Panel
Pre-Cardiopulmonary Arrest Signs and Symptoms
Questionnaire

You are invited as a member of an expert panel to assist in the development of probe questions for a study of the clinical reasoning of acute care Registered Nurses in pre-cardiopulmonary arrest events. The expert panel will aid in the development of a rank order listing of the signs and symptoms that frequently occur prior to cardiopulmonary arrest. Probe questions will be formulated from the results of this questionnaire to assist in ensuring that a subject’s recollection of the pre-cardiopulmonary arrest event has been comprehensive and inclusive of the most important information.

Please write your answers directly on the questionnaire and complete the demographic form. When finished, place the questionnaire and demographic form in the attached stamped, addressed envelope and mail it by April 10, 2000. If you should have any questions, please do not hesitate to call me (W: ; H: ). Thank you for your time and expertise. It is very much appreciated.

Sincerely,

Alyce S. Ashcraft MSN, RN, CS, CCRN
Doctoral Candidate
The University of Texas at Austin

208
Pre-Cardiopulmonary Arrest Signs and Symptoms

Part I Please answer the following questions.

A. What pre-cardiopulmonary arrest signs and symptoms may be exhibited by the neurological system?

B. What pre-cardiopulmonary arrest signs and symptoms may be exhibited by the cardiovascular system?

C. What pre-cardiopulmonary arrest signs and symptoms may be exhibited by the respiratory system?

D. What pre-cardiopulmonary arrest signs and symptoms may be exhibited by the gastrointestinal system?
E. What pre-cardiopulmonary arrest signs and symptoms may be exhibited by the renal system?

_________________________________________  ____________________________
_________________________________________  ____________________________
_________________________________________  ____________________________
_________________________________________  ____________________________

Part II  Select the top ten priority signs or symptoms from your listings above and place them in rank order (1 being the most important sign or symptom) without regard for the body system being assessed.

1. ________________________________
2. ________________________________
3. ________________________________
4. ________________________________
5. ________________________________
6. ________________________________
7. ________________________________
8. ________________________________
9. ________________________________
10. ________________________________
Part III  What other contributing factors might you consider in an effort to identify a patient who is in an emergent pre-cardiopulmonary arrest state?
Demographic Information

Age:
How many hours per week do you currently work in acute care?
How many hours per week do you currently teach in acute care?
How many years have you worked in acute care? (specify clinical areas if possible)

Current work setting:
Are you certified in any specialty? Yes No
What specialty? What organization?
Date of original certification:

Highest degree held: Associate Baccalaureate Masters PhD (Circle One)

Highest degree in nursing held:
Associate Baccalaureate Masters PhD (Circle One)

Do you consider yourself to be an expert nurse? Yes No

Briefly, why or why not?

Thank you for your time and assistance. Please contact me if you have any questions.

212
Appendix G
Recall Probe Questions
Stage Three

These questions, developed from the review of literature and from the results of the Pre-Cardiopulmonary Arrest Signs and Symptoms Questionnaire (Appendix F), were used to ensure that specific areas had been covered concerning the subject’s recollection of the pre-cardiopulmonary arrest event. A question was asked only if the subject did not cover the topic in Stage Two.

1. Did you consider (or did you notice) any of the following signs or symptoms in your assessment data?

   Any alteration in intracranial pressure, in particular
   (a) change in level of consciousness (consider the subject covered if any of the following words are used: level of consciousness, anxiousness, irritability, restlessness, slowed thinking, lethargy, confusion, hallucinations, somnolence, stupor)?
   (b) change in pupils?
   (c) change in breathing pattern?

   Any alteration in blood pressure, in particular hypotension?
   Any change in heart rate/pulse?
   Any particular dysrhythmia?
   Any change in respirations including rate? rhythm? depth? effort?
   Decreased oxygen saturation?
Cyanosis (consider the subject covered if mention is made of color)?
Decreased urine output?

3. What was the patient doing when there was a change in their clinical status?

4. Did the patient ever talk of death as being imminent?

5. Did you consider anything in particular in the patient’s history?

6. Did the patient have a dependent lifestyle prior to admission?

7. What was the patient’s current medical diagnosis?

8. Were there any other chronic illnesses that were important to consider?
   If so, what were they?

9. Were any procedures or surgery performed during the hospitalization?
   Did you consider their results?

10. Did you consider any particular lab values?

11. Did you consider the patient’s nutritional state?

12. Did you consider the medications the patient was currently taking?
   If so, what were they?

13. Was the patient’s age a factor? If so, how old was the patient?

14. Have you ever heard of the Pre-arrest Morbidity Index (PAM) or the APACHE (Acute Physiology, Age, Chronic Health Evaluation) Prognostic System?
   Have you ever used either index in your practice?
   Do you think a systematic assessment that could quantify prearrest variables would be helpful in your practice?
   Why or why not?
15. Is there anything else you wish to mention at this time as being important in your role of preventing a cardiopulmonary arrest?
Appendix H
An Invitation to Participate in a Nursing Research Study
Title: A Descriptive Analysis of the Clinical Reasoning of Expert Acute Care Nurses

Expert Nurse Nomination by Registered Nurse Peer Consent Form

You are invited to participate in the initial phase of a doctoral study of expert acute care nurses' clinical reasoning. My name is Alyce Ashcraft and I am a student at The University of Texas at Austin, School of Nursing. The results of this study will be used for completion of my doctoral dissertation. I hope to learn more about how expert acute care nurses think in certain situations. You have been selected for the first phase, which requires the identification of expert Registered Nurses on your unit by peers.

If you would like to participate, simply fill out the form below and put it in the box located on your unit labeled “Nursing Research Study” before April 15, 2000. Your completion of the bottom section of this form indicates your willingness to participate and serves as your consent to have the information used for the purposes of the study. Any information that is obtained in connection with this study and that can be identified with you will remain confidential. This includes the names of the nurses you choose to nominate. There are no foreseeable risks for your participation, other than the inconvenience of your time. You will not receive any monetary compensation for participation in the study. The overall benefits of the study will be a contribution to nursing research.

Your decision to participate or refusal to participate will not affect your future relations with The University of Texas at Austin or your current employee—employer relationship. If you decide to participate, you are free to discontinue participation at any time. If you have any questions, please ask me. If you have any additional questions later, please call me, Alyce Ashcraft, MSN, RN (1-409-), or my advisor, Susan Grobe PhD, RN (1-512-), The University of Texas at Austin, School of Nursing, 1700 Red River, Austin, Texas 78701) and we will be happy to answer them. You may retain the upper portion of this letter that explains the nature of your participation and the handling of the information you supply.

An expert Registered Nurse is able to understand the problems, issues, and concerns of patients and their families and is able to respond to meet these needs in concerned and involved ways. An expert Registered Nurse sees the “big picture” and can anticipate the unexpected. The expert Registered Nurse is recognized by peers and management as being involved and working well with others for the benefit of the patient.

Unit: __________________

Name two Registered Nurses on your unit who best exemplify this definition.

1. ______________________ 2. ______________________

Thanks for your time!!
Appendix I
An Invitation to Participate in a Nursing Research Study
Title: A Descriptive Analysis of the Clinical Reasoning of Expert Acute Care Nurses

Expert Nurse Nomination by Head Nurse/Nurse Manager Consent

You are invited to participate in the initial phase of a doctoral study of expert acute care nurses' clinical reasoning. My name is Alyce Ashcraft and I am a student at The University of Texas at Austin, School of Nursing. I hope to learn more about how expert acute care nurses think in certain situations. The results of this study will be used for completion of my doctoral dissertation. You have been selected for the first phase, which requires that you identify the expert Registered Nurses on your unit.

If you would like to participate, simply fill out the form below and mail it in the attached self-addressed stamped envelope before April 15, 2000. Your completion of the bottom section of this form indicates your willingness to participate and serves as your consent to have the information used for the purposes of the study. Any information that is obtained in connection with this study and that can be identified with you will remain confidential. This includes the names of the nurses you choose to nominate. There are no foreseeable risks for your participation, other than the inconvenience of your time. You will not receive any monetary compensation for participation in the study. The overall benefits of the study will be a contribution to nursing research.

Your decision to participate will not affect your future relations with The University of Texas at Austin or your current employee-employer relationship. If you decide to participate, you are free to discontinue participation at anytime without prejudice. If you have any questions, please ask me. If you have any additional questions later, please call me, Alyce Ashcraft, MSN, RN (1-400-123-4567), or my advisor, Susan Grobe, PhD, RN (1-512-234-5678). The University of Texas at Austin, School of Nursing, 1700 Red River, Austin, Texas 78701) and we will be happy to answer them. You may retain the upper portion of this letter that explains the nature of your participation and the handling of the information you supply.

An expert Registered Nurse is able to understand the problems, issues, and concerns of patients and their families and is able to respond to meet these needs in concerned and involved ways. An expert Registered Nurse sees the "big picture" and can anticipate the unexpected. The expert Registered Nurse is recognized by peers and management as being involved and working well with others for the benefit of the patient.

Unit: __________________

Name the Registered Nurses on your unit who best exemplify this definition.

1. __________________
2. __________________
3. __________________
4. __________________
5. __________________
6. __________________
7. __________________
8. __________________
Appendix J
An Invitation to Participate in a Nursing Research Study
Title: A Descriptive Analysis of the Clinical Reasoning of Expert Acute Care Nurses

You are invited to participate in a study of expert acute care nurses' clinical reasoning. My name is Allyce Ashcraft and I am a doctoral student at The University of Texas at Austin, School of Nursing. The results of this study will be used for completion of my doctoral dissertation. I hope to learn more about how expert nurses think in certain situations. You have been selected because of recognition by your peers and/or nursing management as an expert Registered Nurse. You will be one of fifteen subjects chosen to participate in this phase of the study.

Participation in this study is voluntary. If you decide to participate, I, Allyce Ashcraft RN, MSN, will schedule a 30 minute appointment with you during one of your shifts at the hospital that will take place in a quiet room on your unit as a scheduled break from patient care. During this meeting I will ask you reason about a specific patient situation and to complete a demographic data sheet. The session will be audio-tape recorded for transcription and analysis at a later date. You will not receive any monetary compensation for participation in the study. The overall benefits of the study will be a contribution to nursing research.

The study procedures present no risk or discomfort to you other than the possible inconvenience of your time. An individual benefit of the study is knowing that you are recognized by your peers as an expert acute care Registered Nurse and an overall benefit is your contribution to nursing research. Any information that can be associated with you as a study subject will be kept confidential. You will not be identified by name on the tape, written transcripts, notes or subsequent published reports of this research. Only codes will be used to identify study subjects. Code lists, tapes, and materials containing data from subjects will be kept in secure locations known by the investigator and will be destroyed after five years.

Your decision to participate or refusal to participate will not affect your future association with The University of Texas at Austin or your current employee-employer relationship. If you decide to participate, you are free to discontinue participation at any time. If you have any questions, please ask me. If you have any additional questions later, please call me, Allyce Ashcraft, MSN, RN (123-456-7890), or my advisor, Susan Grobe PhD, RN (123-456-7891). The University of Texas at Austin, School of Nursing, 1700 Red River, Austin, Texas 78701) and we will be happy to answer them. You will be offered a copy of this form that explains the nature of your participation in the study and the handling of the information you supply.

You are making a decision whether or not to participate. Your signature indicates that you have read the information provided and decided to participate. You may withdraw at any time after signing this form. Should you choose to discontinue participation in this study.

______________________________ Date: ________________
(Participant Signature)

______________________________ Date: ________________
(Investigator Signature)
Appendix K
Demographic Information

Age:
Are you employed full-time or part-time? (Circle one)
Number of years you have worked as a Registered Nurse:
Current work setting: (Circle one of the following)

- ICU
- CCU
- Progressive Care/Subacute Care/Telemetry
- PACU

Other (please specify): _______________

Number of years experience in above setting:
Number of years experience in related settings:
Are you certified in any specialty? Yes No
If so, what specialty? And by what organization?

Date of original certification:
Highest degree held: Associate Baccalaureate Masters
(Circle One)

Highest degree in nursing held:

Associate Baccalaureate Masters
(Circle One)

Do you consider yourself to be an expert nurse? Yes No
Briefly, why or why not?
Appendix L
Research Protocol Checklist

1. Talk with each unit’s head nurse/nurse manager and distribute forms requesting expert acute care Registered Nurse (RN) nominations by April 15, 2000.

2. Compile results of nominations.

3. Obtain schedules/phone numbers from the unit’s head nurse/nurse manager for each identified expert acute care RN.

4. Call/meet with each identified expert acute care RN and request participation in the study. A mutually convenient time and potential room will be scheduled for data collection with the expert acute care RN.

5. Take the following supplies for data collection:
   • tape recorder with extra batteries
   • large envelope labeled with the subject’s code number containing the consent form, demographic data sheet, blank tape marked with the subject’s code number, extra blank tape
   • “DO NOT DISTURB–RESEARCH IN PROGRESS” sign
   • field notebook

6. Arrive at data collection site 30 minutes early.

7. Check room lighting, arrangement of furniture. Set up tape recorder
and check functioning.

8. Go to unit and wait for subject.

9. Escort subject to room and have them sit comfortably close to the tape recorder facing the researcher to simulate a conversation type atmosphere.

10. Place “Research in Progress” sign on the door.

11. Have subject read and sign consent.

12. Review what will take place during the session with the subject:

    • Tape recorder will be turned on.
    • Think Aloud session
    • Completion of demographic data sheet

13. Turn tape recorder on and record beginning time. ______________


    **Stage One**

    a. **Researcher questions:** “As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care patients need to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?” (If the answer is “Yes,” proceed to stage two. This probe may also lead to the subject spontaneously presenting a scenario without prompting.)
b. If answer is no, **researcher asks** “Why not?” (If this is the answer, **conclude** interview by thanking participant for their time.)

**Stage Two**

a. **Researcher queries** “Tell me all about a clinical situation when you prevented a patient from arresting--in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.”

b. If subject pauses for > 5 seconds, **researcher asks** “Now that you have recalled the event, are there any other details you wish to include but did not mention?”

**Stage Three**

**Researcher asks** probe questions: We are almost through. I just want to ask a few questions to make sure I have recorded, as thoroughly as possible, your recollection of the event.

a. Did you consider (or did you notice) any of the following signs or symptoms in your assessment data?

   Any alteration in intracranial pressure, in particular
   (1) change in level of consciousness (consider the subject covered if any of the following words are used: level of consciousness, anxiousness, irritability, restlessness, slowed
thinking, lethargy, confusion, hallucinations, somnolence, stupor)?
(2) change in pupils?
(3) change in breathing pattern?
Any alteration in blood pressure, in particular hypotension?
Any change in heart rate/pulse?
Any particular dysrhythmia?
Any change in respirations including rate? rhythm? depth? effort?
Decreased oxygen saturation?
Cyanosis (consider the subject covered if mention is made of color)?
Decreased urine output?
b. What was the patient doing when there was a change in their clinical status?
c. Did the patient ever talk of death as being imminent?
d. Did you consider anything in particular in the patient’s history?
e. Did the patient have a dependent lifestyle prior to admission?
f. What was the patient’s current medical diagnosis?
g. Were there any other chronic illnesses that were important to consider? If so, what were they?
h. Were any procedures or surgery performed during the hospitalization? Did you consider their results?
i. Did you consider any particular lab values?
j. Did you consider the patient's nutritional state?

k. Did you consider the medications the patient was currently taking? If so, what were they?

l. Was the patient's age a factor? If so, how old was the patient?

m. Have you ever heard of the Pre-arrest Morbidity Index (PAM) or the APACHE (Acute Physiology, Age, Chronic Health Evaluation) Prognostic System? Have you ever used either index in your practice? Do you think a systematic assessment that could quantify prearrest variables would be helpful in your practice? Why or why not?

n. Is there anything else you wish to mention at this time as being important in your role as a professional nurse of preventing a cardiopulmonary arrest?

**Stage Four**

**Researcher asks** “What would you tell a less experienced nurse about preventing cardiopulmonary arrest?”

15. Turn tape recorder off and record ending time. __________________

16. Ask subject to complete demographic data form.

17. Thank subject.

18. Collect equipment and supplies.

19. Proceed to next subject or return home and file data under subject’s code.
Appendix M.1

RPA--Interview #1

**Researcher:** As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Yes, by ah . . .
L2 *just usually by your um . . .*
L3 **observation of the patient.**
L4 *And other times you can ah . . .*
L5 *intervene before um . . .*
L6 *intervene and be able to . . .*
L7 *[be able to] get medical attention prior,*
L8 *[be able to] treat prior to the actual arrest.*

**Researcher:** Tell me all about a clinical situation when you prevented a patient from arresting— in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L9 Hmm. Let me think.

**Researcher:** Take your time.

L10 Well . . .
L11 ah . . .
L12 *usually it would be a patient that’s fairly compromised anyway.*
L13 Um, *maybe somebody that was . . .*
had cardiomyopathy or severe cardiac compromise

maybe somebody that had fluid overload in surgery.

In the recovery room, just by observation of the fluid status

maybe um . . .

[just by observation of] their lung situation,

by listening to their lungs and

maybe starting to hear some crepitus and um . . .

[starting to hear] fluid overload in the patient's . . .

observation of their jugular vein distention

um . . .

[observation of ] rapid, shallow breathing

um . . .

they [the patient] would probably be

um . . .

quite tachycardic.

Um . . .

just observing the whole situation

of seeing how much urine output they've had

and [seeing] if their blood pressure is low

and [if] they have had to have quite a lot of resuscitation with crystalloid,

they may not be able to um . . .

compensate with that [crystalloid].
So, just by the observation of that [crystalloid] maybe ah...

maybe the patient ah...

bled a little bit more than what they thought,

maybe the patient needs blood products rather than crystalloid

and um...

[maybe the patient needs] some diuresing just to reestablish

and sometimes that patient may need um...

invasive monitoring to actually find their status

to be able to correctly um...

[to be able] to correctly treat them [the patient]

and then the patient may have um...

some arrhythmias

maybe patient may [have] become so tachycardic that they may

have become um...

[may have] gone into an atrial fibrillation which would increase the

um...

[would increase] fluid overload.

Researcher: Now that you have recalled the event, are there any other details you wish to include but did not mention?

Um...

sometimes just[observing] the color of the patient

and just somehow or other I think, over experience, just [observing]

the look of the patient
L54 and that gut feeling that you have
L55 and I know that some people say that 50% of gut feelings are wrong but usually if I have the gut feeling about something,
L56 I act on it [the feeling] because 9 times out of 10 my gut feeling tends to go that way.

**Researcher:** Tends to be right?
L57 Yeah, it does [tend to be right].

**Researcher:** And even if it's wrong, what does that do? You protected the patient.
L58 Yes, and . . .
L59 and alot of times its just that gut feeling that makes you intervene
L60 or just observe just that little bit closer
L61 so that you can pick up on things maybe a little bit sooner than what you would in normal circumstances.

**Key:** *Italics* = referring phrase(s)
**Bold** = object of a verb, verb phrase, or gerund
Underlined Text = verb(s) or verb phrase(s) (including gerunds)
[ . . . ] = implied verb repeated from previous line
Appendix M.2

RPA–Interview #2

**Researcher:** As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Yes

**Researcher:** Tell me all about a clinical situation when you prevented a patient from arresting—in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L2 Ah . . .

L3 *mainly by recognizing* ah . . .

L4 *change in patient condition*

L5 *whether it be arrhythmias*

L6 *or even patterns of the emotional status of the patient* [pause]

L7 *or several key signs to work with them* [the patient].

**Researcher:** Is there any particular patient that comes to mind recently that you cared for that you could say well . . . they had this and I did this, this, this . . .

L8 Yea,

L9 *but they didn’t make it though.*

**Researcher:** That’s, well, that’s all right, ok, they don’t have to make it.

L10 Ok, um . . .,
there was a 91 year old little lady that came in here [Recovery Room] uh . . .

and she had been for an EGD for GI bleed

and she came in here [Recovery Room]

and her breathing at that point was ah . . .

labored . . .

[and] she came in here [Recovery Room] in poor condition.

Ah . . .

within 15 minutes of admission her O2 saturation had dropped.

I called anesthesia,

got blood gasses.

We treated the respiratory aspect very quickly

and then her being 90 years old

her heart just stopped.

didn't tolerate any different arrhythmias which we treated

and spoke with the family

and decided not to do much overall.

Researcher:  So she came in bad and you knew that because she came in bad you had your hands full.

Ah . . .

no,

because she could have stayed . . .

she was like that [poor condition] on the floor
L31 and she could have stayed on the floor like that [poor condition].
L32 The report I got.
L33 she came in.
L34 this is the way [poor condition] she has been.
L35 but I think after the procedure it distressed her too much and she ...

Researcher: Now that you have recalled the event, are there any other details you wish to include but did not mention?
L36 No

Key: *Italics* = referring phrase(s)
*Bold* = object of a verb, verb phrase, or gerund
*Underlined text* = verb(s) or verb phrase(s) (including gerunds)
[... ] = implied verb repeated from previous line
Researcher: As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Um . . .

L2 in many cases.

Researcher: Tell me all about a clinical situation when you prevented a patient from arresting— in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L3 Um . . .

L4 the situations that come most quickly to mind is identifying changes in ECG, blocks and um . . .

L5 just not the . . .

L6 something, something that you observe ah . . .

L7 a block that is perhaps transient um . . .

L8 and then ah . . .

L9 and not consistent so that you start to develop a feeling of something’s going wrong.

L10 So . . .

L11 ah . . .

L12 I mean that’s the one[situation that] comes most quickly to mind.
**Researcher:** Is there a particular patient that comes to mind, that you could talk about? That because you were there you remember that you really made a major difference.

L13 Um...

L14 *The ones [patients] that come quickly to mind are the ones [patients] that...*

L15 that didn’t survive despite everything.

L16 *And those are the ones [patients] that stick with you as well as... you know, the ones that do ok, you just ah... go on over.*

**Researcher:** Tell me about one of those that didn’t survive but... and what you necessarily observed.

L19 Um...

L20 *I had a post thorocotomy patient that I think of immediately because I will never forget this one... that was post thorocotomy to the ICU and ah...*

L21 *that was post thorocotomy to the ICU and ah...*

L22 *was awake, extubated, talking, doing fine, restless, [was] becoming restless a little, couldn’t keep still, you know.*

L23 *needed* Lots of *reassurance* and um...

L24 *then I left the room to help another nurse turn a patient or something and when I came back he had bled out totally into his um... chest tube to the Atrium unit, you know.*

L25 *Boom, all the way, [had to]crack the chest, and the whole thing, and they [physicians] never did find the bleeder.*
But that patient was, you know, awake one minute, and not the next.

Researcher: Not the next.

Yea, he was not alive.

And yet in retrospect, you know,

I had observed, you know,

I had seen the tale-tale signs.

Researcher: What were the tale-tale signs?

The restlessness was key to me,

yet there was nothing that you could put your finger on you know,

[w]hether there was nothing measurable in the chest tube at that time, you know.

And [w]as no particular change in blood pressure

and then you sort of put [have] the tachycardia,

I don't think he was extremely tachycardic,

but,

you know,

[w]as just a little bit [tachycardic] to go along with the restlessness.

And you think he was so...
[He was] anxious cause it was cancer that was being treated, a lung cancer,

so, you know,

[There was] alot of emotion.

[He had] Daughters, no sons, but daughters so there was alot of emotion flying around,

you know,

but . . .

in particular I remember.

I also think of ah . . .

other patient's where I have identified ah . . .

Wenckebach block and uh . . .

I have a patient now that comes back occasionally [to visit]

and she always remembers me because she always says she remembers me,

my voice ah . . .

saying “She’s doing it [Wenckebach block] again.”

She would block right down.

She ended up getting a transvenous pacemaker.

So I guess that was her time.
But...

um...

I didn't know that she had Wenckebach to that degree prior to surgery.

And then you go on to the other cases where you, you know,

when you have shock, you know,

and you want to, you know,

the doctors want to hang dopamine and you want to hang some nitroglycerin as well, you know, and you have to...

in hypotensive situations, you know, that [hanging nitroglycerin] doesn't always make sense but...

you know if you can balance the two [dopamine and nitroglycerin] just right you get a much better effect.

Key: Italics = referring phrase(s)
      Bold = object of a verb, verb phrase, or gerund
      Underlined text = verb(s) or verb phrase(s) (including gerunds)
      [...] = implied verb repeated from previous line
Appendix M.4
RPA--Interview #4

(For this nurse, English is a second language)

**Researcher:** As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 No, I don’t.

L2 *Maybe a few case you can look*, you know,

L3 *may be we can think about*, you know,

L4 *this patient might expire*. . .

L5 *but I don’t think that we’re able to prevent it [cardiopulmonary arrest] for that.*

**Researcher:** Ok, you said a couple of cases you might be able to . . .

L6 *No, no you know we can think about maybe this patient might will go and might, you know, expire*,

L7 *so we can think of this patient look like sick enough. We can just . . .*

L8 *be prepared [for cardiopulmonary arrest] but I don’t think that any, you know, any . . .*

L9 *I do not know maybe alot of, you know, PVCs and stuff we can . . .*

L10 *cardiac arrest we can prevent it for that*

L11 *and notify the doctors first but, you know,*
the ventricle failure is probably the same.

This patient look like going too bad we can call looks bad.

Those kinda stuff but I don't think anything actually happen we can, we can prevent it [cardiopulmonary arrest].

Researcher: Once it actually happens, there's . . . yea . . . right.

Yes

Researcher: Ok, you talked about when, when somebody was going bad that, that their might be something that we can do. Do you remember a particular client that you had where you remember that because you did something you prevented that client from arresting--you did it, and as a result he didn't, didn't go down any further. Can you tell me about an instance?

Well, few cases I can think but I do not know exactly when . . .

you know how long.

Researcher: Just some generalities about what you did, you know because you did something, you made a difference.

When . . .

let me think about it.

You know patient was already intubated, was . . .

heart was ah . . .

already has history of coronary artery disease and already was been . . .

heart rate, you know, goes up a little bit faster go to like SVT . . .

know about the next step the blood pressure going down . . .

so . . .
you know, notify for the doctors . . .

those that we gave him some medicine, I cannot remember . . .

blood pressure is too low to give him Cardizem . . .

we digitalized (gave digitalis to him), you know,

those stuff, we, I think we was been done

and the other thing is respiratory arrest.

Prearrest, prearrest . . .

patient, you know,

breathing shallow and bad enough.

I think we did blood gas

and call the doctors

and started we give him some sodium bicarbs and . . .

just . . .

I do not remember exactly but, you know,

patient did.

poor patient arrested.

I think the doctors came by first

and then we intubated (him).

You know . . .

you know . . .
you know...

the oxygenating (hyperoxygenated him), preventative to hypoxygenating.

Researcher: Right, so you did things that then would stop...

Uh ha.

Uh ha.

Yea.

Actually, you know, actually people we called code. Yea.

Those things we wanted to do it (call the code).

And the other thing is patient [had] alot of PVCs and bigeminys goes around,

we call the doctors

and give him some lidocaine,

stop those, ah...

you know, pre ah...

little geminys, we can stop that [bigeminy]...

I think we done that [give lidocaine to stop bigeminy] before.

And then the other thing is that we done first CABG was a heart rate was, there is no pacer wires.

Heart rate was slowed down

and junction rhythm, escape [goes] back and forth
and then heart rate actually comes down 40s and 50s.

I think we give him the atropine

and then heart rate comes back

and then call the doctor

and of course there is nothing particular we can do at that point.

Just put in a call for the Zoll external pacers on,

put on just preventative.

Just a particular make it anything happen.

**Key:** *Italics* = referring phrase(s)

**Bold** = object of a verb, verb phrase, or gerund

**Underlined text** = verb(s) or verb phrase(s) (including gerunds)

[... ] = implied verb repeated from previous line
Appendix M.5
RPA--Interview #5

Researcher: As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Well, *I believe if you talk to your patient,*
L2 *believe what your patient tells you about their symptoms*
L3 *and you don't just look at your vital signs and your cardiac monitor,*
L4 *I believe you can.*

Researcher: What I'd like you to do is tell me all about a specific clinical situation (specific client) where you prevented a patient from arresting—in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented it from occurring.

L5 *I had a patient once um . . .*
L6 *who couldn't talk,*
L7 *he had a stroke and on my floor we had those little . . .*
L8 *R2D2 monitors, we called them, kinda like they have in ICU . . .*
L9 *and we had him hooked up to the telemetry,*
L10 *his respirations were on the rise,*
L11 *they [respirations] went from 20 in the morning to the mid 40s.*
L12 *His heart rate was racing . . .*
it [heart rate] had gotten up to from the 70s to a 160 . . .

and he was just going downhill fast,

apparently he had been doing this [going downhill] all day long and ah . . .

when I gotten there I saw this [going downhill],

and like this [going downhill] is not normal for this guy,

so I'm listening to everything . . .

I rushed and ordered STAT EKG, STAT chest x-ray, all sorts of stuff.

And then I call the doctor with the results of those things.

Alot of nurses are paranoid about ordering things like that . . .

but ah,

called with the results,

the results were horrible . . .

the guy had ah . . .

actually he had a PEG tube,

it [PEG tube] was misplaced.

It [PEG tube] had been getting flushed with potassium and things like that,

he was getting that [potassium] three times a day.

And it turns out that every time he was getting that flushed in,
He was basically in agony.

Well, we called five different doctors.

None of them [doctors] wanted to do anything.

And they were fortunate enough to call one [doctor] that actually knew the patient on a personal basis.

And we rushed the guy into surgery and it turns out we saved his life because he was very, very close to death.

It [the result] was very nice.

Researcher: Wow, now so this PEG tube was misplaced.

Yea.

Everything was going directly into his abdominal cavity, not into the stomach.

All that potassium was doing was irritating the heck out of him.

Researcher: So he was getting like a liquid potassium.

Yes

Researcher: Oh my goodness.

He was just going nuts.

I mean his pulse would just . . .

at one point his pulse went up to well over 200

and he was feverish.
and I think his temp had gotten up to 102, you know,

he was going through it and no one had . . .

you know, I guess they just didn't care what they said.

Key: *italics* = referring phrase(s)

**Bold** = object of a verb, verb phrase, or gerund

*Underlined text* = verb(s) or verb phrase(s) (including gerunds)

[ . . . ] = implied verb repeated from previous line
RPA--Interview #6

**Researcher:** As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1  *For the most part, yes.*

L2  *I mean especially in the arena of . . .*

L3  *of . . .*

L4  *cardiovascular intensive care unit or CCU my personal belief and what I've, what I've tried to communicate to my nursing students and to my preceptors*

L5  *if your patient arrests, it's your fault . . .*

L6  *because for the most part,*

L7  *and speaking of course in the broadest of terms,*

L8  *but in my, my experience in all my, my whole career has been cardiovascular, cardiothoracic.*

L9  *If your patient arrests, it's . . .*

L10 *you should have seen it [the arrest] coming.*

L11 *And it's [the arrest is] preventable,*

L12 *especially in the realm of acute myocardial infarction,*

L13 *even in, you know, getting into things like um . . .*
PE, getting into the realm of hypotensive events,

getting into the realm of...

I mean...

in very few situations is it possible to not prevent an arrest event from occurring.

Um...

and there in, I try to communicate that to...

even sometimes to my peers

who may be very good nurses but they're novice ICU nurses

and most of our work is tracking and trending of information.

You're looking at the flow sheet,

you're looking at what has gone on.

That's why we work 12 hour shifts, continuity of care,

and if you see something

and go "all right we got, we got six to eight." [PVCs]

A guy had an AMI say...

eyesterday and he's too hot [poor condition] to take to the cath lab

and you're having six to eight, you're having six to eight PVCs a minute

and your magnesium is 1.2.
You know, there are things that you need to be doing.

Um...

and it's, and it's, it's a global approach,

it's not always easy, but...

again for the most part, and in the broadest terms, arrests are preventable.

Researcher: Tell me all about a clinical situation when you prevented a patient from arresting--in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

Two weeks ago we had a patient up here who had an acute myocardial infarction,

he had a global MI, and...

ah...

we were waiting for the guy,

I mean it was a high LAD lesion and...

ah...

the only thing that could have made it [the situation] worse was if it [the lesion] was in the LM.

Ah...

and...

he was having all sorts of arrhythmia problems.

And cardiologist was in route,
cath lab is in route,

we're just gettin(g) this guy ready to go

and he starts blocking down.

Well, he bradyed down to about 30

and he'd come back up,

he'd switch off from a sinus to a junctional,

[he] wasn't having a whole lot of ventricular problems yet,

it [the problem] was mostly conduction system.

What we did, got a mag level,

actually we had a mag level drawn on the lab that was already downstairs,

we put pacing pads on him, and...

ah...

when it came time that he bradyed down,

we paced him back,

gave him a little atropine, ...

it's [the bradycardia is] not a problem.

Ah...

um...

that's, and then...
L68  um . . .
L69  thinking acutely . . .
L70  ah . . .
L71  there was another situation in which I participated in . . .
L72  I wasn’t, I wasn’t the primary nurse but there was another situation that was almost identical to that where we had a guy with um . . .
L73  with dish, and he was having . . .

Researcher:  A guy with . . .
L74  dish.  Yea, ankylosing spondylitis.

Researcher:  Ok
L75  And he [had] C6ed [fractured C6] himself stepping off the bus.
L76  And, in fact he’s still in the ICU
L77  and this we had coded this guy several times
L78  and it [the code] was prevention,
L79  it was all preventative measures by the nursing staff which allowed him to pull through those really awful events.
L80  The guy had a hypomagnesemia,
L81  or however it is you say that,
L82  I mean he was like,
L83  like he was like a 1.1, 1.2 [low numbers reflective of hypomagnesemic state] something like that.
And he kept getting.

he would go from,

he would go from a heart rate of 20,

we would have to pace him all the way up to this v tach,

which...

which we would have to either convert or we would have to give him... um lidocaine for ah...

and it's all preventative, it's all preventative.

Ah...

and you have to be two steps ahead,

you have to be two steps ahead...

cause if you're not, your patient's going to suffer.

That's 100% nursing process right there.

Key: Italic = referring phrase(s)

Bold = object of a verb, verb phrase, or gerund

Underlined text = verb(s) or verb phrase(s) (including gerunds)

[... ] = implied verb repeated from previous line
Appendix M.7

RPA--Interview #7

**Researcher:** As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Yes, I do.

**Researcher:** Tell me all about a clinical situation, involving a specific patient, when you prevented a patient from arresting--in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L2 Oh, the patient is hypoxic

L3 and needing to be ventilated.

L4 You can get the oxygen to them,

L5 specifically the patient started to brady down

L6 and at that point, had he not been adequately ventilated.

L7 he would have gone into complete aystole and arrested.

L8 So we gave him oxygen

L9 and then we gave him some atropine to bring his heart rate up

L10 and then he compensated

L11 and didn't go into an arrest.

**Researcher:** (Silence) Are there any other details about that particular event that you wish to include but did not mention?
No, I don't think so.

Key: *italics* = referring phrase(s)
*Bold* = object of a verb, verb phrase, or gerund
*Underlined Text* = verb(s) or verb phrase(s) (including gerunds)
[... ] = implied verb repeated from previous line
Appendix M.8

AA--Interview #8

Researcher: As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 It’s possible.

Researcher: Tell me all about a clinical situation when you prevented a patient from arresting—in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

At this time the tape was paused because the subject indicated she wanted to talk and not be recorded. She asked exactly what I meant by “prevented?” I told her that prevention is when a nurse does something and, as a result, something does not happen. She said she just wanted to make sure that her definition and my definition were the same. She also wanted to know if this data would be going anywhere else because she was talking about patients. I told her that, just as the consent form stated, she would not be identified by name on the tape, written transcripts, notes, or subsequent reports or articles. That as a researcher, I too am held to an ethical standard. I asked if she wished to withdraw from the study. She said no, she just wanted to make sure of a couple of things.

L2 By notifying the doctor of abnormal, extremely high cardiac enzymes.

L3 We had to get the patient to ICU and emergency heart cath . . .

L4 and she had an acute MI . . .

L5 possibly could have arrested on us probably.

Key: Italics = referring phrase(s)
Bold = object of a verb, verb phrase, or gerund
Underlined Text = verb(s) or verb phrase(s) (including gerunds)
[ . . . ] = implied verb repeated from previous line

254
Appendix M.9
RPA--Interview #9

Researcher: As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 In some circumstances.

Researcher: Tell me all about a clinical situation when you prevented a patient from arresting--in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L2 Hm . . .
L3 had a . . .
L4 63 year old patient presented to the ER with ah . . .
L5 syncope and chest pain,
L6 his friend drove him to the hospital.
L7 We hooked him up to the monitor
L8 and he was in idioventricular rhythm . . .
L9 ah, [was] sweaty, diaphoretic . . .
L10 pressure was low . . .
L11 um, gave him atropine to speed up his heart rate.
L12 Call the doctor.
L13 Put him on oxygen,
L14  started an IV,

L15  got him to ICU . . .

L16  but it [AMI] was impending.

Key:  Italics  = referring phrase(s)
       Bold  = object of a verb, verb phrase, or gerund
       Underlined Text  = verb(s) or verb phrase(s) (including gerunds)
       [ . . . ]  = implied verb repeated from previous line
Appendix M.10

RPA--Interview # 10

**Researcher:** As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Yea

**Researcher:** Tell me all about a clinical situation when you prevented a patient from arresting--in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented it from occurring.

L2 Me specifically, or just anybody?

**Researcher:** Anybody. (This was said because this nurse is one of the unit's charges nurses and does not take direct patient assignment, though she is directly involved in the care of each of the patients on the floor during her assigned shift.)

L3 Ok, um . . .

L4 in the two last weeks we had a patient going into respiratory arrest . . .

L5 um . . .

L6 doctor was called . . .

L7 um . . .

L8 we . . .

L9 um . . .

L10 doctor was here pretty fast . . .

257
then we called anesthesia,
then they were going to intubate her at the bedside,
we transferred her to ICU really fast,
they intubated her immediately in ICU and she has . . .
now come back to the floor and is stable.
Researcher: So, did she arrest or just was very close?
No, she was very close [to arresting].
Researcher: Just close to . . .
So she did not [arrest].
Researcher: Are there any other details of the event that you wish to include but didn’t mention?
Um . . .
no, you called RT immediately and they're here like STAT.
Um . . .
we called anesthesia immediately and they were here like immediately, so it's like um . . .
everything just works really fast so that,
you know, it's like this
and so therefore it really didn't become a problem.
Appendix M.11

RPA--Interview # 11

Researcher: As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 I think most of the time it [cardiopulmonary arrest] probably is [preventable] . . .

L2 ah . . .

L3 if you're watching your patient

L4 and getting the vital signs like you should be and . . .

L5 well . . .

L6 [if you] decide what, you know,

L7 whether or not you need to, to do something before it gets critical

L8 then you can probably prevent it [cardiopulmonary arrest].

Researcher: Tell me all about a clinical situation when you prevented a patient from arresting--in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L9 (silence) We had a patient one time that the ah . . .

L10 potassium was real, real high and ah . . .

L11 we had to um call the doctor

L12 and get something going before the patient got into any more trouble.
Researcher:  Ok . . . are there any other details about the event in particular . . .

L13  Well . . .

L14  they, they [the physician] went ahead and ordered um . . .

L15  the medication to, to counteract the potassium

L16  and brought it [the potassium] on down

L17  so that the patient didn’t get into any . . .

L18  was beginning to have some irregularities and ah . . .

L19  that stopped and . . .

L20  the potassium came on down.

Key:  Italics = referring phrase(s)
      Bold = object of a verb, verb phrase, or gerund
      Underlined Text = verb(s) or verb phrase(s) (including gerunds)
      [...] = implied verb repeated from previous line
Appendix M.12

RPA--Interview # 12

**Researcher:** As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Ah . . .

L2 yes, of course.

**Researcher:** Tell me all about a clinical situation when you prevented a patient from arresting— in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L3 *The most common situations that we see.*

L4 *actually it [acute pulmonary edema] is the most common [situation].*

L5 acute pulmonary edema ah . . .

L6 flash pulmonary edema from heart failure ah . . .

L7 *from acute CHF.*

L8 Ah . . .

L9 *it [pulmonary edema secondary to acute CHF] can all be treated very quickly and rapidly with . . .*

L10 *with a diuretic . . .*

L11 *it can be . . .*
in some cases it's [acute pulmonary edema] very obvious and sometimes ah . . .

the signs are very subtle

and they're progressive.

Pulmonary edema can some . . .

the onset is often very rapid.

You [the patient] compensate and compensate

and then something decompensates very rapidly . . .

um . . .

CHF is easier than something that takes days to build up.

Um . . .

depending on your diet . . .

why it's [CHF] happening.

You [the patient] can have decreased heart function from previous MIs . . .

or . . .

and . . .

or, and, or, ah . . .

your [the patient's] kidneys aren't functioning as well to get rid of extra fluid,

it's just more fluid that you [the patient] had to push through.
So, I guess you [patient] can get through [survive] . . .

[can get] through the entire deal [pulmonary edema] without pulmonary collapse.

**Researcher:** Ok, do you have a specific patient in mind that you can remember did develop CHF that you can tell me about? A specific client?

Um . . .

I work in different areas, ER being one of them.

I met this one man.

He came in ah . . .

he had ah . . .

[he had] a long history of multiple problems.

About 20 years ago he had suffered an MVA . . .

he was involved in an MVA.

He ended up losing ah . . .

[losing] one of his legs, one of his arms, and a half of another leg.

So . . .

I mean he came in.

he was about dead.

[He had] Very thick, leathery skin.

Um . . .

he was in acute CHF.

264
And he was getting ready to check out [die].

He was very diaphoretic.

Ah...

he had no veins.

Um...

Researcher: Of course!

No other extremity access was really available.

He had one, one little tiny vein in his hand

and I remember my own hand shaking as I was trying to chase this one little vein,

trying to get an IV in

so I could save his life.

So...

that [event] was the most obvious, the most um...

makes you realize you make a difference in people.

That [event] doesn’t happen so cut and dry but ah...

yes, we make a big difference.

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     Underlined Text = verb(s) or verb phrase(s) (including gerunds)
     [...] = implied verb repeated from previous line
Appendix M.13

RPA--Interview # 13

Researcher: As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Yes

Researcher: Tell me all about a clinical situation when you prevented a patient from arresting—in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L2 Can I think for a minute?

Researcher: Sure you can think for a minute. Yea, we’ll pause the tape recorder and let you think.

L3 Ok, as far as thinking on a particular situation,

L4 um, a person came out of the unit after open heart surgery . . .

L5 and the monitor tech indicated they were in v tach

L6 so immediately it was me and another nurse that went in there.

L7 And he wasn’t responsive,

L8 so right away I thumped on his, on his chest.

L9 And then went ahead and brought the crash cart in there,

L10 we started lidocaine.

L11 He was able to come out of it [v tach] with just a simple intervention as that.
**Researcher:** Ok, now that you have recalled the event, are there any other details you wish to include but did not mention?

L12 *Only that that [situation] was kinda odd,*

L13 *I thought about the situation when we called the doctor,*

L14 *and we had already started lidocaine,*

L15 *she [the on call doctor] did not want the lidocaine started.*

L16 *And that just really threw us off . . .

L17 *trying to understand the reasoning behind it.*

**Researcher:** What was the reasoning behind it?

L18 *She [the on call doctor] really wouldn't give it [the reasoning].

L19 *I mean we were trying to second guess the matter of fact why she didn't want it started.*

L20 *Um . . .

L21 *we got to the point where we even had the AD [Assistant Director of Nursing] involved and stuff

L22 *and she [AD] couldn't understand either.*

**Researcher:** So did you have to take it off?

L23 *Yes, we did [discontinue the lidocaine] . . .

L24 *and so we were kinda on pins and needles about it [discontinuing the lidocaine]

L25 *if it [v tach] was going to happen again.*
Researcher: Ok, interesting. Did you put something else on instead?

L26 No,

L27 but it [the situation] was one of those, you know,

L28 another doctor was on call

L29 so right away when it was the change in the morning

L30 then we went ahead and called him [the patient's primary physician] right away.

L31 He [the patient's primary physician] appreciated us notifying him of what [v tach/discontinuation of lidocaine] had happened.

L32 I'm not quite sure if there was conversation between the two doctors or not

L33 but we kinda run into that [situation] quite abit.

L34 That they [the physicians] might not agree on each others actions.

Researcher: You have to play intermediary?

L35 Yes, or second guess

L36 and whatever else.

Key: Italic = referring phrase(s)
   Bold = object of a verb, verb phrase, or gerund
   Underlined Text = verb(s) or verb phrase(s) (including gerunds)
   [. . .] = implied verb repeated from previous line
Researcher: As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Yes,

L2 I believe it is [possible to prevent cardiopulmonary arrest].

Researcher: Tell me all about a clinical situation when you prevented a patient from arresting—in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L3 Um . . .

L4 I don't know if there was a specific instance where I was involved in preventing one,

L5 but I can tell you one where I was involved in getting a patient that was infarcting to C C U instead of coming to telemetry.

L6 Um . . .

L7 this patient was on a,

L8 [was] on a medical floor and had been.

L9 was being treated all day long,

L10 probably for 12 hours,

L11 by some resident for GI problems.

L12 They [the patient] were diaphoretic,
L13 their um . . .
L14 no cardiac enzymes had been drawn all day.
L15 Ah, I believe . . .

Researcher: No cardiac enzymes.
L16 No mam.
L17 When night shift got there, um . . .
L18 one of the charges nurses started trying to head them [the physicians] towards cardiac possibly, um . . .
L19 and I believe it was after,
L20 it was getting close to midnight when they [the Assistant Director of Nurses] called.
L21 well the AD [Assistant Director of Nurses] called report for this patient to come to my floor.
L22 Um . . .
L23 another nurse took the report
L24 and I happen to walk by and see the report
L25 and the troponin was um . . .
L26 well over 4
L27 and the CKMB and the CK were through the roof [elevated],
L28 I don’t remember the exact results.
L29 So I called the AD
L30 and told her that we would not be receiving this patient 270
and which bed in CCU were they [the Assistant Director of Nurses] going to be sending this patient to

and they said “No bed, you're taking the patient.”

And I said I absolutely will not take this patient

because we can't provide the care this patient needs.

And I was informed that I needed to go tell the doctors that.

So I marched over to that floor and walked in the room and told the two doctors um . . .

that first of all I asked him, you know,

what was going on with this patient

and they said well, “We believe he's having a heart attack.”

I said, “Well let's look at the EKG,

let's look at the lab results

and . . . um . . .”

I said “This patient is infarcting right now.

They [the patient] need to be in CCU.

I will not accept this patient to telemetry

because I can’t provide the appropriate care for this patient.”

And, I came back . . .

I was afraid I was going to be in some big trouble . . .
in about five minutes later, the residents come wheeling this patient down to CCU.

The patient ended up going to cath lab that night I believe and...

um they tried to emergency balloon and stent.

He ended up having a CABG and arresting in ICU after his CABG and he died.

Um...

so I wish I had been working day shift

and we would have been able to prevent his MI.

But at least we got him to the right unit that night.

It was...

um...

I don't know,

it was,

it was pretty interesting.

This is a second event (different patient) related by this subject. A line is skipped purposefully to denote this change.

All right,

one night we got a patient,

I got a patient...

came on shift.
Had a little old lady, 87, cute as a bug, little German lady and...

She had had a huge MI in one of the outlying towns.

I don't know if it was XXXX or YYYY, one of those little hospitals...

I think it was XXXX.

And they [the physician] brought her in and put her in CCU.

Well, her, her cardiologist wanted to move her out of CCU the next day.

Well her um,

because of the nature of her MI, her heart muscle was extremely weak...

and um...

so he moves her out to our floor.

I know the charge nurse [in CCU] the night before had had a real struggle with him [the physician] trying to keep her in the unit so that they could keep her on nitro,

keep her blood pressure down,

give her heart a break and not have to work so hard.

Well, he [physician] says no.

During day shift he [physician] brings her out of CCU.
During day shift he [physician] brings her out [of CCU].

Well all night long she is restless . . .

she is struggling . . .

she has GI upset.

There's no changes on telemetry,

there's no changes in her vital signs,

she's just restless.

So I called the cardiologist twice.

I don't know what,

I can't give you any specific facts,

something's gonna [going to] happen with her.

I just don't know what, you know.

“Well, just monitor her XXXX.

She's all right.

She's old.

She's this, she's that.”

So at two in the morning, her, her neighbor was staying at the bedside with her, she [her neighbor] calls me,

I walk in there and the lady is dead.

Her left ventricle had ruptured.
and they [the physician] had moved her out to tele too quick

and not kept her blood pressure . . .

you know, her blood pressure was 120 over 60,

urine output was fine,

there was no change in mental status,

she just was restless.

That [restlessness] was the only outward symptom I had.

Her O2 was fine, saturation was fine . . .

she was just restless.

So when I talked to the doctor after she . . .

we had to code, cause she was a full code . . .

um . . .

she turned pretty much blue from the shoulder blades, you know, from clavicles up . . .

and ah . . .

we [the code team] could never get a pulse with compressions.

we [the code team] couldn’t get a inguinal pulse . . .

um . . .

never ever got rhythm back on the monitor

and the doctor, the doctor told me her left ventricle had burst and that was . . .
L124 you know, her heart was just too weak from the MI and just blown.

L125 So there was nothing that we could have done to prevent that

L126 unless they [the physicians] had just kept her in the unit [CCU] on, you know,

L127 medication to keep her pressure way down.

L128 Yea, that one,

L129 I know something was gonna [going to] happen with her,

L130 but I just couldn't get anybody to . . .

L131 help me out.

Key: **italics** = referring phrase(s)

**Bold** = object of a verb, verb phrase, or gerund

**Underlined Text** = verb(s) or verb phrase(s) (including gerunds)

[ . . . ] = implied verb repeated from previous line
Appendix M.15

RPA--Interview # 15

Researcher: As you know from the consent form, my research concerns clinical reasoning. Specifically, I hope to learn more about how expert nurses think when reasoning about the care a client needs to prevent cardiopulmonary arrest. Do you believe it is possible to prevent cardiopulmonary arrest?

L1 Yes

Researcher: Tell me all about a clinical situation, a specific client, when you prevented a patient from arresting— in other words, a patient did not experience a cardiopulmonary arrest because you did something that prevented the arrest from occurring.

L2 Um . . .

L3 let's see . . .

L4 I can think of a recent example of a . . .

L5 elderly woman with um . . .

L6 long standing COPD that we had . . .

L7 had been vent [ventilator] dependent . . .

L8 maybe two weeks

L9 and we had weaned her off the vent . . .

L10 that day, actually in the morning and . . .

L11 then after that, so maybe two or three hours . . .

L12 and, um . . .

L13 could tell that she was progressively,
ah...
you know, *she says she feels fine during the whole thing,*

*but just doesn’t look good . . .*

um, *heart rate goes up a little bit, maybe 10, 10 points,*

*blood pressure goes up, I mean systolic goes up maybe um . . .*

120.

*Respiratory rate, of course her respiratory rate typically ran in the 30s ah . . .*

*but could tell with her um . . .*

*looking like she was getting in some distress with um . . .*

*increasing respiratory rate . . .*

*um, she was getting sweaty . . .*

*and that had increased work of breathing um . . .*

*progressively over ah . . .*

*oh my gosh . . .

*maybe 30 minute period of time.*

So . . .

*I had been calling the doctor.*

Um . . .

telling him you know . . .
what her O2 sats were still...

you know with COPD the CO2 retainers, ok, maybe their sats aren't great anyway and that's where they live (normal for patient) but...

so this person's sats were pretty much where she lived, (normal for patient)

however, she just didn't look good.

And...

so, you know,

it's difficult to explain to a doctor...

ok, um...

she just looks uncomfortable

and her blood pressure's up a little bit

and her heart rate's up a little bit.

On the other hand, you know, some of it could be from anxiety because...

of the environment

and she's still nervous about being off the ventilator and so...

um...

so anyway just continued to call the physician on multiple occasions...

and [continued to call] a physician that trusts me I think...
L51 and . . .
L52 ah . . .
L53 had **we not gotten** him [the physician] in there um . . .
L54 because of the **assessment and staying with the patient**
L55 and **he came in**
L56 and we in . . . **reintubated her**,
L57 **put her back on the ventilator just because**
L58 **she wasn't ready** [to be weaned] yet.
L59 So,
L60 **had we not [reintubated], she would have had a cardiopulmonary arrest.**

**Key:** *Italics* = referring phrase(s)  
**Bold** = object of a verb, verb phrase, or gerund  
**Underlined Text** = verb(s) or verb phrase(s) (including gerunds)  
[ . . . ] = implied verb repeated from previous line
Appendix N.1
Objects and Referents of Major Verbs

Interview #1

Observation/Observing/Listening/Starting to hear/Seeing/Pick up

- patient L3
- fluid status L16
- situation L18, L30
  - lung L18
  - whole L30
- lungs L19
- crepitus L20
- fluid overload L21
- JVD L22
- breathing L24
  - rapid L24
  - shallow L24
- output L31
  - urine L31
- pressure L32
  - blood L32
  - low L32
- that [crystalloid] L36
- color L52
- patient L52

281
look

patient

closer

things

Intervene/Act

can (intervene) L4, L5

(act on) it [the feeling] L56

gut

makes L59

Be able to

intervene L6

get attention L7

medical L7

treat L8

arrest L8

prior to actual L8

them (the patient) L45

Compensate L34

not L34

that (crystalloid) L35

282
Would be/Would increase

patient L12
compromised L12
tachycardic L26, L28
fluid overload L50

Had/Have/Have

cardiomyopathy L13
compromise L14
severe L14
cardiac L14
fluid overload L15
resuscitation L33
arrhythmias L47
tachycardic L48
fibrillation L49
atrial L49
feeling L54, L55
gut L55

Bled

patient L37, L38

283
Needs

patient L39, L41, L42
products L39
blood L39
diuresing L41
to reestablish L41
monitoring L44
to find L43
status L43
Appendix N.2
Objects and Referents of Major Verbs

Interview #2

<table>
<thead>
<tr>
<th>Recognizing</th>
<th>L3</th>
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<tbody>
<tr>
<td>change</td>
<td>L4</td>
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<tr>
<td>condition</td>
<td>L4</td>
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<tr>
<td>arrhythmias</td>
<td>L5</td>
</tr>
<tr>
<td>patterns</td>
<td>L6</td>
</tr>
<tr>
<td>status</td>
<td>L6</td>
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<tr>
<td>signs</td>
<td>L7</td>
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</table>

<table>
<thead>
<tr>
<th>Work</th>
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<tbody>
<tr>
<td>them (the patient)</td>
<td>L7</td>
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</table>

<table>
<thead>
<tr>
<th>Did</th>
<th></th>
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<tbody>
<tr>
<td>(not) make</td>
<td>L9</td>
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<table>
<thead>
<tr>
<th>Came in</th>
<th></th>
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<tbody>
<tr>
<td>here (Recovery Room)</td>
<td>L11, L13, L16, L33</td>
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<table>
<thead>
<tr>
<th>Had been/Was/Had/Being/Has been</th>
<th></th>
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<tbody>
<tr>
<td>EGD</td>
<td>L12</td>
</tr>
<tr>
<td>GI bleed</td>
<td>L12</td>
</tr>
</tbody>
</table>

285
breathing labored O₂ Saturation dropped being 90 years old that (poor condition) way (poor condition) Called/Got/Treated anesthesia gasses blood aspect respiratory arrhythmias Stopped heart Spoke family
Decided
not  L26
to do  L26
much  L26

Could have
stayed  L29, L31
that (poor condition)  L31

Distressed
procedure  L35
her (patient)  L35
Appendix N.3

Objects and Referents of Major Verbs

Interview #3

Identifying/Observe/Had observed/Had seen/Have identified

changes \(\text{L4}\)

something \(\text{L6}\)

block \(\text{L7}\)

transient \(\text{L7}\)

signs \(\text{L33}\)

block \(\text{L55}\)

Wenckebach \(\text{L55}\)

Develop

feeling \(\text{L9}\)

something's \(\text{L9}\)

going wrong \(\text{L9}\)

Had/Was/Put/Have

patient \(\text{L20}\)

post thoracotomy \(\text{L21}\)

bled \(\text{L25}\)

out \(\text{L25}\)

awake \(\text{L22, L29}\)

extubated \(\text{L22}\)

288
talking L22

doing L22

fine L22

restless L22

becoming L22

restless L22

could keep still L22

not L22

to crack L27

chest L27

alive L30

not L30

restlessness L34, L42

key L34

nothing L35, L36

measurable L36

change L37

no L37

pressure L37

blood L37

tachycardia L38

tachycardic L39, 42

anxious L44

cancer L44
lung
being treated
emotion
daughters
sons
no
time
Wenchkebach
shock

Needed
reassurance

Doing
it (Wenckebach block)

Would
block

Getting/Get
pacemaker
transvenous
effect
better

290
Want to hang/hanging
dopamine L69
nitroglycerine L69, L70
Can balance
two (dopamine and nitroglycerine) L72
Appendix N.4
Objects and Referents of Major Verbs

Interview #4

Look/Looks
Sick
Patient
Going bad
Bad

Might
Patient
Expired
Will go

Are able to prevent/Can be prepared/Can prevent
It (cardiopulmonary arrest)
PVC's/stuff
Cardiac arrest

Notify/Call/Came by/Called
Doctors
Code
Pacers
Is/Was/Has

Failure

Ventricular

Same

Heart

History

Pressure

Blood

Low

Done

Arrest

Respiratory

Patient

Breathing

Shallow

Bad

PVCs/Bigeminys

Rate

Heart

Wires

Pacer

Slowed

Nothing

Can do

293
Goes/Going
- Rate L23, L63, L65
- Heart L23, L63, L65
- SVT L23
- Pressure L24
- Blood L24
- Junction rhythm L62
- escape L62

Gave/Started/Give
- Him (patient) L27, L28, L29, L37, L43, L47, L55, L64
- Medicine L27
- Cardizem L28
- Digitalized L29
- Sodium bicarbs L37
- Intubated L43
- Oxygenating L47
- Lidocaine L55
- Atropine L64
Did/Done/Wanted to do

Gas L35
Blood L35
Arrest L40, L41
Things/it (call the code) L52
That (give lidocaine) L59

Stop

Those/geminys (bigeminy) L58

Make

It/anything L70
happen L70
Appendix N.5  
Objects and Referents of Major Verbs  
Interview #5

<table>
<thead>
<tr>
<th>Verb</th>
<th>Referents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had/Were/Was/Is/Had been</td>
<td>Patient (he/him/guy) L5, L7, L9, L14, L25, L26, L29, L30, L31, L37, L43, L46, L48</td>
</tr>
<tr>
<td>Stroke</td>
<td>L7</td>
</tr>
<tr>
<td>Monitors/Telemetry</td>
<td>L8, L9</td>
</tr>
<tr>
<td>Respirations</td>
<td>L10</td>
</tr>
<tr>
<td>Rise</td>
<td>L10</td>
</tr>
<tr>
<td>Rate</td>
<td>L12, L13</td>
</tr>
<tr>
<td>Heart</td>
<td>L12, L13</td>
</tr>
<tr>
<td>Racing/Gotten up</td>
<td>L12, L13</td>
</tr>
<tr>
<td>Going down hill</td>
<td>L14, L15</td>
</tr>
<tr>
<td>Fast</td>
<td>L14</td>
</tr>
<tr>
<td>Normal</td>
<td>L17</td>
</tr>
<tr>
<td>Not</td>
<td>L17</td>
</tr>
<tr>
<td>Guy (patient)</td>
<td>L17</td>
</tr>
<tr>
<td>Results</td>
<td>L24</td>
</tr>
<tr>
<td>Horrible</td>
<td>L24</td>
</tr>
<tr>
<td>Tube</td>
<td>L25, L27, L28</td>
</tr>
<tr>
<td>PEG</td>
<td>L25, L27, L28</td>
</tr>
<tr>
<td>Malplaced</td>
<td>L27</td>
</tr>
</tbody>
</table>
Flushed
Potassium
Things
Getting
Potassium
Flushed
Agony
Death
Close
Result
Nice
Everything
Going
Cavity
Abdominal
Nuts
Through it
Potassium
Doing
Irritating
Feverish
Temp
Gotten up
| Went | 
|------|---|
| They (respirations) | L11 |
| Pulse | L45 |
| Up |  |

| Saw/Listing | 
|-------------|---|
| This (going downhill) | L16 |
| Everything | L18 |

| Rushed/Ordered/Ordering | 
|-------------------------|---|
| EKG | L19 |
| X-ray | L19 |
| Stuff | L19 |
| Things | L21 |
| Guy (patient) | L35 |
| Surgery | L35 |

| Called/To call | 
|----------------|---|
| Doctor(s) | L20, L32, L34 |
| Knew | L34 |
| Patient | L34 |
| Results | L20, L23 |
Wanted to do

Anything L33

Saved

Life L36

Would

Pulse L44

Did

They L49

Not L49

Care L49
Appendix N.6
Objects and Referents of Major Verbs
Interview #6

Seen/Looking/See

<table>
<thead>
<tr>
<th>Verb</th>
<th>Objects/Referents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italics (the arrest)</td>
<td>L 6, L10</td>
</tr>
<tr>
<td>Coming</td>
<td>L11</td>
</tr>
<tr>
<td>Sheet</td>
<td>L24</td>
</tr>
<tr>
<td>Flow</td>
<td>L24</td>
</tr>
<tr>
<td>What</td>
<td>L25</td>
</tr>
<tr>
<td>Has gone one</td>
<td>L25</td>
</tr>
<tr>
<td>Something</td>
<td>L27</td>
</tr>
</tbody>
</table>

Is/Had/Having/Are/Were/Was/Have

<table>
<thead>
<tr>
<th>Verb</th>
<th>Objects/Referents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrest(s)</td>
<td>L6, L 10, L12, L37</td>
</tr>
<tr>
<td>Preventable/Preventative</td>
<td>L12, L37, L91, L91</td>
</tr>
<tr>
<td>Acute myocardial infarction (AMI)</td>
<td>L13, L29, L38</td>
</tr>
<tr>
<td>Situations</td>
<td>L18</td>
</tr>
<tr>
<td>Prevent</td>
<td>L18</td>
</tr>
<tr>
<td>Not</td>
<td>L18</td>
</tr>
<tr>
<td>Event</td>
<td>L18</td>
</tr>
<tr>
<td>Arrest</td>
<td>L18</td>
</tr>
<tr>
<td>Occurring</td>
<td>L18</td>
</tr>
<tr>
<td>Work</td>
<td>L23</td>
</tr>
<tr>
<td>Tracking/Trending</td>
<td>L23</td>
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</table>

300
<table>
<thead>
<tr>
<th>Information</th>
<th>L23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient (guy, he, him)</td>
<td>L29, L30, L38, L39, L47, L55, L72, L75, L76, L77, L79, L80, L82, L83</td>
</tr>
<tr>
<td>Too hot (poor condition)</td>
<td>L30</td>
</tr>
<tr>
<td>to take</td>
<td>L30</td>
</tr>
<tr>
<td>to lab</td>
<td>L30</td>
</tr>
<tr>
<td>cath</td>
<td>L30</td>
</tr>
<tr>
<td>PVC’s</td>
<td>L31</td>
</tr>
<tr>
<td>Six to eight a minute</td>
<td>L31</td>
</tr>
<tr>
<td>Magnesium (level, hypomagnesemia)</td>
<td>L32, L58, L80</td>
</tr>
<tr>
<td>1.2</td>
<td>L32, L83</td>
</tr>
<tr>
<td>Approach</td>
<td>L35</td>
</tr>
<tr>
<td>Global</td>
<td>L35</td>
</tr>
<tr>
<td>Easy</td>
<td>L36</td>
</tr>
<tr>
<td>Not</td>
<td>L36</td>
</tr>
<tr>
<td>MI (myocardial infarction)</td>
<td>L39</td>
</tr>
<tr>
<td>global</td>
<td>L39</td>
</tr>
<tr>
<td>Lesion</td>
<td>L42, L44</td>
</tr>
<tr>
<td>High</td>
<td>L42</td>
</tr>
<tr>
<td>LAD (Left Anterior Descending)</td>
<td>L42</td>
</tr>
<tr>
<td>LM (Left Main)</td>
<td>L44</td>
</tr>
<tr>
<td>Problem(s)</td>
<td>L47, L55, L56, L64</td>
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<tr>
<td>Arrhythmia</td>
<td>L47</td>
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</table>
System L56
Conduction L56
It (the bradycardia) L64
Not L64
DISH (Ankylosing Spondylitis) L74
C₆ed (fractured C₆) L75
In L76
ICU L76
Coded L77
Code L78
Prevention L78
Measures L79
Preventative L79
Allowed L79
To pull through L79
Events L79
Awful L79

Got/Getting L14, L15, L16
Things/Realm L14, L15, L16
PE (Pulmonary Edema) L15
Events L15
Hypotensive L15

302
PVC's L28
Six to eight L28
Ready to go L50
Level L57
Mag(nesium) L57

Need to be doing
Things L33

Starts blocking/Bradyed/Would go
Patient (He) L51, L52, L61
Down L51, L52, L61
Rate L86
Heart L86
20 L86

Would come
Back up L53

Would switch
Off L54
Sinus to a junctional L54
Would have

Pace
V tach
Convert
Give lidocaine

Put

Pads
Pacing

Gave
atropine
Appendix N.7

Objects and Referents of Major Verbs

Interview #7

Is/Had

Patient \hspace{1cm} L2
Hypoxic \hspace{1cm} L2
Ventilated \hspace{1cm} L7
Not \hspace{1cm} L7
Adequately \hspace{1cm} L7

Needing

Ventilated \hspace{1cm} L3

Can get

Oxygen \hspace{1cm} L4
Patient (them) \hspace{1cm} L4

Started to

Brady \hspace{1cm} L5
Down \hspace{1cm} L5

Would have gone

Asystole \hspace{1cm} L7
Arrested \hspace{1cm} L7
Gave
  Patient (him) L8, L9
  Oxygen L8
  Atopine L9

Compensated
  Patient (he) L10

Did
  go L11
  not L11
  arrest L11
Appendix N.8
Objects and Referents of Major Verbs
Interview #8

Notifying
   Doctor   L2
   Enzymes  L2

Had
   to get  L3
   patient L3
   to ICU  L3
   to cath L3
   emergency heart L3
   Acute MI  L4

Could have
   Arrested L5
Appendix N.9

Objects and Referents of Major Verbs

Interview #9

Had/Was/Presented

<table>
<thead>
<tr>
<th>Word</th>
<th>Line</th>
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<tbody>
<tr>
<td>Patient</td>
<td>L4</td>
</tr>
<tr>
<td>Syncope</td>
<td>L5</td>
</tr>
<tr>
<td>Chest pain</td>
<td>L5</td>
</tr>
<tr>
<td>Rhythm</td>
<td>L8</td>
</tr>
<tr>
<td>Idioventricular</td>
<td>L8</td>
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<tr>
<td>Sweaty</td>
<td>L9</td>
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<tr>
<td>Diaphoretic</td>
<td>L9</td>
</tr>
<tr>
<td>Pressure</td>
<td>L10</td>
</tr>
<tr>
<td>Low</td>
<td>L10</td>
</tr>
<tr>
<td>It (AMI)</td>
<td>L16</td>
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<tr>
<td>Impending</td>
<td>L16</td>
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Presented

Patient

Hooked/Put/Started/Gave

<table>
<thead>
<tr>
<th>Word</th>
<th>Lines</th>
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<tbody>
<tr>
<td>Patient (him)</td>
<td>L7, L13</td>
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<tr>
<td>Monitor</td>
<td>L7</td>
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<td>Atropine</td>
<td>L11</td>
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<tr>
<td>Oxygen</td>
<td>L13</td>
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308
IV
Call
Doctor
Got
Patient (him)
ICU
Appendix N.10

Objects and Referents of Major Verbs

Interview #10

<table>
<thead>
<tr>
<th>Verb</th>
<th>Line(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had/Was/Were/Has/Is</td>
<td></td>
</tr>
<tr>
<td>Patient</td>
<td>L4</td>
</tr>
<tr>
<td>Going into</td>
<td>L4</td>
</tr>
<tr>
<td>Arrest</td>
<td>L4</td>
</tr>
<tr>
<td>Respiratory</td>
<td>L4</td>
</tr>
<tr>
<td>Doctor</td>
<td>L10</td>
</tr>
<tr>
<td>Here</td>
<td>L10</td>
</tr>
<tr>
<td>They (the doctors)</td>
<td>L13</td>
</tr>
<tr>
<td>Going to</td>
<td>L13</td>
</tr>
<tr>
<td>Intubate</td>
<td>L13</td>
</tr>
<tr>
<td>Patient (her)</td>
<td>L13</td>
</tr>
<tr>
<td>Patient (she)</td>
<td>L16, L17</td>
</tr>
<tr>
<td>Come back</td>
<td>L16</td>
</tr>
<tr>
<td>Stable</td>
<td>L16</td>
</tr>
<tr>
<td>Close</td>
<td>L17</td>
</tr>
<tr>
<td>(to arresting)</td>
<td>L17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Called</th>
<th>Line(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor</td>
<td>L6</td>
</tr>
<tr>
<td>Anesthesia</td>
<td>L12, L23</td>
</tr>
<tr>
<td>RT</td>
<td>L21</td>
</tr>
</tbody>
</table>

310
Transferred
  Patient (her) L14
  ICU L14

Intubated
  They (the doctors) L15
  Intubated L15
  Patient (her) L15

Did
  Patient (she) L18
  Arrest L18
    Not L18
  Become L26
    Not L26
  Problem L26
Appendix N.11
Objects and Referents of Major Verbs
Interview #11

<table>
<thead>
<tr>
<th>Verb</th>
<th>Object/Referent</th>
<th>Line</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Is/Are/Had/Was</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It (Cardiopulmonary arrest)</td>
<td>L1</td>
<td></td>
</tr>
<tr>
<td>Preventable</td>
<td>L1</td>
<td></td>
</tr>
<tr>
<td>Watching</td>
<td>L3</td>
<td></td>
</tr>
<tr>
<td>Patient</td>
<td>L3, L9</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>L10</td>
<td></td>
</tr>
<tr>
<td>Beginning to have</td>
<td></td>
<td>L18</td>
</tr>
<tr>
<td>irregularities</td>
<td>L18</td>
<td></td>
</tr>
<tr>
<td><strong>Getting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>L4</td>
<td></td>
</tr>
<tr>
<td>Vital</td>
<td>L4</td>
<td></td>
</tr>
<tr>
<td><strong>Decide</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>need to do</td>
<td>L6</td>
<td></td>
</tr>
<tr>
<td>something</td>
<td>L7</td>
<td></td>
</tr>
<tr>
<td><strong>Can</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevent</td>
<td>L8</td>
<td></td>
</tr>
<tr>
<td>It (Cardiopulmonary arrest)</td>
<td>L8</td>
<td></td>
</tr>
</tbody>
</table>
Call
  Doctor L11

Get/Got
  Something L12
  Going L12
  Patient L12, L17
  Trouble L12
  Did L17
  Not L17

Ordered
  They (the physician) L14
  Medication L15
    To counteract L15
    Potassium L15

Brought/Came
  It (the medication) L16
    down L16
  Potassium L20
    down L20

313
Stopped

That (the irregularities)  L19
### Appendix N.12

**Objects and Referents of Major Verbs**

**Interview #12**

<table>
<thead>
<tr>
<th>See</th>
<th>Situations</th>
<th>L3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Is/Are/Had/Was</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute/Flash pulmonary edema</td>
<td>L4, L5, L6, L12</td>
<td></td>
</tr>
<tr>
<td>Acute CHF/CHF</td>
<td>L7, L20, L23, L47</td>
<td></td>
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<tr>
<td>Obvious</td>
<td>L12</td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>L13, L14</td>
<td></td>
</tr>
<tr>
<td>Subtle</td>
<td>L13</td>
<td></td>
</tr>
<tr>
<td>Progressive</td>
<td>L14</td>
<td></td>
</tr>
<tr>
<td>Onset</td>
<td>L16</td>
<td></td>
</tr>
<tr>
<td>Rapid</td>
<td>L16</td>
<td></td>
</tr>
<tr>
<td>Easier</td>
<td>L20</td>
<td></td>
</tr>
<tr>
<td>Happening</td>
<td>L23</td>
<td></td>
</tr>
<tr>
<td>Kidneys</td>
<td>L28</td>
<td></td>
</tr>
<tr>
<td>Functioning</td>
<td>L28</td>
<td></td>
</tr>
<tr>
<td>Not</td>
<td>L28</td>
<td></td>
</tr>
<tr>
<td>Fluid</td>
<td>L29</td>
<td></td>
</tr>
<tr>
<td>Patient (you, he)</td>
<td>L29, L36, L37, L38, L39, L44, L45</td>
<td></td>
</tr>
<tr>
<td>To push</td>
<td>L29</td>
<td></td>
</tr>
</tbody>
</table>

315
Suffered L38
MVA L38, L39
Involved L39
Dead L44
Skin L45
  Thick L45
  Leathery L45
Getting L48
To check out (die) L48
Diaphoretic L49
Vein(s) L51, L54
  No L51
  Little L54
  Tiny L54
Access L53
  No L53
  Extremity L53
Available L53

Can/Can be/Can have/Can get
Pulmonary edema L9, L15, L31
  Treated L9
    Quickly L9
    Rapidly L9

316
Diuretic

Patient (you)

Decreased

Function

Heart

Through (survive)

Compensate/Decompensates

Patient (you)

Something

Depending

Diet

Came in

Patient (he)

Losing

Patient (he)

Leg(s)

Arms

Get

IV

317
Appendix N.13
Objects and Referents of Major Verbs
Interview #13

Came out
  Patient (person) L4
  Surgery L4
  Open heart L4

Were/Was/Had
  Patient (they) L5, L7, L11
  V tach L5, L11, L25
  Responsive L7
  Not L7
  Able to come out L11
  That/It (situation) L12, L27
  Odd L12
  Started L14
  Lidocaine L14
  Going to happen L25
  Doctor L28
  On Call L28
  Change L29
  Morning L29
Went/Brought

  In               L6
  Cart             L9
  Crash            L9

Thumped

  Chest           L8

Started

  Lidocain       L10

Called/Notifying

  Doctor (him)   L13, L30, L31

Did

  Doctor (she)   L15
  Want           L15
  Not            L15
  Lidocaine      L15, L23
  Started        L15
  (Discontinue)  L23
Would

Doctor (she)  L18
Give  L18
Not  L18
It (reasoning)  L18
Appendix N.14
Objects and Referents of Major Verbs
Interview #14

Part 1
Is/Was/Had been/Was being/Were/Having

Prevent L2
Cardiopulmonary arrest L2
Patient (they, he) L5, L7, L12, L31, L38, L39, L43
Infarcting L5, L43
Floor L8
   CCU L5
   Telemetry L5
   Medical L8
Treated L9
Resident L11
GI problems L11
Diaphoretic L12
Enzymes L14
   No L14
   Cardiac L14
Drawn L14
Troponin L25

322
Elevated (well over 4, through the roof)

CKMB/CK

Going

to be sending

on

Heart attack

CABG

Arresting

Started trying

Nurses

Charge

To head

Towards

Them (the physicians)

Cardiac

Called

They (the Assistant Director of Nurses)

Report

Took/Taking/Take

Nurse
Patient L32, L33
   Not L33

See
Report L24

Would/Will
Receiving L30
   Not L30
Patient L30, 45
Accept L45
   Not L45

Can
Provide L34, L46
   Not L34, L46
Care L34, L46
Patient L34, L46
Needs L34

Tell/Told/Asked
Doctors (him) L35, L36, L37
Look

EKG L40
Results L40
Lab L40

Need to be

Patient (they) L44
CCU L44

Come wheeling

Residents L49
Patient L49
CCU L49

Going to

Patient L50
Cath Lab L50

Tried to

They (the doctor) L51
Balloon L51
Emergency L51
Stent L51
Died

Patient (he) L53

Part 2
Got

Patient L65, L66
Rhythm L122
Monitor L122

Had/Was/Is

Patient (lady, her, she) L68, L70, L82, L87, L88, L89, L92, L99, L100, L101, L103, L110, L113, L115
MI L71, L79
Muscle L79
Heart L79
Weak L79, L124
Nurse L82
Charge L82
Struggle L82
Trying to keep L82
in the unit L82
Could keep L82
on nitro 326
Restless
Struggling
GI upset
Change(s)
No
Telemetry
Signs
Vital
Status
Mental
Restless
All right
Old
This/That
Dead
Ventricle
Left
Ruptured
They (physicians)
Moved
to tele
too quick
Pressure
Blood

L87, L110, L111
L88
L89
L90, L91, L109
L90, L91, L109
L90
L91
L91
L109
L109
L92, L110, L113
L99
L100
L101
L103
L104
L104
L104
L104
L105
L105
L105
L105
L107
L107
327
Normal (120/60)       L107
Output                L108
Urine                 L108
Normal (fine)         L108
Symptom               L111
O2                    L112
Normal (fine)         L112
Saturation            L112
Normal (fine)         L112
Code                  L115
Full                  L115
Heart                 L124
Blown                 L124
Nothing               L125
Could have done       L125
Something             L96, L129
Going to happen       L96, L129

Brought in/Put in/Brings out
Physician (they, he)  L75, L86
CCU                   L75, L86
Wanted to move/Moves

- Physician (cardiologist, he) L77, L81
- Patient (her) L77, L81

Keep/Kept

- Pressure L83, L106, L127
- Blood L83, L106
- Down L106, L127
- Physicians (they) L126
- Patient (her) L126
- Unit (CCU) L126
- Medication L127

Give

- Heart L84
- Break L84

Says

- Physician (he) L85
- No L85

Called/Calls/Talked/Told

- Physician (cardiologist) L93, L114, L123
- She (her neighbor) L102
Monitor
Patient (her) L98

Turned
Patient (she) L117
Blue L117

Could
Code Team (we) L119, L120
Pulse L119
Never/Not get L119, L120, L130
Inquinal L120
Anybody L130
To help L131
Appendix N.15
Objects and Referents of Major Verbs

Interview #15

Had/Was/Were/Are/Is

Patient (woman, her, she) L5, L9, L47, L58
COPD L6
Dependent L7
Vent (Ventilator) L7
Weaned L9
Getting sweaty L24
Increased work L25
of breathing L25
O₂ sats L33, L34, L35
Not L34
great L34
CO₂ retainers L34
Normal of patient (where they live) L34, L35
Pressure L42
Blood L42
Up L42, L43
Rate L43
Heart L43
Nervous L47

331

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Gotten him (the physician) Not Ready Not

Feels
Patient (she) Fine

Look/Looking/Assessment
Good Patient (she) Getting in distress Rate Respiratory Increasing Uncomfortable Staying

Goes Up Rate Heart Pressure Blood

332
Systolic 120
Ran Rate
Respiratory 30s

Calling/Telling
Doctor
Trusts

Could/Would
Tell Anxiety Environment Arrest Cardiopulmonary

Came in
Physician (he)

Intubated
Patient (her)

333
Put

Patient (her)  L57
Back  L57
Ventilator  L57
Observation/Observing/Listening/Starting to hear/Seeing/Pick up

L2 just usually by your um . . .
L3 observation of the patient.
L16 In the recovery room, just by observation of the fluid status
L18 [just by observation of] their lung situation,
L19 by listening to their lungs and
L20 maybe starting to hear some crepitus and um . . .
L21 [starting to hear] fluid overload in the patient’s . . .
L22 observation of their jugular vein distention
L24 [observation of] rapid, shallow breathing
L30 just observing the whole situation
L31 of seeing how much urine output they’ve had
L32 and [seeing] if their blood pressure is low
L36 So, just by the observation of that [crystalloid] maybe ah . . .
L52 sometimes just [observing] the color of the patient
L53 and just somehow or other I think, over experience, just [observing]
the look of the patient
L60 or just observe just that little bit closer
L61 so that you can pick up on things maybe a little bit sooner than
what you would in normal circumstances.
Intervene/Act

L4 And other times you can ah . . .
L5 intervene before um . . .
L6 intervene and be able to . . .
L56 I act on it [the feeling] because 9 times out of 10 my gut feeling tends to go that way.
L59 and allot of times its just that gut feeling that makes you intervene

Be able to

L6 intervene and be able to
L7 [be able] to get medical attention prior,
L8 [be able to] treat prior to the actual arrest.
L44 to be able to correctly um . . .
L45 to [be able] to correctly treat them [the patient]

Would be

L12 usually it would be a patient that's fairly compromised anyway.
L26 they [the patient] would probably be
L28 quite tachycardic.

Had/Have

L13 Um, maybe somebody that was . . .
L14 had cardiomyopathy or severe cardiac compromise
L15 maybe somebody that had fluid overload in surgery.
and [if] they have had to have quite a lot of resuscitation with crystalloid,
then the patient may have um . . .
some arrhythmias
maybe patient may [have] become so tachycardic that they may have become um . . .
[may have] gone into an atrial fibrillation which would increase the um . . .
[would increase] fluid overload.
and that gut feeling that you have
and I know that some people say that 50% of gut feelings are wrong but usually if I have the gut feeling about something,

Compensate
they may not be able to um . . .
compensate with that [crystalloid].

Bled
maybe the patient ah . . .
bled a little bit more than what they thought,
Needs

L39  *maybe the patient needs blood products rather than crystalloid*

L41  *[maybe the patient needs] some diuresing just to reestablish*

L42  *and sometimes that patient may need um . . .*

L43  *invasive monitoring to actually find their status*
Recognizing

L3  mainly by recognizing ah . . .
L4  change in patient condition
L5  whether it be arrhythmias
L6  or even patterns of the emotional status of the patient [pause]

Work

L7  or several key signs to work with them [the patient].

Did

L9  but they didn’t make it though

Came in

L11 well there was a 91 year old little lady that came in here [Recovery Room] uh . . .
L13  and she came in here [Recovery Room]
L16  [and] she came in here [Recovery Room] in poor condition.
L33  she came in.
Had been/Was/Had/Being/Has Been
L12  and she had been for an EGD for GI bleed
L14  and her breathing at that point was ah . . .
L15  labored . . .
L18  within 15 minutes of admission her O2 saturation had dropped
L22  and then her being 90 years old
L30  she was like that [poor condition] on the floor
L34  this is the way [poor condition] she has been.

Called/Got/Treated
L19  I called anesthesia,
L20  got blood gasses.
L21  We treated the respiratory aspect very quickly
L24  didn't tolerate any different arrhythmias which we treated

Stopped
L23  her heart just stopped.

Spoke
L25  and spoke with the family

Decided
L26  and decided not to do much overall.
Could have

L29  *because* she *could have stayed* . . .

L31  *and she* *could have stayed* *on the floor like that* [poor *condition*].

Distressed

L35  *but I think* *after the procedure* it *distressed* her *too much* and she
Appendix 0.3
AA–Interview #3

Identifying/Observe/Had observed/Had Seen/Have identified

the situations that come most quickly to mind is identifying changes
in ECG, blocks and um . . .

something, something that you observe ah . . .

a block that is perhaps transient um . . .

I had observed, you know,

I had seen the tale-tale signs.

other patient’s where I have identified ah . . .

Wenckebach block and uh . . .

Develop (feeling)

and not consistent so that you start to develop a feeling of

something’s going wrong.

Had/Was/Have

I had a post thorocotomy patient that I think of immediately

because I will never forget this one . . .

that was post thorocotomy to the ICU and ah . . .

[was] awake, extubated, talking, doing fine, restless, [was]

becoming restless a little, couldn’t keep still, you know.

then I left the room to help another nurse turn a patient or something

342
and when I came back he had bled out totally into his um . . .

chest tube to the Atrium unit, you know.

But that patient was, you know,

awake one minute, and not the next.

Yea, he was not alive.

The restlessness was key to me,

yet there was nothing that you could put your finger on you know,

[there was] nothing measurable in the chest tube at that time, you know.

And [was] no particular change in blood pressure

and then you sort of put [have] the tachycardia,

I don't think he was extremely tachycardic,

[he was] just a little bit [tachycardic] to go along with the restlessness.

And you think he was so . . .

[he was] anxious cause it was cancer that was being treated, a lung cancer,

[There was] alot of emotion.

[He had] Daughters, no sons, but daughters

so there was alot of emotion flying around,

So I guess that was her time.

I didn't know that she had Wenckebach to that degree prior to surgery.
when you have shock, you know,

Needed
Lots of reassurance and um...

Boom, all the way, crack the chest and the whole thing, and they never did find the bleeder.

"She's doing it [Wenckebach block] again."

She would block right down.

She ended up getting a transvenous pacemaker.

the doctors want to hang dopamine and you want to hang some nitroglycerin as well, you know, and you have to...

in hypotensive situations, you know, that hanging nitroglycerin doesn't always make sense but...
Can balance

L72 you know if you can balance the two [dopamine and nitroglycerin] just right you get a much better effect

12-21-00
Appendix O.4

AA--Interview #4

(For this nurse, English is a second language)

Look/Looks
L2  Maybe a few case you can look, you know,
L7  so we can think of this patient look like sick enough. We can just
    ...  
L13 This patient look like going too bad we can call, looks bad.

Might
L4  this patient might expire. . .
L6  No, no you know we can think about maybe this patient might will
    go and might, you know, expire,

Are able to prevent/Can be prepared/Can prevent
L5  but I don’t think that we’re able to prevent it [cardiopulmonary
    arrest] for that.
L8  [can just] be prepared [for cardiopulmonary arrest] but I don’t
    think that any, you know, any . . .
L9  I do not know maybe alot of, you know, PVCs and stuff we can . . .
L10 cardiac arrest we can prevent it for that

346
Those kinda stuff but I don't think anything actually happen we can, we can prevent it [cardiopulmonary arrest].

and notify the doctors first but, you know,

This patient look like going too bad we can call, looks bad.

you know, notify for the doctors . . .

and call the doctors

I think the doctors came by first

Actually, you know, actually people we called code. Yea.

we call the doctors

and then call the doctor

Just put in a call for the Zoll external pacers on,

the ventricle failure is probably the same.

You know patient was already intubated, was . . .

heart was ah . . .

already has history of coronary artery disease and already was been . . .

blood pressure is too low to give him Cardizem . . .

those stuff, we, I think we was been done

and the other thing is respiratory arrest.
patient, you know,

breathing shallow and bad enough.

And the other thing is patient had a lot of PVCs and bigeminys goes around,

And then the other thing is that we done first CABG was a heart rate was, there is no pacer wires.

Heart rate was slowed down

and of course there is nothing particular we can do at that point.

Goes/Going

heart rate, you know, goes up a little bit faster go to like SVT . . .

know about the next step the blood pressure going down . . .

and junction rhythm, escape goes back and forth

and then heart rate actually comes down 40s and 50s.

and then heart rate comes back

Gave/Give/Started

those that we gave him some medicine, I cannot remember . . .

blood pressure is too low to give him Cardizem . . .

we digitalized (gave digitalis to him), you know,

and started we give him some sodium bicarbs and . . .

and then we intubated (him).

348
the oxygenating (hyperoxygenated him), preventative to hypooxygenating.

and give him some lidocaine,

I think we give him the atropine

put on just preventative.

Did/Done/Wanted to do

I think we did blood gas

patient did.

poor patient arrested.

Those things we wanted to do it (call the code).

I think we done that [give lidocaine to stop bigeminy] before.

Stop

stop those, ah...

little geminys, we can stop that [bigeminy] . . .

Make

Just a particular make it anything happen.
Appendix O.5

AA—Interview #5

Had/Were/Was/Is/Had been

L5  *I had* a patient once um . . .
L6  *who couldn’t talk,*
L7  *he had a stroke and on my floor we had those little . . .
L8  *R2D2 monitors,* we called them, *kinda like they have in ICU . . .
L9  *and we had him hooked up to the telemetry,*
L10  *his respirations were on the rise,*
L12  *His heart rate was racing . . .
L13  *it [heart rate] had gotten up to from the 70s to a 160 . . .
L14  *and he was just going downhill fast,*
L15  *apparently he had been doing this [going downhill] all day long
and ah . . .
L17  *and like this [going downhill] is not normal for this guy,*
L24  *the results were horrible . . .
L25  *the guy had ah . . .
L26  *actually he had a PEG tube,*
L27  *it [PEG tube] was malplaced.*
L28  *It [PEG tube] had been getting flushed with potassium and
things like that,*
L29  *he was getting that [potassium] three times a day.*
L30  *And it turns out that every time he was getting that flushed in,*
he was basically in agony.
because he was very, very close to death.
It [the result] was very nice.
Everything was going directly into his abdominal cavity, not into the stomach.
All that potassium was doing was irritating the heck out of him.
He was just going nuts.
and he was feverish
and I think his temp had gotten up to 102, you know,
he was going through it and no one had . . .

Went
they [respirations] went from 20 in the morning to the mid 40s.
at one point his pulse went up to well over 200

Saw/Listening
when I gotten there I saw this [going downhill],
so I’m listening to everything . . .

Rushed/Ordered/Ordering
I rushed and ordered STAT EKG, STAT chest x-ray, all sorts of stuff.

Alot of nurses are paranoid about ordering things like that . . .

351
And we rushed the guy into surgery

And then I call the doctor with the results of those things.

I called with the results,

Well, we called five different doctors.

And they were fortunate enough to call one [doctor] that actually knew the patient on a personal basis.

None of them [doctors] wanted to do anything.

and it turns out we saved his life

I mean his pulse would just . . .

you know, I guess they just didn't care what they said.  

12-21-00
Appendix 0.6
AA—Interview #6

Seen/Looking/See

L6 if your patient arrests, it's your fault
L10 If your patient arrests, it's...
L11 you should have seen it [the arrest] coming.
L24 You're looking at the flow sheet,
L25 you're looking at what has gone on.
L27 and if you see something

Is/Had/Having/Are/Were/Was/Have

L12 And it's [the arrest is] preventable,
L13 especially in the realm of acute myocardial infarction,
L18 in very few situations is it possible to not prevent an arrest event from occurring.
L23 and most of our work is tracking and trending of information.
L29 A guy had an AMI say...
L30 yesterday and he's to hot [poor condition] to take to the cath lab
L31 and you're having six to eight, you're having six to eight PVCs a minute
L32 and your magnesium is 1.2.
L35 and it's, and it's, it's a global approach,
it's not always easy, but…

again for the most part, and in the broadest terms, arrests are preventable.

Two weeks ago we had a patient up here who had an acute myocardial infarction,

he had a global MI, and...

I mean it was a high LAD lesion and...

the only thing that could have made it [the situation] worse was if it [the lesion] was in the LM.

he was having all sorts of arrhythmia problems.

[he] wasn’t having a whole lot of ventricular problems yet,

it [the problem] was mostly conduction system.

actually we had a mag level drawn on the lab that was already downstairs,

it's [the bradycardia is] not a problem.

I wasn't, I wasn't the primary nurse but there was another situation that was almost identical to that where we had a guy with um...

with dish, and he was having...

dish. Yea, ankylosing spondylitis.

And he [had] C6ed [fractured C6] himself stepping off the bus.

And, in fact he's still in the ICU

and this we had coded this guy several times

and it [the code] was prevention,
it was all preventative measures by the nursing staff which allowed him to pull through those really awful events.

The guy had a hypomagnesemia,

I mean he was like, like he was like a 1.1, 1.2 [low numbers reflective of hypomagnesemic state] something like that.

and it's all preventative, it's all preventative.

Got/Getting
even in, you know, getting into things like um . . .

PE, getting into the realm of hypotensive events,

getting into the realm of . . .

and go "all right we got, we got six to eight." [PVCs]

we're just gettin(g) this guy ready to go

What we did, got a mag level,

And he kept getting.

Need to be doing

You know, there are things that you need to be doing.

Starts blocking/Bradyed/Would go

and he starts blocking down.

Well, he bradyed down to about 30

when it came time that he bradyed down,
when it came time that he bradyed down,

he would go from,

he would go from a heart rate of 20,

Would come

and he'd come back up,

Would switch

he'd switch off from a sinus to a junctional,

Would have

we would have to pace him all the way up to this v tach,

which we would have to either convert or we would have to give him ... 

um lidocaine for ah. ...

Put

we put pacing pads on him, and ... 

Paced

we paced him back,
Gave

L63  gave him a little atropine, . . .
Is/Had

L2 Oh, the patient is hypoxic

L6 and at that point, had he not been adequately ventilated.

Needing

L3 and needing to be ventilated.

Get

L4 You can get the oxygen to them,

Started to

L5 specifically the patient started to brady down

Would have gone

L7 he would have gone into complete aystole and arrested.

Gave

L8 So we gave him oxygen

L9 and then we gave him some atropine to bring his heart rate up

Compensated

L10 and then he compensated

Did

L11 and didn’t go into an arrest.
Appendix O.8
AA—Interview #8

Notifying
L2 By notifying the doctor of abnormal, extremely high cardiac enzymes.

Had
L3 We had to get the patient to ICU and emergency heart cath . . .
L4 and she had an acute MI . . .

Could have
L5 possibly could have arrested on us probably.

12-22-00

359
Appendix O.9
AA—Interview # 9

Had/Was
L3  had a . . .
L5  syncope and chest pain,
L8  and he was in idioventricular rhythm . . .
L9  ah, [was] sweaty, diaphoretic . . .
L10 pressure was low . . .
L16 but it [AMI] was impending.

Presented
L4  63 year old patient presented to the ER with ah . . .

Hooked/Put/Started/Gave
L7  We hooked him up to the monitor
L11  um, gave him atropine to speed up his heart rate.
L13  Put him on oxygen,
L14  started an IV,

Call
L12  Call the doctor.

Got
L15  got him to ICU . . .
Appendix 0.10
AA—Interview # 10

Had/Was/Were/Has/Is

L4  in the two last weeks we had a patient going into respiratory arrest . . .

L10 doctor was here pretty fast . . .

L13 they [the doctors] were going to intubate her at the bedside,

L16 [She has] now come back to the floor and is stable.

L17 No, she was very close [to arresting].

Called

L6 doctor was called . . .

L12 then we called anesthesia,

L21 no, you call RT immediately and they're here like STAT

L23 we called anesthesia immediately and they were here like immediately, so its like um . . .

Transferred

L14 we transferred her to ICU really fast,

Intubated

L15 they (the doctors) intubated her immediately in ICU and she has . . .

Did

L18 So she did not [arrest].

L26 and so therefore it really didn't become a problem

361
Appendix O.11
AA--Interview # 11

Is/Are/Had/Was

L1  *I think most of the time it [cardiopulmonary arrest] probably is [preventable]...*

L3  *if you're watching your patient*

L9  *We had a patient one time that the ah...*

L10  *potassium was real, real high and ah...*

L18  *was beginning to have some irregularities and ah...*

Getting

L4  *and getting the vital signs like you should be and...*

Decide

L6  *[if you] decide what, you know,*

L7  *whether or not you need to do something before it gets critical*

Can prevent

L8  *then you can probably prevent it [cardiopulmonary arrest].*

Call

L11  *we had to um call the doctor*

362
Get/Got
L12 and get something going before the patient got into any more trouble.
L17 so that the patient didn’t get into any . . .

Ordered
L14 they, they [the physician] went ahead and ordered um . . .
L15 the medication to, to counteract the potassium

Brought/Came
L16 and brought it [the potassium] on down
L20 the potassium came on down.

Stopped
L19 that [the irregularities] stopped and . . .
Appendix O.12
AA--Interview # 12

See

L3  The most common situations that we see.

Is/Are/Had/Was

L4  actually it [acute pulmonary edema is the most common [situation],

L5  acute pulmonary edema ah . . .

L6  flash pulmonary edema from heart failure ah . . .

L7  [from] acute CHF.

L12  in some cases it's [acute pulmonary edema] very obvious and sometimes ah . . .

L13  the signs are very subtle

L14  and they're [the signs are] progressive.

L16  the onset is often very rapid.

L20  CHF is easier than something that takes days to build up.

L23  why it's [CHF] happening.

L28  your [the patient's] kidneys aren't functioning as well to get rid of extra fluid,

L29  it's just more fluid that you [the patient] had to push through.

L36  he had ah . . .

L37  [he had] a long history of multiple problems.

364
About 20 years ago he had suffered an MVA . . .

he was involved in an MVA.

he was about dead.

[He had] Very thick, leathery skin.

he was in acute CHF.

And he was getting ready to check out [die].

He was very diaphoretic.

he had no veins.

No other extremity access was really available.

He had one, one little tiny vein in his hand

Can/Can be/Can have/Can get

it [pulmonary edema secondary to acute CHF] can all be treated very quickly and rapidly with . . .

with a diuretic . . .

it can be . . .

Pulmonary edema can some . . .

You [the patient] can have decreased heart function from previous MIs .

So, I guess you [patient] can get through [survive] . . .

[can get] through the entire deal [pulmonary edema] without pulmonary collapse.
Compensate/Decompensates

L17 You [the patient] compensate and compensate

L18 and then something decompenses very rapidly . . .

Depending

L22 depending on your diet . . .

Came in

L35 He came in ah . . .

L43 I mean he came in,

Losing

L40 He ended up losing ah . . .

L41 [losing] one of his legs, one of his arms, and a half of another leg.

Get

L56 trying to get an IV in

Save

L57 so I could save his life.
Appendix O.13
AA--Interview # 13

Came out
L4 um, a person came out of the unit after open heart surgery . . .

Were/Was/Had
L5 and the monitor tech indicated they were in v tach
L7 And he wasn’t responsive,
L11 He was able to come out of it [v tach] with just a simple intervention as that.
L12 Only that that [situation] was kinda odd,
L14 and we had already started lidocaine,
L25 if it [v tach] was going to happen again.
L27 but it [the situation] was one of those, you know,
L28 another doctor was on call
L29 so right away when it was the change in the morning

Went/Brought
L6 so immediately it was me and another nurse that went in there.
L9 And then went ahead and brought the crash cart in there,

Thumped
L8 so right away I thumped on his, on his chest.
we started lidocaine.

I thought about the situation when we called the doctor,
then we went ahead and called him [the patient’s primary physician] right away.
He [the patient’s primary physician] appreciated us notifying him of what [v tach/discontinuation of lidocaine] had happened.

she [the on call doctor] did not want the lidocaine started.
Yes, we did [discontinue the lidocaine] . . .

She [the on call doctor] really wouldn’t give it [the reasoning].
Part 1

Is/Was/Had been/Having

L2 I believe it is [possible to prevent cardiopulmonary arrest].
L5 but I can tell you one where I was involved in getting a patient that
was infarcting to CCU instead of coming to telemetry.
L7 this patient was on a,
L8 [was] on a medical floor and had been.
L9 was being treated all day long,
L10 probably for 12 hours,
L11 by some resident for GI problems.
L12 They [the patient] were diaphoretic,
L14 no cardiac enzymes had been drawn all day.
L25 and the troponin was um . . .
L26 well over 4
L27 and the CKMB and the CK were through the roof [elevated].
L31 and which bed in CCU were they [the Assistant Director of Nurses]
going to be sending this patient to
L38 what was going on with this patient
L39 and they said well, “We believe he's having a heart attack.”
L43 I said “This patient is infarcting right now.
L52 He ended up having a CABG and arresting in ICU after his CABG
Started trying

L18 one of the charges nurses started trying to head them [the physicians] towards cardiac possibly, um . . .

Called

L20 it was getting close to midnight when they [the Assistant Director of Nurses] called.

L21 well the AD [Assistant Director of Nurses] called report for this patient to come to my floor.

L29 So I called the AD

Took/Taking/Take

L23 another nurse took the report

L32 and they said “No bed, you’re taking the patient.”

L33 And I said I absolutely will not take this patient

See

L24 and I happen to walk by and see the report

Would/Will

L30 and told her that we would not be receiving this patient

L45 I will not accept this patient to telemetry
Can (not)

L34  *because we can't provide the care this patient needs.*

L46  *because I can't provide the appropriate care for this patient.*

Tell/Told/Asked

L35  *And I was informed that I needed to go tell the doctors that.*

L36  *So I marched over to that floor and walked in the room and told the two doctors um . . . .

L37  *that first of all I asked him, you know,*

Look

L40  *I said, "Well let's look at the EKG,"

L41  *let's look at the lab results*

Need

L44  *They [the patient] need to be in CCU.*

Come

L49  *in about five minutes later, the residents come wheeling this patient down to CCU.*
Going

L50  The *patient* ended up going to cath lab that night I believe and

...  

Tried to

L51  um *they tried* to emergency balloon and stent.

Died

L53  and he died.

**Part 2**

Got

L65  *one night we got* a patient,

L66  I got a patient . . .

L122  *never ever got* rhythm back on the monitor

Had/Was/Is

L68  Had a little old lady, 87,

L69  cute as a bug,

L70  little German lady and . . .

L71  she had had a huge MI in one of the outlying towns.

L72  I don't know if it was XXXX or YYY,

L73  one of those little hospitals . . .
I think it was XXXX.

because of the nature of her MI, her heart muscle was extremely weak . . .

I know the charge nurse [in CCU] the night before had had a real struggle with him [the physician] trying to keep her in the unit so that they could keep her on nitro,

Well all night long she is restless . . .

she is struggling . . .

she has GI upset.

There’s no changes on telemetry,

there’s no changes in her vital signs,

she’s just restless.

something’s gonna [going to] happen with her.

She’s all right.

She’s old.

She’s this, she’s that.”

I walk in there and the lady is dead.

Her left ventricle had ruptured

and they [the physician] had moved her out to tele too quick

you know, her blood pressure was 120 over 60,

urine output was fine,

there was no change in mental status,

she just was restless.
That [restlessness] was the only outward symptom I had.

Her O₂ was fine, saturation was fine . . .

she was just restless.

we had to code, cause she was a full code . . .

you know, her heart was just too weak from the MI and just blown.

So there was nothing that we could have done to prevent that

I know something was gonna [going to] happen with her,

And they [the physician] brought her in and put her in CCU.

During day shift he [physician] brings her out [of CCU].

her, her cardiologist wanted to move her out of CCU the next day.

so he moves her out to our floor.

keep her blood pressure down,

and not kept her blood pressure . . .

unless they [the physicians] had just kept her in the unit [CCU] on, you know,

medication to keep her pressure way down.
Give

L84  *give her heart a break and not have to work so hard.*

 Says

L85  *Well, he [physician] says no.*

 Called/Calls/Talked/Told

L93  *So I called the cardiologist twice.*

L102  *So at two in the morning, her, her neighbor was staying at the bedside with her, she [her neighbor] calls me,*

L114  *So when I talked to the doctor after she...*

L123  *and the doctor, the doctor told me her left ventricle had burst and that was...*

 Monitor

L98  *“Well, just monitor her XXXX.*

 Turned

L117  *she turned pretty much blue from the shoulder blades, you know,*

from clavicles up...
Could

L119  we [the code team] could never get a pulse with compressions,

L120  we [the code team] couldn't get a inguinal pulse . . .

L130  but I just couldn't get anybody to . . .

L131  help me out.
Appendix O.15
AA--Interview # 15

Had/Was/Were/Are/Is

L5  elderly woman with um . . .

L6  long standing COPD that we had . . .

L7  had been vent [ventilator] dependent . . .

L8  maybe two weeks

L9  and we had weaned her off the vent . . .

L10 that day, actually in the morning and . . .

L11 then after that, so maybe two or three hours . . .

L13 could tell that she was progressively, ah . . .

L24 um, she was getting sweaty . . .

L25 and that had increased work of breathing um . . .

L26 progressively over ah . . .

L28 maybe 30 minute period of time.

L33 what her O₂ sats were still . . .

L34 you know with COPD the CO₂ retainers, ok, maybe their sats aren't great anyway and that's where they live (normal for patient) but . . .

L35 so this person's sats were pretty much where she lived, (normal for patient)

L42 and her blood pressure's up a little bit

L43 and her heart rate's up a little bit.
and she's still nervous about being off the ventilator and so . . .

had we not gotten him [the physician] in there um . . .

just because she wasn't ready [to be weaned] yet.

Feels

you know, she says she feels fine during the whole thing,

Look/Looking/Assessment

but just doesn't look good . . .

looking like she was getting in some distress with um . . .

increasing respiratory rate . . .

however, she just didn't look good.

she just looks uncomfortable

because of the assessment and staying with the patient

Goes

um, heart rate goes up a little bit, maybe 10, 10 points,

blood pressure goes up, I mean systolic goes up maybe um . . .

120.

Ran

Respiratory rate, of course her respiratory rate typically ran in the 30s ah . . .
Calling/Telling

L30 I had been calling the doctor.
L32 telling him you know . . .
L49 so anyway just continued to call the physician on multiple occasions. . .
L50 and [continued to call] a physician that trusts me I think . . .

Could/Would

L21 but could tell with her um . . .
L44 On the other hand, you know, some of it could be from anxiety because . . .
L46 of the environment
L60 had we not [reintubated], she would have had a cardiopulmonary arrest.

Came in

L55 and he came in

Intubated

L56 and we in . . . reintubated her,

Put

L57 put her back on the ventilator
Appendix P

Definition and Categorization of Major Verbs and Verb Phrases

Operator 1

Scenario Set—a description of a patient outlining data that is inclusive of a variety of patient cues as well as location of the patient and probability of a cardiopulmonary arrest event occurring.

>Search—previously processed cues that represent direct or indirect changes in a patient’s physiologic status

Observe/Observed/Observing/Observation
Recognizing
Identifying/Identified
Look/Looks/Looking
See/Seeing/Saw/Seen
Listening/Starting to hear
Assessment
Monitor
Pick up
(It’s a global) approach
Are watching

>Variations—specific searching by the nurse for patient cues that relate to disease progression or signs and symptoms

Disease Progression—positive (wellness) or negative (illness)
state of health

Stop/Stopped (heart, bigeminy, irregularities)
Go/Goess/Going/Went (HR, SVT, BP, junctional rhythm abdominal cavity, nuts, through it, PVCs, mag level, in)
Take/Taking/Took (nurse, patient)
Starts blocking/Bradyed (slowed)/Would block
Bled
Doing [it (Wenckebach block)]
Got/Getting (things, PE, realm, events, something going, patient, trouble, rhythm)
Keep/Kept (BP, down, physicians, patient, unit, medication)
Feels (patient, fine)
Ran (RR)
Turned (patient, blue)
Would have (to pace, to convert, to give lidocaine)/Would come (up)/Would switch (off [rhythms])

Signs and symptoms (from forms of the verb “to be”)—
objective or subjective changes in bodily functions indicative of disease or phases of a disease
Cardiomyopathy/severe cardiac compromise
Fluid overload/more fluid
Resuscitation
Arrhythmias
  tachycardic/tachycardia
  Bradycardia
  Atrial fibrillation
  Wenckebach
  PVCs
  Bigeminy (ventricular)
  Conduction system (irregularities)
  Ventricular tachycardia
GI bleed
Breathing/respirations (labored, shallow, bad, rising, increased work)
O₂ saturation (O₂ sats)
Post thoracotomy
Bled
Awake
Extubated
Talking
Doing fine
Restless/becoming restless/couldn’t keep still/restlessness (Nothing) measurable
Change in BP (no change, low BP, up)
Anxious/nervous
Cancer

381
Emotion
Daughters/sons
Time
Shock
Ventricular failure
Intubated/intubate
Heart
History
Arrest/arresting
Heart rate (slowed, racing, up)
Pacer wires
Stroke
Monitors
Hooked up to telemetry
PEG tube (malplaced, flushed with potassium, going into abdominal cavity)
Irritating
Going nuts
Feverish, temp
Acute myocardial infarction (AMI)/ heart attack/infarcting/ high lesion
Magnesium
Ankylosing spondylitis
C6 fracture
Hypoxic
Syncope
Chest pain
Sweaty/diaphoretic
Potassium
Acute pulmonary edema/flash pulmonary edema
Acute congestive heart failure (CHF)
Kidneys
MVA (motor vehicle accident)
Skin
Veins/access
GI problems/GI upset
Enzymes (troponin, CKMB, CK)
CABG
Heart muscle was weak/heart was weak/blown
(No) changes on telemetry
(No) changes in vital signs

382
Old
Urine output
(No) change in mental status
COPD/CO$_2$ retainers
Vent(ilator) dependent
Weaned off

> **Location**—place where nursing care is delivered

Came/Come(s)/Came in/Came out/Come back
Presented
Moves/Had moved/Transferred
Going
Brought/Brought in/Brings outs
Put in
ICU
CCU
Telemetry
Medical floor

> **Probability**—likelihood of a cardiopulmonary arrest occurring

Would be/Would have
Could be/Could have
Might
Depending
Can/Can be/Can have/Can get
Getting (into the realm)
If it was going to happen again
Something’s gonna happen
Operator 2

Intervene—to act in an effort to modify disease progression

>Level 1—General acts—non-specific actions
Intervene
Act
Treated/Was being treated
Rushed
Tracking and trending
Work

>Level 2—More specific acts—detailed actions
Ordered/ordering
Get/Got/Getting
Give/Gave
Started/Had started
Did.Done
Put
Brought

>Level 3—Very specific acts—illustrative or graphic actions
Crack
Wanted to hang/hanging
Can balance
Had coded/Had to code
Pace/Paced
Intubated
Hooked
Thumbed
Convert
Balloon and stent
Trying to keep her in the unit
Could keep her on nitro

>Communicate—to convey information to physicians or family
Call/Calling/Called/On Call
Notify/Notifying
Tell/Telling/Told

384
Ask
Says
Come/Came by/Was here
Help
Had struggle
Had gotten him
Spoke
Operator 3

Decision/Rationale--to reach a conclusion based upon a reason

>Positive--evaluation of interventions as favorable to patient outcome
Be able to/are able to
Can be prepared/can prevent/is, are preventable/prevent/prevention/preventative
Decide/Decided
Give heart a break
Have feeling/Develop feeling
Would have to (pace or convert or give lidocaine)

>Negative--evaluation of interventions as unfavorable to patient outcome
Is nothing we can do/nothing we could have done wanted to do (none)
Didn’t care
Is not normal
Results were horrible
Had not been ventilated
Will not/Would not
Cannot
Ventricle had ruptured
Wasn’t ready to be weaned

>Needs--requirements to meet patient physiologic demands
Needs/Needed
Need to be doing
Needing to be ventilated
Needs to be in ICU
Operator 4

Outcome—patient result, usually survival or death

> Positive—favorable consequences of interventions
  Compensate/Compensated
  Make (anything happen)
  Saved
  Pull through
  Didn’t go (into an arrest)
  Is stable
  Did not arrest
  Brought down/Came down
  Was able to come out of it
  Is all right

> Negative—favorable consequences of interventions
  Distressed
  Died/Didn’t make it/is dead
  Was (not) alive
  Was going down hill fast
  Was in agony
  Was close to death/Was about dead
  Losing
  Decompensate
  Was getting ready to check out
  Wasn’t responsive
  Could never get/Could not get

revised 12-26-00
Appendix Q

Figure 3. The Structure of Clinical Reasoning: Operators, subcategories, and subject's terms
(N = 15)

<table>
<thead>
<tr>
<th>OPERATORS</th>
<th>SUBCATEGORIES</th>
<th>SUBJECTS' TERMS (EXAMPLES)</th>
<th>ASSERTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario Set</td>
<td>Search</td>
<td>Observe, Look, See, Listening</td>
<td>Observational</td>
</tr>
<tr>
<td></td>
<td>Variations</td>
<td>Disease progression--Stop, Go, Got, Starts blocking</td>
<td>Indicative</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>Came, ICU</td>
<td>Observational</td>
</tr>
<tr>
<td></td>
<td>Probability</td>
<td>Would be, Would have, Could be, Could have</td>
<td>Conditional</td>
</tr>
<tr>
<td>Intervene</td>
<td>Level 1--General acts</td>
<td>Treated, Was being treated</td>
<td>Decisional/Action</td>
</tr>
<tr>
<td></td>
<td>Level 2--More specific acts</td>
<td>Ordered, Get, Give, Started, Did, Put</td>
<td>All Operators</td>
</tr>
<tr>
<td></td>
<td>Level 3--Very specific acts</td>
<td>Had coded, Had to code, Pace, Paced</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communicate</td>
<td>Call, Notify, Tell, Come</td>
<td></td>
</tr>
<tr>
<td>Decision/Rationale</td>
<td>Positive</td>
<td>Can be prepared, Decide, Have feeling</td>
<td>Interpretive</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Is nothing we can do, Will not, Would not Needs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Positive</td>
<td>Compensate, Saved, Pull through, Was able to come out of it</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Distressed, Died, Was (not) alive, Was going downhill fast, Was in agony, Could never get/Could not get</td>
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### Appendix R
#### Data Analysis--Scenario Set

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**Appendix R**

**Data Analysis--Scenario Set**

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*Note: The table shows the frequency of certain phrases across different scenario sets. Each column represents a different scenario set, and the entries indicate the number of times each phrase was used. The total number per subject column shows the cumulative frequency for each subject.
## Appendix R
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### Appendix R

#### Data Analysis--Scenario Set

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### Appendix R

Data Analysis--Scenario Set

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### Data Analysis--Scenario Set

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### Data Analysis--Intervene

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| Ordered/Ordering |   |   |   |   |   |   | X | X | X |   |   |   |   |     |     |     |
| Get/Got/Getting |   |   |   |   |   |   | X | X | X | X | X | X | X |     |     |     |
| Give/Gave |   |   |   |   |   |   | X | X | X | X | X | X | X |     |     |     |
| Started/Had started* |   |   |   |   |   |   | X | X | X | X | X | X | X |     |     |     |
| Did/Done |   |   |   |   |   |   | X | X | X | X | X | X | X |     |     |     |
| Put |   |   |   |   |   |   | X | X | X | X | X | X | X |     |     |     |
| Brought |   |   |   |   |   |   |   |   |   |   |   |   |   |     |     |     |
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- Needs/Needed
- Need to be doing
- Needing to be ventilated
- Needs to be in ICU

*used in forms of "to be"

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* indicates a significant result.
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*used in forms of "to be*
Appendix V

Nursing Expertise Research Model

Antecedents

- Theoretical Knowledge
- Experiential Knowledge
- Disposition
- Standards
- Nurse/Patient Interaction

Time

Metacognition

Context

Clinical Reasoning

Presence (Multiple Cues Acquisition)

Multiple Hypothesis Generation

Cue Interpretation (Decision/Rationale)

Patient/Client Outcome
- Complications Prevented
- Purposeful Recovery
- Failure to Prevent Complications
- Death

Conclusion

Clinical Judgment

Nursing Interventions

Figure 4. Nursing Expertise Research Model
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Alyce Smithson Ashcraft was born in Borger, Texas on the daughter of Elise Winifred Grubham Smithson and Wiley Smithson, Jr. After graduating from Borger High School in 1976, she attended Texas Women's University, graduating in 1980 with a B.S.N., and The University of Texas at Arlington, graduating in 1984 with an M.S.N. She has practiced as a staff nurse at Parkland Memorial Hospital (Dallas) and Southeastern Methodist Hospital (Dallas); a Critical Care Clinical Nurse Specialist and Director of Education at Baptist Hospital of Southeast Texas (Beaumont); and Instructor of Nursing at Blinn College (Bryan). In September 1993 she entered the Graduate School of The University of Texas at Austin. She continues to be active in local and state community and professional organizations including the Texas Nurses Association and will be teaching at Texas Tech University in Lubbock, Texas in the Fall of 2001.

Permanent Address: [Redacted]

Texas

This dissertation was typed by the author.