INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

ProQuest Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

UMI®

Université d'Ottawa · University of Ottawa

Cue Utilization by Expert Pediatric Critical Care Nurses In Making Clinical Judgments Related to Endotracheal Suctioning

By

S. Margot Thomas

Thesis submitted to the
Faculty of Graduate Studies and Research
In partial fulfillment of the requirements for the degree of
Master of Science in Nursing

University of Ottawa

September, 2002

© Margot Thomas, 2002

National Library of Canada
Bibliothèque nationale du Canada

Acquisitions and Bibliographic Services
Acquisitions et services bibliographiques

395 Wellington Street
Ottawa ON K1A 0N4
Canada

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

Our file Notre référence

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-76642-X

Canada

ACKNOWLEDGEMENTS

This thesis is dedicated to the intensive care nurses with whom I have learned and worked over the past twenty-five years. You have taught me what it means to be a nurse. I am proud to be considered one of you.

Without the continuous support and encouragement from a cadre of teachers, colleagues, friends and family members, this project would still just be an idea in the back of my mind. Without them, I would have missed an adventure that has changed me forever.

I acknowledge the assistance provided to me throughout my graduate education by my thesis supervisor, Dr. Frances Fothergill-Bourbonnais. Frances, you knew just when to say the right thing, that would keep me going towards my goal. I acknowledge the time, effort, and expertise that my committee members, Dr. Kathy Higuchi and Dr. Lynn McCleary, so willingly gave to me in the reading, and rereading, of the drafts of this thesis. Your thoughtful ideas and suggestions have improved this work.

I acknowledge the contributions of the nurses who participated in the pilot and main study for the thesis research. Your willingness to share your thoughts aloud, and wear the recording equipment, while caring for critically ill children and their families, is a testament to your beliefs in the value of the knowledge of expert nurses. Your words have made this thesis possible.

I acknowledge the support received throughout my graduate studies from my employer, the Children's Hospital of Eastern Ontario. As well, I acknowledge the financial support received from the Canadian Association of Critical Care Nurses, the American Association of Critical Care Nurses, the Registered Nurses Association of Ontario, the Registered Nurses Association of Ontario Foundation, the Research

Institute of the Children's Hospital of Eastern Ontario and the University of Ottawa through their studentship, scholarship, and bursary programs.

I acknowledge the support given to me, and to my family, by a group of friends who will never know just how much that hug, that phone call, that listening to me ramble on and on, that printing of numerous drafts, or that invitation to dinner have made this journey possible.

It is impossible to acknowledge all that my husband, Butch, and daughters, Kate and Kristin, have done for me that has made this thesis possible. I am grateful for your laughter and your jokes, even though I may not have laughed at them all the time. I am grateful for your unending confidence in me, even when I wasn't so sure about myself. It has been an adventure that I could not have started, or completed, without the three of you by my side. Thank you for being there with me, and for me, every day.

ABSTRACT

The nature of nursing judgment in clinical practice situations remains incompletely explored. It is known that nurses perform endotracheal suctioning as part of the nursing care of critically ill children. However, the ways in which nurses judge the need for suctioning and the method used to suction are not well understood. This research study was conducted to describe the cues that expert pediatric critical care nurses use in making the judgment to suction and to describe how those cues are used in determining the timing of endotracheal suctioning.

A qualitative naturalistic study was conducted in a quaternary pediatric critical care unit in Central Canada. A purposive sample of seven expert pediatric critical care nurses participated in the study. Data were collected using three methods- participant observations (field notes), think aloud (concurrent verbalizations) and semi-structured interviews (retrospective verbalizations)- as participants cared for ventilated, critically ill children.

Content analysis of transcribed audiotaped verbalizations and field notes revealed that nurses made judgments based on a process of cue utilization. Cue utilization is comprised of a process of cue recognition, in which nurses identified cues, and a process of weighing the evidence, in which nurses considered these cues. Cue recognition and weighing the evidence contributed to the overall process of cue utilization that nurses used to determine the need for, and the method of, suctioning. Cue recognition is comprised of two categories of cues: perceptual awareness and knowing. The category of perceptual awareness is the visual, auditory and tactile cues that nurses recognized. The category of knowing is the nurses' cues related to their knowledge of this type of patient, this particular patient and the practice environment. Weighing the evidence emerged as a process comprised of two cognitive activities

named (a) determining the significance of the perceptions and (b) corroborating impressions. Nurses use the process of cue utilization to determine the need to suction as well as the method of suctioning the patient. Nurses suction patients using a process named skilled performance that is focused on protecting the patient from the negative consequences of the suctioning procedure. Nurses are actively involved in cue recognition (sensing), weighing the evidence (thinking), and skilled performance (doing). The relationships between the processes of cue utilization and skilled performance are intertwined, iterative, and interrelated.

The finding that nurses use a process of cue utilization in making judgments related to the need for, timing of, and method of, endotracheal suctioning has implications for the teaching of this skill, the development of practice guidelines and procedures, and the conduct of further research examining the complexity of other nursing clinical skills.

TABLE OF CONTENTS

Acknowledgements i

Abstract iii

Table of Appendixes viii

List of Tables ix

List of Figures x

1. Introduction 1

1.1. Background 1

1.2. Purpose 2

2. Review of the Literature 3

2.1. Clinical Judgment 5

a. The Importance of Clinical Judgment 5
b. Theoretical Perspectives 8
i. Analytical Perspective 8
ii. Intuitive Perspective 13

2.2. Cue Utilization 15

2.3. Influencing Factors 18

a. Experience 19
b. Expertise 19
c. Context 21
d. Knowing the Patient 23
e. Personal Characteristics of the Nurse 24
f. Patient Situation 25

2.4. The Judgment to Suction 26

2.5. Conclusion 28

2.6. Research Questions 29

3. Method 30

3.1. Research Design 30

3.2. Methodological Assumptions 30

3.3. Setting 33

3.4. Sampling Method 34

3.5.Data Collection 37
a. Pilot Study 39
b. Main Study 40
3.6.Data Analysis 42
3.7.Enhancing Methodological Rigor 43
3.8.Ethics and Human Rights 45
3.9.Summary 46
4. Findings 47
4.1.Context 47
a. Nature of Pediatric Critical Care Patients 48
b. Nature of Pediatric Critical Care Nursing in this Unit 50
c. Nature of the Health Care Team 59
d. Nature of the Use of Technology in Endotracheal Suctioning . 63
4.2.Cue Utilization in Making Judgments: An Overview 66
4.3.Cue Recognition 70
a. Perceptual Awareness 70
b. Knowing 84
4.4.Weighing the Evidence 94
a: Determining the Significance of Perceptions 96
b: Corroborating Impressions 101
4.5.Skilled Performance 104
a. Protecting the Endotracheal Tube Placement 106
b: Preventing Hypoxemia 107
c: Reducing Distress 108
d: Accessing Human Resources 109
e: Promoting Secretion Clearance 110
f: Minimizing the Number of Suctioning Passes 112
4.6.Cue Utilization in Making Judgments: A Summary 113
5. Discussion 115
5.1.Research Question 1 115
5.2.Research Question 2 127
5.3.Skilled Performance of Suctioning 132
5.4.Research Method: Strengths 137
5.5.Research Method: Limitations 139

5.6.Recommendations 141

a. Practice 141
b. Education 143
c. Research 144

5.7.Role of the Clinical Nurse Specialist 146

a. Direct Care Provider Role 147
b. Educator Role 148
c. Consultant Role 149
d. Researcher Role 150

5.8.Conclusions 152

References 154

Appendixes 166

TABLE OF APPENDIXES

Appendix A: Participant Introductory Letter 166

Appendix B: Consent for Main Study 167

Appendix C: Consent for Sound Recording for the Main Study 170

Appendix D: Focused Observation Guide 171

Appendix E: Demographic Data of Participant 175

Appendix F: Semi-Structured Interview Guide 176

Appendix G: Ethical Approval for Pilot Study 177

Appendix H: Consent for Pilot Study 178

Appendix I: Ethical Approval for Main Study 181

Appendix J: Letter of Study Explanation for Parents of Patients Cared for by Nurse Participants 182

LIST OF TABLES

Table 1: Visual Cues 71

Table 2: Auditory Cues 78

Table 3: Tactile Cues 82

Table 4: Knowing 84

Table 5: Weighing the Evidence 96

LIST OF FIGURES

Figure 1: Cue Utilization in Making Judgments Related to Endotracheal Suctioning 67

1. INTRODUCTION

1.1. Background

Critical care nursing is a specialized field of practice that is physically, intellectually and emotionally challenging. The critical care nurse (CCN) must make rapid assessments and judgments that have narrow margins of error in caring for patients experiencing life-threatening illnesses. How practitioners respond to patient situations, and make judgments about when and how to implement nursing interventions, have an effect on the physical, emotional and spiritual health of patients and families. However, little is known about the judgments nurses make in performing specific nursing interventions. Radwin (1995a) suggested that the essence of expertise in nursing practice is the ability to make relevant and appropriate judgments based on "cognitive, intuitive, personal and experiential knowing" (p. 19). Nursing studies examining judgment and decision making support the premise that multiple perspectives of nurses' knowing contribute to nursing practice, as initially described by Carper (1978). However, it is not known how these ways of knowing actually contribute to nurses' judgment processes.

"A major problem in contemporary nursing practice is an under valuation of practical nursing skill, as well as a general underrating of the complexity of such skill." (Bjork & Kirkevold, 2000, p. 630). Endotracheal suctioning (ETS) is a nursing intervention that requires not only psychomotor, but also assessment and judgment skills. Nurses assess the patient by noting and considering patient cues, or signs, that indicate the patient needs to be suctioned. The potential negative patient outcomes of ETS include hemodynamic compromise, hypoxemia, pain and distress. When considering the timing of ETS, nurses must balance the risks of suctioning with those of not suctioning such as atelectasis and endotracheal tube blockage. The complexity of the judgments, and the ways in which nurses come to make judgments related to ETS,

are not well understood. Therefore a study to explore how nurses make the judgment to suction is warranted.

1.2. Purpose

The purpose of the study is to describe the cues that expert pediatric critical care nurses use in making clinical judgments about suctioning ventilated, critically ill children.

2. REVIEW OF THE LITERATURE

A review of the literature was conducted before commencing the study in order to determine what has been studied before, to critically analyze the research findings related to the use of cues in making clinical judgments and to examine the literature related to endotracheal suctioning. During the initial review of the literature about nursing clinical judgment, it became evident that multiple terms have been used in the research: decision making, critical thinking, diagnostic reasoning and clinical judgment. It was necessary to first define and examine the usage of these terms in order to propose the direction for this research.

Matteson and Hawkins (1990), in a concept analysis, suggested that decision making is the "process of making a mental choice between two or more options that follows a consideration of all the variations of the options" (p. 8). Facione, Facione, and Sanchez (1994) suggested a conceptual definition of critical thinking as a "process of purposeful, self-regulatory judgment: an interactive, reflective, reasoning process" (p. 345), which is derived from the results of the Delphi Research project on Critical Thinking (American Philosophical Association, 1990). Carnevali (1984) defined the diagnostic reasoning process as a "complex observation, critical thinking and data gathering process used to identify and classify phenomena that are encountered in presenting clinical decisions " (p. 26). Clinical judgment is defined as "the ways in which nurses come to understand the problems, issues or concerns of clients/patients, to attend to salient information and to respond in concerned and involved ways" (Benner, Tanner, & Chesla, 1996, p. 2). These four terms- decision making, critical thinking, diagnostic reasoning, and clinical judgment- may all describe similar cognitive activities that nurses perform in making choices about patient care options. However the inclusion of an element of action in the term clinical judgment, as defined by Benner et al. (1996)

sets this term apart from the definitions of the other three concepts. As a result of this distinction, the term clinical judgment became the focus for this research examining a clinical nursing activity in direct practice situations.

MEDLINE (1966 to 2001), Dissertation Abstracts (1861-February 2001), and the Cumulative Index of Nursing and Allied Health Literature (CINAHL) (1982-2001) were searched using the key words clinical judgment or judgement and endotracheal suctioning. The search strategies were repeated using the key words diagnostic reasoning, critical thinking and decision making to include works related to these concepts. Names of authors, who had widely published on the subject of clinical judgment, were also searched in the indexes. The Education Resources Information Center (ERIC: 1966-December 2000), PsychINFO (1967-2001), and Sociological Abstracts and Sociofile (1974-December 2000) indexes were searched using the key words judgment or judgement, clinical judgment, diagnostic reasoning and clinical reasoning. The Cochrane Data Base of Systematic Reviews, including EBM Reviews and the Database of Abstract of Reviews of Effectiveness, was searched using key words nursing and judgment or judgement. Reference lists of identified articles were also searched. Articles reviewed were limited to English publications. Both qualitative and quantitative research studies, non-research papers, chapters in books, clinical practice guidelines, and opinion papers were reviewed. Research studies examining suctioning included both human and animal studies. As the study progressed, further literature searches were conducted to include newly published papers pertaining to suctioning and clinical judgment.

During the review of the literature, similarities between the research designs and findings of nursing studies examining clinical judgment, diagnostic reasoning and decision making were noted. Benner et al. (1996), Facione & Facione (1996), Kataoka-Yahiro and Saylor (1994), Miller and Malcolm (1990), and Tanner (1994) and have

supported the proposition that these terms may refer to roughly the same phenomenon with overlapping competencies. Although a significant body of knowledge about clinical judgment in nursing has been developed, there is not one explanatory theory, or framework, that has been widely accepted. Consequently, literature from the disciplines of psychology and medicine examining clinical judgment, diagnostic reasoning and decision making has been included in the review.

2.1. Clinical Judgment

The ways that nurses integrate and use theoretical and practical knowledge to make judgments remains to be completely explained. Brykczynski (1989) has suggested, "Clinical judgment is the essence of practical wisdom. It is the least specifiable, yet most crucial aspect of clinical knowledge" (p. 76). The following section will discuss the literature in relation to (a) the importance of clinical judgment, (b) the theoretical perspectives, (c) cue utilization, and (d) influencing factors.

a. The Importance of Clinical Judgment

The literature review identified four critical care nursing studies, which concluded that beneficial outcomes of patient care are positively linked to nursing clinical judgments. Jacavone and Dostal (1992) observed and informally interviewed four expert and four beginning level critical care nurses to identify the clinical knowledge and thought processes used by nurses in the assessment and management of cardiac pain. The authors reported exemplars, collected with focused observation and participant retrospective verbalizations that demonstrated how nurses made life-saving judgments in the care of critically ill patients. The authors concluded that experts' knowledge of cardiac ischemia, pain, and vasoactive drugs enabled them to be confident in the aggressive titration of several medications at one time, whereas beginners were passive and hesitant with titration of these medications. The strength of this study is the inclusion of beginner practitioners in the sample that enabled the authors to contrast the findings

of beginner and expert nurse. The timing of the interviews in relation to the observations made in practice is not identified, and consequently the influence of selective remembering, which may bias the nurses' verbalizations, cannot be assessed in this study. The finding that expert nurses made judgments that helped to prevent negative patient outcomes highlights the importance of clinical judgment in patient care.

Stannard, Puntillo, Miaskowski, Gleeson, Kehrle, and Nye (1996) conducted a qualitative analysis of the use of a pain assessment and intervention algorithm in managing acute pain. Fourteen nurses, with at least six months critical care nursing experience, were audiotaped thinking aloud on an hourly basis as they cared for adult postoperative patients. Nurses verbalized their thoughts while using a prepared algorithm designed to direct the nurses' thoughts and actions related to the assessment of pain, the decision for analgesic treatments, and the identification of potential problems in pain management strategies. The authors identified that nurses used both physiological and behavioral cues as indicators of pain, however the specific cues utilized by the nurses in determining the quality of pain were not reported. The authors concluded that postoperative patients experienced improved pain management when nurses relied on their assessment of patient cues and clinical judgment skills in comparison to when nurses followed the prescribed pain management algorithm.

Jenny and Logan (1992, 1994) conducted a qualitative study to identify the knowledge, judgments, and actions used when critical care nurses wean the patient from ventilatory support. Participants provided a written description of a clinical incident that served as the focus of the interview discussion. The interviews were audiotaped, transcribed and analyzed using the constant comparative method of the grounded theory approach. The analysis revealed that the specific cues nurses recognized and considered in determining the patient's readiness to wean were distinct from the biomedical and technological models of ventilatory weaning. The authors concluded that

the judgments made by nurses provided for an element of individualization of care that was important in successful patient outcomes. A major contribution of this study to the knowledge about clinical nursing judgment was the identification of nurses' use of case specific information in performing a nursing skill.

Hanneman (1996) conducted a qualitative field research study of twenty-seven adult critical care nurses to explore nurses' patterns of practice and the relationship of those practices to patient outcomes. Study design included participant observation, unstructured interviews and the constant comparison method of the grounded theory approach. The author concluded that expert nurses "prevent complications with vigilant monitoring and advanced preparation of personnel and equipment" (p. 335). The author also concluded that the decisions that expert nurses made, based on patient assessments, helped to protect the patient from negative consequences related to the misinterpretation of technological monitoring, and the performance of unnecessary diagnostic tests. The specific assessments made by nurses that prevented complications were not specified in the study.

Negative patient outcomes have also been associated with inappropriate nursing judgments (Hospital for Sick Children, 2000a). In 2001, inadequate assessment, diagnosis and monitoring of a patient were the most commonly identified problems resulting in a lawsuit, according to the Canadian Nurses Protective Society liability trend information (McLean, 2002). Nursing leaders are charged with the responsibility for creating and sustaining environments that promote positive patient outcomes and reduce patient complications. Nursing leaders must ensure the provision of practice environments in which new staff can safely learn the skills and knowledge inherent in clinical judgment to meet this responsibility (Benner, Hooper-Kyriakidis, & Stannard, 1999). Recent reductions in the number of supporting, coaching, and mentoring experts in direct clinical practice environments, have challenged nursing leaders to provide

opportunities for staff to acquire both theoretical and practical knowledge (Crow & Spicer, 1995). Further exploration of clinical judgments by expert nurses will add to the understanding of the nature and the complexity of the phenomenon.

b. Theoretical Perspectives

There are two predominant theoretical perspectives- the analytic and the intuitive- in the clinical judgment literature. The following section provides an overview of the theoretical perspectives that have been used as explanatory frameworks in medical, psychological, and nursing research examining the phenomenon of clinical judgment.

i. Analytical Perspective

Medical decision making research has focused on the processes that physicians use in the identification of correct medical diagnosis and the selection of the most appropriate medical treatment for a disease. Elstein, Shulman, and Sprafka (1978) examined the way in which physicians used information to identify and resolve clinical problems. They concluded that medical problem solving is a sequential cognitive activity in which early problem identification and hypotheses generation guides subsequent data collection and hypotheses evaluation. Dowie and Elstein (1988) presented a collection of studies examining physician clinical decision making activities. The collection showed the diversity of research approaches and the number of theoretical models that have been proposed to explain medical decision making. Multiple models have been proposed to describe the cognitive processes used by physicians: Brunswick lens model (Wigton, Hoellerich, & Patil, 1986), information processing theory (Newell & Simon, 1972), the Bayesian formula of probability (Eddy & Clanton, 1982), the clinical continuum theory (Hamm, 1988), and decision analysis (Doubilet & McNeil, 1985; Sonnenberg, 1997). It is evident that not one model or theory has been universally accepted to explain the ways that physicians make decisions in clinical practice.

The analytical, problem solving activity of diagnostic reasoning in medical practice was researched in an effort to construct models that would predict and direct specific clinical decision making activities. An underlying assumption of these approaches was that if practitioners could be taught how to make better decisions, they would make fewer poor decisions and patient care would improve. In a similar approach, nursing researchers strove to describe the processes used by nurses as an initial step in developing a prescription for improved decision making. The first nursing studies investigating nurses' judgment processes (Hammond, Kelly, Schneider, & Vancini, 1967; Kelly, 1966) followed the medical, analytic framework in examining how nurses used clinical inferences about signs and symptoms in identifying priorities for care for patients experiencing pain following abdominal surgery. The authors were unable to relate specific patient cues to specific nursing actions and concluded that the cognitive tasks of nurses were complex with respect to: (a) the number of cues involved, (b) the numbers of responses to tasks, and (c) the relation between cues and actions.

The information processing theory of Newell and Simon (1972) has been the framework most widely used in nursing studies (Baumann & Bourbonnais, 1982, 1983, 1984; Corcoran, 1986a, 1986b, 1986c; Gordon, 1995; Grossman, Campbell, & Riley, 1996; Hansen & Thomas, 1968 a, 1968b; Henry, 1991; Holl, 1994; Holzemer, 1986; Seldomridge, 1996; Sims & Fought, 1989; van den Berg, 1996). According to the information processing theory, there is a series of six steps in making a judgment: (a) gathering cues, (b) organizing cues into patterns, (c) generating hypotheses, (d) gathering additional cues, (e) testing hypotheses, and (f) making the judgment. However, it is relevant to note that the linear and sequential steps of information processing theory has not been consistently identified in the decision making activities of expert nurses.

Jenkins (1985), in examining nursing students' perceptions of their own decision making, used the conflict decision making theory (Janis & Mann, 1977). This theory postulates seven criteria that represent the cognitive activities in making decisions. These activities include: (a) canvassing a wide range of alternative courses of action, (b) surveying the full range of objective data, (c) weighing the risks and benefits, (d) searching for new information, (e) assimilating new information, (f) reexamining the positive and negative consequences of alternatives, and (g) making detailed provisions for executing the chosen course of action in a linear process.

Putzier, Padrick, Westfall, and Tanner (1985) and Tanner, Padrick, Westfall, and Putzier (1987) have used the hypothetico deductive model in their studies examining diagnostic reasoning of students and practicing nurses. The hypothetico deductive model (Elstein et al. 1978) proposed that the process of diagnostic reasoning is comprised of four components: (a) attending to cues, (b) generating hypotheses, (c) gathering information related to hypotheses, and (d) evaluating each hypothesis.

The three theories presented above each postulate that the judgment process is initiated with recognition of cues followed by specific steps in an apparently linear fashion. The linear models that have been used in medical problem solving research support nurse researchers' conclusions that nurses make judgments about patient care in a rational process (Baumann & Bourbonnais 1983, 1984; Gordon 1995) and in ways that are influenced by situational, personal and contextual variables (Henry, 1991; Holl, 1994; Jenkins, 1985). However, some researchers (Benner, 1983, 1984; Benner & Tanner, 1987; Tanner et al., 1987) have suggested that the analytic linear approach, proposed in the medical models, did not predict the ways in which expert nurses made judgments. Five studies that found evidence that the thought processes of expert nurses were not linear were identified in the literature search (Corcoran, 1986a; Fowler, 1997; Holzemer, 1986; Pyles & Stern, 1983; Tanner, 1987a,b). The findings of these studies

have prompted nursing researchers to consider alternative approaches to examining nursing judgment.

Corcoran (1986a, b) examined the relationships among task complexity and nursing expertise and the planning processes of generating, evaluating and choosing alternative actions of 6 expert and 5 novice hospice nurses. Participants shared their thought processes by thinking aloud as they developed and wrote out a plan of care for pain management for a hypothetical patient situation. Transcripts of the think aloud sessions and the written care plans were then coded and scored using rules previously established by the investigator and a consultant. Comparisons between expert and novice planning processes were made using non-parametric statistics. The author concluded that expert nurses did not implement the planning phase of the nursing process as described in textbooks, did not generate alternative actions or decisions before evaluating any of the options, and that there was no relationship between task complexity and the quality of the plan developed. The use of simulated case studies, the lack of control for educational background and experience in participant groups, and the number of participants may limit the generalizability of the findings. However, the finding that expert nurses varied their approach to decision making based on the complexity of the situation is noteworthy, as it is not fully explained by a rational analytic approach.

Fowler (1997) utilized a descriptive content analysis method to examine the thinking processes of five home health nurses. Findings indicated that participants used a series of cognitive processes involving (a) practical knowledge, (b) framing, (c) hypothesizing, (d) reflexive comparison, (e) testing, and (f) prototype case reasoning in a process not congruent with the nursing process. The author concluded that the findings did not support a rational linear problem solving approach to nursing clinical judgment.

Holzemer (1986) explored the problem solving cognitive structure that 79 nurse practitioners used in assessing and managing a patient with acute pneumonia. The

survey study identified two modalities of problem solving- typical and atypical. Nurses appeared to use a typical, linear model when working through new problem situations in the simulation exercise. When faced with familiar patient problems, it appeared that nurses used unpredictable patterns and an atypical method that is not congruent with the rational analytic approach to judgment. The researcher concluded that the theories of clinical problem solving based on the medical model are not adequate to explain the breadth of nurses' judgment processes.

Pyles and Stern (1983) used in-depth interviews of 28 critical care nurses to examine decision making processes in the early detection and prevention of cardiogenic shock secondary to an acute myocardial infarction. Transcripts of interviews were coded and analyzed using the grounded theory approach. They concluded that experienced nurses used a process linking basic knowledge, past experiences, cues presented by patients, and personal sensory clues (gut feelings) as a basis for the decision about whether or not a patient was developing cardiogenic shock. The authors suggest that an important element in the assessment of cardiogenic shock is the perception of stimuli that are related to relevant knowledge or past experience. Nurses reported certain cues- signs, symptoms or other information reflecting changes in patient condition- that were relevant to the assessment of cardiogenic shock. These cues included the look of the patient, mental changes, colour, temperature and dampness of skin, and increased respiratory and heart rates. As well, the authors reported that nurses made their final decisions on the basis of several cues rather than on one individual cue. The authors proposed a theory of Nursing Gestalt to explain the cognitive processes used by experienced critical care nurses. Nursing Gestalt theory was proposed as a matrix of the dimensions of cue identification, cue differentiation, knowledge, and gut feelings that served as a foundation for the nurse's assessment and decision making activities. The processes proposed by these authors are not congruent with a rational linear approach

to decision making. The complex theory is based on interwoven relationships between the four dimensions that are not well explicated by the authors. The complexity of the model may explain why the theory of Nursing Gestalt as proposed by Pyles and Stern (1985) has not been tested in further nursing research.

Tanner (1987a, b) extensively reviewed 53 studies which met four criteria: (a) relevant to the teaching of nursing clinical judgment, (b) presented empirical evidence, (c) examined the practice of either student or practicing nurses, and (d) described or measured a component of clinical judgment, defined as observation, diagnosis or management. The purpose of these reviews was to summarize and evaluate the nursing research related to the teaching of clinical judgment. The author concluded that there might not be a single process underlying nursing judgment and that not all nursing practices can be described as analytic, problem solving activities. As well, Tanner suggested that quantitative designs, using simulation methods characteristic of nursing research at that time, did not provide valid measures of performance in clinical judgment, and that inductive approaches should be the method of further investigations of clinical judgment.

In response to the need to further explain the phenomenon of judgment, nurse researchers (Greenwood, 2000; Benner et al., 1996, 1999; Cioffi, 1997) have employed alternative theoretical frameworks drawn from other disciplines and from an intuitive perspective.

ii. Intuitive Perspective

Greenwood (2000) discussed the application of schema theory to nursing judgments and suggested that the use of nursing scripts (ways of doing) and the influence of personal relevance (an interaction of contextual, cultural, and environmental features with the nurse's perception of task complexity) explained the ways that expert nurses' practiced. Skill acquisition theory (Dreyfus & Dreyfus, 1986) has been widely

used in nursing judgment research (Benner, 1983, 1984; Benner et al., 1996, Benner et al., 1999) in developing an understanding of how levels of expertise influence the nature of nurses' judgments and practice. In an opinion paper, Cioffi (1997) suggested the application of heuristics- described as mental rules of thumb (Tversky & Kahneman, 1982)- to explain the use of intuition by expert nurses in making clinical decisions. These three models- schema theory, skill acquisition theory and heuristics- share the position that decision making by experts is based in part on a non-rational cognitive process labeled intuition. It is evident from the number of analytic and non-analytic theories employed in the nursing research on judgment that no one definitive approach has been widely accepted as a framework that predicts and explains the complexity and variability of nurses' judgment processes.

To address the gaps between rational models of decision making and the findings of clinical nursing research on judgment, Buckingham and Adams (2000a, b) have proposed an alternative approach- the psychological classification model- as a unifying framework. In two linked papers, these authors integrated evidence from nursing clinical studies and decision making theories of related disciplines to support the stance that the general psychological classification model presents a framework to explain the philosophical approaches used in the research. In this model, the decision-maker notes physical data (patient cues) and creates an internal psychological value of that cue. The classification model proposed that nurses integrate multiple cues to generate a single judgment. The process of how nurses generated that judgment incorporated both rational hypothetico-deductive reasoning, *conscious thoughts,* and at the same time intuitive reasoning, *unconscious thoughts*. The authors have presented a valuable theoretical contribution to the nursing knowledge of clinical judgment in suggesting that clinical judgment should not be considered either rational ***or*** intuitive, but rather rational ***and*** intuitive. Further investigations of nurses in clinical practice are

needed to assess the utility of the classification model in describing and predicting this complex phenomenon. As suggested by nurse researchers Crow, Chase, and Lamond (1995), Henry (1991), and Miller and Malcolm (1990) the process of clinical judgment remains an incompletely understood phenomenon and one that warrants further examination.

In summary, two schools of thought- the analytic and the intuitive- are evident in the literature related to nursing clinical judgment. Rational models, such as the information processing theory that had been widely used in early nursing investigations of this phenomenon, do not fully explain the complexity of the cognitive processes of expert nurses in clinical practice. Intuitive models have been proposed to account for the non-linear processes that have been identified in some nursing research. Similarly, two approaches to examining judgment- quantitative and qualitative- are evident in the literature. Further studies examining the phenomenon in direct practice is essential to address the gaps that exist between the theories of judgment and the practices of nurses.

2.2. Cue Utilization

The recognition of a cue, or stimuli, as the initial phase in making a judgment is found throughout the literature examining judgment. Cue utilization is considered a cognitive process that includes not only the recognition of a cue, but also the consideration of that cue in making a judgment. The following section of the literature review discusses the nursing research related to cue utilization.

The nursing research examining clinical judgment has suggested that nurses attend to cues about a specific patient in a specific situation, and use cues (cue utilization) in the process of making judgments. The Oxford dictionary definition of cue includes a stimulus to perception or a signal for action (Thompson, 1998). This definition

is congruent with the use of the term in nursing and in this research. Cues are a part of the salient information that nurses consider in decisions made in practice situations.

Ways in which nurses recognize and attend to cues has been examined in simulations and direct clinical practice. Fonteyn (1998) has suggested that recognizing a pattern of cues represents a common thinking strategy used by nurses in identifying characteristic pieces of data that fit together. In the Thinking in Practice study (Fisher & Fonteyn, 1995), fifteen experienced nurses were given a written clinical situation, asked to read the situation aloud, and then to think aloud (TA) as they considered how to resolve the problems in the scenario. Transcripts of the audiotaped think aloud sessions were analyzed and twelve thinking strategies were identified: (a) recognizing a pattern, (b) setting priorities, (c) searching for information, (d) generating hypotheses, (e) making predictions, (f) forming relationships, (g) stating a proposition, (h) asserting a practice role, (i) making choices, (j) judging the value (k) drawing conclusions, and (l) providing explanations. Nursing research has used think aloud methods with simulated clinical scenarios, as it is convenient, time efficient, and not disruptive to patient care. However, the major limitation remains that the use of simulations to collect data on participants' thinking processes may not reflect what actually happens in clinical practice. In response to their recognition of the limitations of simulated TA studies, Fonteyn and Fisher (1995) explored the feasibility of using the TA method in clinical settings. These researchers studied one neuroscience nurse in direct practice and concluded that TA during practice situations was safe, feasible, and effective in producing data for interpretive analysis. In a subsequent study, Fisher and Fonteyn (1995) examined three nurses use of heuristics- mental rules of thumb, or short cuts when gathering and interpreting information- in direct clinical practice. TA data was collected by having participants carry a voice activated tape recorder in their uniform pocket to capture the nurses' verbalizations as they reasoned and made judgments about patient care. The

findings of this study suggested that nurses used a heuristic of pattern recognition in reasoning about patient care. Pattern recognition was defined as "identifying similarities and difference in patient conditions, problems, and responses to therapy with those previously encountered during the care of similar cases" (p. 270).

Benner and colleagues (Benner et al., 1996; Benner et al., 1999) have contributed significantly to the understanding of nurses' use of cues in a two-phase interpretive phenomenological study examining the clinical practices and thinking of critical care nurses. Over one hundred American critical care nurses participated in small group and individual interviews and were observed in direct clinical practice. A team of nursing researchers thematically analyzed the data transcripts. Findings included that the nurse's recognition of cues contributed to the concept of clinical grasp, which is a fundamental element of clinical judgment. These authors concluded that clinical grasp is the process of gaining an understanding of the patient situation based on the perceptual skill of recognizing salient cues in the patient situation. The findings of this clinical study are limited in that the nurses' verbalizations about their thoughts and judgments are retrospective. Verbalizations drawn from memory may not accurately represent the actual thoughts and judgments made in direct clinical practice situations.

Fowler (1997) examined clinical reasoning, which this author defined as "the process of entertaining multiple possibilities when making judgments about client situations" (p. 350). Five home health care nurses were audiotaped thinking aloud while they made decisions on planning client care. The findings of this qualitative study suggested that the nurses used cognitive strategies that are heuristics in making decisions. The first cognitive strategy, named cue logic, is cognitive approach used to appraise incoming cues. Although the purpose of the study was to elicit the cues noted by nurses in the situation, these cues were not reported. As well, how the strategy of cue logic influenced the nurse's appraisal of cues was not reported.

Einhorn (2000), in a study of the judgment processes of three expert medical pathologists proposed, "...after cues are identified, measured and clustered, the important cognitive work of weighting and combining to form a global evaluation follows" (p. 325). The participants were asked to give a judgment as to the amount of a specific characteristic that was important to them in interpreting pathological slides. Participants rated the characteristics on a six-point scale that was chosen by the researcher. As well, overall judgments on the classification of disease were ranked on a nine-point scale. The findings suggested that although experts may arrive at similar judgments, the cognitive work in forming a global evaluation of the recognized cues may be different. The author concluded that the expert practitioner might be able to "discern and use contingent relationships between cues, that is, complex interactions among cues" (p. 335). However, the cognitive processes that are used to manage complex relationships between cues were not discussed. The sample of 30 judgments (ten judgments for each of three participants) may not have been adequate to examine similarities and differences between experts' thought processes.

It is apparent that although nursing and medical research has identified the importance of cue recognition and utilization in making judgments, the cues, and ways in which nurses use those cues, in specific clinical situations have yet to be widely studied. Buckingham and Adams (2000a) proposed that deciding which patient attributes, or clinical cues, are relevant to clinical judgment is "one of the most important tasks in clinical decision making and distinguishes experienced nurses from novices" (p. 985). It is imperative that further direct clinical practice studies be conducted to explore cue utilization.

2.3. Influencing Factors

To further increase the understanding of clinical judgment, nurse researchers have examined factors that influence the nature of clinical judgment in nursing practice.

These include: (a) experience, (b) expertise, (c) context, (d) knowing the patient, (e) personal characteristics of the nurse, and (f) the patient situation.

a. Experience

Experience in nursing has been postulated as a factor influencing the quality of nursing judgments. In a study of 9 psychiatric staff nurses, Holzworth and Wills (1999) concluded that nurses' experience influenced the judgments that nurses made related to the use of restraints in psychiatric patients. Nurses with less than three years experience judged the need for the most restrictive type of recommendations more frequently as compared with nurses with more experience. Similarly, Dela Cruz (1994) examined the decision making styles of 21 home health care nurses in a grounded theory study and concluded that patient's clinical status, context of the situation and the nurse's knowledge and experience influenced the ways the nurses made decisions. These findings are congruent with the conclusions of Hamm (1988) and O'Neill and Dluhy (1997) who proposed that the critical thinking and diagnostic reasoning processes of medical practitioners develop in stages related to experience and knowledge acquisition.

b. Expertise

Expertise in nursing practice has been proposed as a factor that influences the ways in which nurses make clinical judgments. It is relevant to note that prior to the work of Benner (1984) the terms experience and expertise were often considered inclusive of each other. Benner suggested that the two terms represent different aspects of a nurse's practice. Experience, the acquisition of practical knowledge and skill through working with multiple patients with similar needs for nursing care, is influenced by the years in which a nurse works in a specific setting. However, expertise, the application of skill, knowledge and judgment in unpredictable situations, is influenced not only by the nurse's tenure in a clinical setting, but also by a personal development resulting from

creativity and self-reflective thinking (Benner, Tanner, & Chesla, 1992; Benner et al., 1996).

The proposition that the judgment process of experts is not identical to the process of non-expert nurses is supported by a study conducted by Fisher and Fonteyn (1995) previously mentioned in this literature review. In an exploratory study, these authors used verbal protocol analysis to study the reasoning processes of three experienced critical care nurses. One participant, experienced in a specific domain of critical care nursing, was studied caring for a patient in another critical care setting. The authors found that the reasoning strategies used by the nurse when practicing in her familiar setting were different from those used when practicing in an environment in which she had less experience and less domain specific knowledge. The finding that expert nurses incorporated non-rational processes that included intuition when making judgments about situations with which the nurse was familiar supported the conclusions of Benner (1984) and Benner, Tanner, and Chesla (1996).

Hanneman (1996) further developed the understanding of expert/non-expert practices and judgments in a previously mentioned study of critical care nurses. This researcher used participant observation and unstructured interviews to examine the practices of expert and non-expert nurses. The transcribed interviews and observation field notes were analyzed using the constant comparative method of grounded theory. The findings identified substantive differences in the practices and patient outcomes of expert and non-expert nurses caring for critically ill adults. Hanneman proposed that expert practice is characterized by both a gestaltic nursing process and a practice independence. The structural characteristics of the gestaltic nursing process included presence with- being attuned to a specific patient situation- and focused assessment of a patient situation. The structural characteristics of practice independence were decisive action and outcome orientation. In contrast, non-expert practice was characterized by a

dissociative nursing process and a practice dependence. Dissociative nursing practice had the structural characteristics of variable or absent presence with the patient and unfocused assessment of a patient's situation. Practice dependence was characterized by restrained action and task orientation. This author noted that over two thirds of the sample of non expert nurses did make the transformation to expert nurses, in response to experiential learning and the influence of expert nurse role models. Not all nurses became more expert over time automatically. However, the study period of six months is short and may not have been adequate to capture the progression from non-expert to expert practice for all participants.

In order to continue to develop nursing knowledge about clinical judgment, research that clearly identifies the level of skill and knowledge of participants is needed. Knowledge about expert practice will be advanced by an examination of the practices of nurses at the same level of expertise, or by comparisons between expert and non-expert nurses.

c. Context

The importance of understanding the context of nurse/patient situations in examining decision making is evident in the findings of Benner et al. (1996), Jenny and Logan (1992, 1994), and Tanner, Benner, Chesla, and Gordon (1993). "Each unit culture sets up patterns of practice, relationships, surveillance and transmission of clinical and caring knowledge" (Benner et al., 1996, p. 223). In a phenomenological study, MacLeod (1994) examined the practices of 10 expert surgical nurses. She concluded that the context of the nurse/patient relationship was important in how nurses related to the patient. This author suggested that when the context of care was patient centred and directed at specific goals nurses were able to implement caring practices that were based on three intertwined non-linear processes: (a) noticing, (b) understanding, and (c)

acting, that made a difference to patient outcome. However, the specifics of what nurses noted and understood in performing patient care was not reported in this study.

Prescott, Dennis, and Jacox (1987) conducted a multi site study of 150 staff nurses, 68 head nurses, 49 nursing supervisors and 111 physicians, using data collected from hospital records, questionnaires and interviews to examine the kinds of decisions practitioners made. The findings demonstrated that organizational factors including the nursing care delivery system (primary nursing) and the type of patient care unit (small inpatient units and intensive care units) had positive influences on nurses' clinical decision making. A significant finding of this study was the positive influence on the scope of nurses' decisions that was attributed to the degree of trust and the feelings of value that nurses perceived from management and the physician group. Van den Berg (1996), in a think aloud case study of twenty-four critical care nurses from four intensive care units in different institutions, examined the integration of patient cues, nursing knowledge, and clinical judgments in critical care nurse's practices. The number of knowledge items verbalized was positively correlated with the level of the intensive care unit (ICU). This finding is congruent with the findings of Prescott, Dennis, and Jacox (1987), who concluded that nature of the patient care unit influenced the scope of nurse decision making.

Chase (1990, 1995, 1997) conducted an ethnographic study of ten critical care nurses to examine the social context of nursing clinical judgments from the nurses' perspectives. The finding that the nursing hierarchy had a positive influence on preventing lapses in judgments is noteworthy. The nursing hierarchy was described to include the support roles of manager, resource nurses, and clinical nurse specialists.

Additional contextual factors that influence nursing judgments, such as the setting, nursing workload, and attitudes of coworkers, have been identified (Benner & Wrubel, 1982; Greenwood, Sullivan, Spence, & McDonald, 2000; Weinert, Chan, &

Gross, 2001). For example, settings that valued independent nursing judgments were associated with a higher number of independent judgments made by nurses (Scott, Sochalski, & Aiken, 1999).

Aspects of the context of critical care influence the nature of nurse's clinical judgments. In order to understand nurses' practices and judgments, it is essential to understand the context in which those practices and judgments take place. Consequently, future studies examining clinical judgment must clearly identify the context in which the participants practice.

d. Knowing the Patient

Knowing the patient has been proposed as an important concept contributing to the intuitive models of expert nurse clinical judgments. Knowing the patient is an expression used by nurses to represent the ways in which they understand the patient and develop a sense of the patient's situation. One aspect of knowing the patient has been described as practical knowledge- the knowing how- that is gained through direct practice in the clinical situation. Tanner et al. (1993) used an interpretive phenomenologic approach in a study of 130 nurses to describe the nurses' use of practical knowledge in caring for critically ill patients. They concluded that knowing the patient is central to skilled clinical judgment and practical knowledge. The authors concluded that the complexity of nursing judgment could not be identified when viewed through the lens of the rational decision making models. They suggested that clinical judgement should be further examined using interpretive models.

Stannard et al. (1996) used an interpretive phenomenological approach to study the pain management practices of fourteen critical care nurses. In examining the care and judgments made by nurses, the researchers identified that assessing the patient is related to practical knowledge of the patient and the situation. Determining the optimal patient intervention was related to the nurse's clinical grasp of the situation. As well,

knowing the patient influenced how and what judgments were made. Research studies conducted by Chase (1995), Jenny and Logan (1992), Johnson and Ratner (1997), and Radwin (1996) have similarly concluded that nurses' knowledge derived from knowing the patient, in addition to theoretical and practical knowledge, influences the ways in which expert clinicians make decisions about patient care.

e. Personal Characteristics of the Nurse

Personal characteristics of the nurse including beliefs, attitudes, and confidence have been suggested as factors that influence the nature of the nurse's judgment processes. Hamers, Abu-Saad, and Halfens (1994) examined the practices of pediatric nurses caring for children in pain and concluded that the nurse's attitudes towards pain have major influence on the nurse's medication practices. In a subsequent literature review of the factors influencing decision making by nurses caring for children experiencing acute pain, AbuSaad and Hamers (1997) suggested that the personal dimensions knowledge, experience, beliefs, and attitudes influenced nurse's decisions regarding pain assessment and pain management in children.

Nurses' confidence and comfort in considering different ways to manage patient problems has also been considered a factor influencing clinical judgment processes. Greenwood et al. (2000) conducted a qualitative study of four neonatal intensive care nurses examining the relationship between learning and practice. They concluded that the participants did not always do in practice what they knew from theory, and that this 'rule breaking' may be attributed to characteristics of the practice situation and the personal characteristic of confidence in the nurse. The viewpoint that expert nursing judgment incorporates the decision not to follow all written rules is supported by similar conclusions of Benner et al. (1999) and Seldomridge (1996).

f. Patient Situation

Characteristics of the patient situation including acuity, complexity of nursing care required, and instability of condition have been considered factors that are closely linked to nursing clinical judgments (Baumann & Bourbonnais, 1982, 1983, 1984; Baumann & Deber, 1989). Benner et al. (1999) suggested that patients' critical conditions "define and orient the interventions and practices of critical care nurses" (p. 90). The timing, number, and scope of nursing judgments in critical care are significant. As well, the rapidly changing, and sometimes unpredictable, trajectory of illness experienced by critically ill children, influences the nature and scope of clinical judgments made by critical care nurses. Baumann and Bourbonnais (1983) conducted an exploratory study of fifty critical care nurses using semi-structured interviews and a simulated patient case study to examine the decision making process of critical care nurses in crisis situations. They concluded that nurses made multiple decisions in a crisis situation in varying sequences and that some flexibility was allowed in the ordering of decisions, as long as they were made with the time limit applicable to the patient situation.

In summary, nursing clinical judgment has been examined from the perspectives of two theoretical schools of thought (rational and intuitive) and from two research approaches (qualitative and quantitative). A variety of research methods have been employed: (a) retrospective and concurrent verbalizations using case studies and simulations, (b) concurrent verbalizations using think aloud method in direct practice and in case study exercises, (c) focused observation of nurses in clinical practice, (d) pen and paper writing exercises in developing nursing care plans, and (e) focus group discussions. As no single theory or research approach or method has been shown to completely explain or predict the complexities of the phenomenon of clinical judgment in nurses' clinical practice, further studies related to clinical judgment are indicated. It is imperative that nurse researchers continue to develop new knowledge and apply

knowledge learned from nursing studies about judgment in order to assist nursing practitioners, educators, and managers in providing health care that promotes optimal patient outcomes. One such outcome is optimal airway management that is related to safe and effective endotracheal suctioning.

2.4. The Judgment to Suction

The medical and nursing literature related to endotracheal suctioning is discussed in the following section of this chapter. Assisted mechanical ventilation is a fundamental intervention in the management of critically ill children. One nursing intervention in the care of mechanically ventilated children, that is associated with a specific judgment on the part of the critical care nurse, is endotracheal tube suctioning (ETS). Under the Regulated Health Professions Act of Ontario (1994), the high-risk procedure of endotracheal suctioning is identified as a controlled act that nurses, physicians, physiotherapists, and respiratory therapists are authorized to perform. ETS is the sterile aspiration of the artificial airway (endotracheal tube) using a suction catheter attached to vacuum source, with the intent to remove secretions from the airway when patients are intubated and mechanically ventilated (Titler & Jones, 1992). A survey of practitioners in Ontario revealed variations in suctioning practices that included the frequency, the use of saline instillations, and the discipline of the practitioner performing the skill (Brooks, Solway, Graham, Downes & Carter, 1999). There is no one guideline for suctioning frequency that is consistently followed by practitioners. The most recent published clinical practice guideline does not give specific direction as to the indications for or the frequency for suctioning (Brooks, Anderson, Carter, Downes, Keenan, Kelsey, & Lacy, 2001). It is known that nurses may suction according to a prescribed frequency, as in every four hours, as part of the unit routine (Copnell & Ferguson, 1995; Rivera & Tibbals, 1992). However, nurses also determine frequency for suctioning based on patient criteria (Copnell & Ferguson, 1995). Although there is

nursing literature recommending that ETS be based on patient need (Knox, 1993), it is not known how expert nurses determine patients' needs for suctioning and whether or not that need consistently directs their clinical judgment about the timing of ETS. Thus, the examination of critical care nurses' judgments about suctioning is relevant to not only further develop practical knowledge about this nursing intervention, but also to further the understanding of the judgment process of clinicians.

ETS, as a routine practice in critical care units, has been thought to be a method to reduce the problems resulting from a build up of secretions and tube obstruction. However, the evidence to support this stance is drawn from small, non-randomized studies (Ackerman, 1985; Kleiber, 1986). The medical, nursing, and respiratory therapy literature describe the complications associated with endotracheal intubation including soft tissue irritation, inflammation, and increased secretions that may augment the likelihood of tube blockage and lobar collapse (Abrams & Johnson, 1984; Baun, 1984; Boothroyd, Murthy, Darbyshire, & Petros, 1996; Brodsky, Naviwala, & Stanievich, 1987; Drew, Padoms, & Clabburn, 1984). The complications associated with ETS include hypoxia, hypoxemia, bradycardia, tachycardia, atelectasis, pneumonia, hemodynamic fluctuations, localized trauma to the airway, sepsis, and tube dislodgment (Ackerman, Ecklund, & Abu-Jumah, 1996; Brodsky, Reidy, & Stanievich, 1987; Hagler & Traver, 1994; Hodge, 1991; Kleiber, 1986; Kleiber, Krutzfield, & Rose, 1988; Rivera & Tibbals, 1992; Wood 1998a). A protocol for a Cochrane Review, designed to examine whether different approaches to endotracheal suctioning can mitigate the effects of mechanical ventilation, is currently being developed (Woodgate & Flenady, 2000).

Protocols for determining the timing for artificial airway suctioning vary between institutions and are not, in general, based on rigorous evidence (AARC, 1993; ATS 2000; Brooks et al. 1999; De Carle, 1985;Tolles & Stone, 1990). Two nursing studies have examined the decisions that nurses make related to the frequency and timing of

endotracheal tube suctioning. Copnell and Ferguson (1995) used semi-structured interviews to explore nurses' theoretical knowledge and ability to apply that knowledge to their suctioning practice and decision making regarding suctioning. Twenty-four pediatric critical care nurses identified twenty criteria used to make judgments to suction the patient. However, no single criterion was mentioned by all respondents. All participants believed their patients required suctioning every one to three hours. The authors suggest that the large number of criteria identified by a relatively homogeneous population illustrate that decisions to suction are complex and require the consideration of many factors. Wood (1998b) conducted a non-randomized controlled trial of intensive care nurses. Nurses in the control group suctioned per unit routine while the experimental group suctioned based on patient need as determined by the nurses who had been taught auscultation skills to assess a patient's need for suction. Dependent variables included changes in patient ventilator parameters and oxygenation indices. The author concluded that the experimental group demonstrated fewer complications than the control group. However the frequency of suctioning by the experimental group and the outcome measures were not clearly specified. Additionally, the researchers did not control for knowledge, experience and expertise of the participants.

2.5. Conclusion

The literature pertaining to clinical judgment, cue utilization and endotracheal suctioning has been reviewed to determine what has been studied before, to critically analyze the research findings, to identify theoretical assumptions, and to select elements of previous research and data collection methods that would have relevance to the current study of pediatric critical care nurses judgments about endotracheal suctioning. It is evident that how nurses recognize cues, and use cues, in making decisions to suction critically ill children has not been previously examined. No single theoretical perspective has been shown to explain or predict the dimensions of nursing clinical judgment.

Studies, conducted in the last fifteen years using a qualitative interpretive approach to examine the phenomenon, have identified dimensions of the judgment process not previously described in the earlier quantitative studies. The recognition of cues has been proposed as an initial process in the clinical judgment process that is influenced by the expertise of the practitioner. However, what specific cues expert nurses identify and consider in making the judgment to suction critically ill children remains unknown. The literature has identified that concurrent thinking aloud during direct clinical practice is a feasible method to collect data about nurses' judgment processes. Despite the pivotal role played by pediatric critical care nurses in the care of ventilated children, very little is known about how expert nurses recognize and utilize cues in making the judgment to suction. Consequently, a study examining this phenomenon was warranted.

2.6. Research Questions

In light of the above analysis of the literature review, two research questions were posed:

1. What are the cues that expert pediatric critical care nurses recognize in determining the need for endotracheal suctioning (ETS) when caring for mechanically ventilated children?

2. How do expert critical care nurses utilize these cues in determining frequency and timing of ETS?

3. METHOD

3.1. Research Design

A fundamental, qualitative, descriptive study, as described by Sandelowski (2000), was conducted in the critical care unit of a metropolitan, quaternary, pediatric care institution. This method was selected because the literature review revealed that quantitative approaches to clinical judgment have been incomplete in uncovering the nature of this phenomenon. As little is known about how nurses use cues in making the judgment to suction, a descriptive approach was warranted.

3.2. Methodological Assumptions

The purpose of this study was to describe the cues that expert pediatric critical care nurses use in making clinical judgments about suctioning ventilated, critically ill children. An assumption underlying this study was the premise that nurses deliberate and decide on actions that are informed, purposeful, and goal directed. The study used three data collection methods namely: participant observation, think aloud, and semi-structured interviews with staff nurses. These methods, congruent with the general tenets of naturalistic inquiry (Boyle, 1991, Holzworth & Wills, 1999; Sandelowski, 2000), resulted in direct, real time information about nursing judgments related to endotracheal suctioning. The method of the study enabled nurses to share their deliberations about actions in direct practice situations.

A second assumption underlying the method of this study was that using more than one method of data collection might decrease potential sources of bias. To address potential sources of informant bias, retrospective thought processes (recorded as the semi-structured interview responses) were verified with observations of the situation and of participants' behaviors (recorded as field notes) and with the concurrent thought processes (recorded as think aloud audiotapes). Selective remembering and forgetting

can shape the memory such that individual reports are distorted to conform to what the participants believe are expectations of the researcher or culture (Kassirer, Kuipers, & Gorry, 1982). Anthropologists have grappled with a similar issue in using interview versus direct systematic observation as research methods.

> "Abundant evidence shows that when research subjects are asked to report on their own behavior, and these reports are compared to researchers' record of the subjects behaviors based on direct observation, the research subjects' accounts of their own behavior are substantially 'wrong'- that is, they show errors of from 50-80% when compared to the observational data" (Johnson & Sackett, 1998, p. 303).

A third assumption was that naturalistic observation would minimally interfere with the nurses' practices. To reduce potential interference, the researcher used a focused observation guide to maintain a distanced, objective stance essential for impartial observation. To reduce the volume of potential observations and to concentrate the observations to one specific nursing activity, the study concentrated on examining a well-defined type of activity (suctioning) with a well-defined participant group (expert pediatric critical care nurses in one institutional setting) as has been suggested by Angrosino and Mays de Perez (2000). To address the bias that can be a result of an interaction between the researcher and study participants in naturalistic settings, the researcher purposefully removed herself from the immediate locale, when nurses were thinking out loud. To ensure that the participants were comfortable with the audio taping equipment and the think aloud protocol and to ensure that the participants felt comfortable to freely verbalize their thoughts, the nurses had opportunities to practice with the audio recording equipment prior to performing the first suctioning procedure. To minimize the potential of the researcher to interfere with thought processes the researcher remained silent during the participants think aloud sessions.

The fourth assumption was that verbal reporting of thought processes reflected nurses' ongoing cognitive processes. This assumption was supported by the studies of

cognitive psychologists (Kuipers, Moskowitz, & Kassirer, 1988; Rubin & Rubin, 1995). It was assumed that each nurse would recognize and utilize cues in making judgments uniquely and personally and the "the relative salience of cues will be a function of the nurse's definition of the situation in which she finds herself" (Howard, 1987, p. 433). Concurrent verbalization collected through think aloud activities during direct clinical practice, "accesses both the information that is acquired from the clinical environment (e.g. clinical cues) and knowledge gained previously which is stored in the long-term memory" (Spence, Greenwood, McDonald, & Sullivan, 1999, p. 28). Tanner and associates (Tanner et al., 1987; Westfall, Tanner, Putzier & Padrick, 1986) have used think aloud and videotaped simulation, supplemented by verbal patient data, to explore the diagnostic reasoning processes of nurses and student nurses. Corcoran (1986a,b) used the think aloud method to examine novice-expert differences in planning and evaluating a drug administration plan to control pain, while Stannard et al. (1996) employed verbal protocol analysis to examine how nurses plan pain management strategies. Similarly, Kuipers, Moskowitz, and Kassirer (1988) used think aloud and verbal protocol analysis techniques to effectively examine decision making by physicians in situations involving risk and uncertainty.

The fifth assumption was that thinking aloud while suctioning would not interfere with the performance of the skill. This assumption was based on the findings of Henry, LeBreck and Holzemer (1989) who studied 60 pediatric nurses in think aloud sessions. Participants were divided into three groups that were given different instructions regarding a cognitive task and performing a skill. Participants in group 1 were instructed to think aloud while doing the activity; participants in group 2 were instructed to recall thinking after the activity; and participants in group 3 were not directed to verbalize while performing the skill. The authors found no effect on performance when participants thought aloud while problem solving compared to when they did not, regardless of level

of expertise. Similarly, Fonteyn and Fisher (1995) demonstrated that an audiotaped transcript of neurosurgical nurses thinking aloud during direct patient care was both "feasible (safe and not disruptive to care or unit routine) and beneficial (produced rich data about nurses' reasoning and decision making)" (p. 127).

The sixth assumption that expertise influences the nature of clinical judgment is supported by Dreyfus and Dreyfus (1986), Hanneman (1996), and MacLeod (1994). It was assumed that nurses who were considered experts by their colleagues would have developed knowledge, psychomotor, and judgment skills that influenced their decision making practices. To reduce the potential effect of differing levels of expertise on the study findings, the study sample was limited to nurses demonstrating clinical expertise. For the purpose of this study, the researcher has defined expertise to mean the application of knowledge, skill and judgment in unpredictable clinical practice situations that is developed over time and characterized by creativity, self-reflection and experiential learning.

3.3. Setting

The study setting was a critical care unit (CCU) in a quaternary metropolitan pediatric institution that has a capacity of over 350 in-patient beds. Patients are admitted to the CCU under the care of an staff intensivist physician while holistic care is provided by a specialized CCU multidisciplinary health care team comprised of the staff intensivist; the patient's primary physician, such as the cardiovascular surgeon; CCU fellows, who are physicians completing advanced training in pediatric critical care; pediatric resident physicians; registered nurses (RN) including a CCU clinical nurse specialist; registered respiratory care practitioners, also known as respiratory therapists (RT); social workers and pharmacists. This unit has the capacity for 44 patients that are distributed to 36 critical care and 8 long-term/continuing care beds. At the time of the study, the unit plan was for only 20 beds to be utilized for critically ill patients. Daily bed

occupancy was 21.5 (range 7-35 beds per day) or 107% of planned occupancy for the year 2000-2001. During that year the unit admitted 1914 patients, with a total of 7954 patient days. Average length of stay was 4.2 days, although over 100 patients stayed in the CCU for more than two weeks. The average age of patients admitted to the CCU was 5.7 years with a range from 1 day to 22 years. Over 870 children annually, or 52% of CCU admissions required mechanical ventilation (Hospital for Sick Children, 2000b).

This CCU is comprised of four separate areas that radiate from a central nursing station: a corridor of single rooms for isolation of patients with infectious diseases; two one-bed rooms that are used for complex isolation patients such as children immediately post operative liver transplant; the long-term care beds, which currently are used overnight for children requiring close observation following orthopedic or craniofacial surgery, and a section of five four-bed rooms and one two-bed room used for both cardiovascular and medical/surgical admissions. Equipment, supplies and emergency carts are located centrally to each of the sections. As the rooms are distanced from the nursing station and from each other, staff used a room intercom communication system to access the nursing station to request medical, nursing, or respiratory therapist support. In the area of four-bed rooms, two rooms are informally designated for the admission of patients postoperative cardiovascular surgery. Approximately one quarter of the children admitted to the CCU, have a diagnosis of cardiac/cardiovascular disorder. By virtue of these numbers of cardiac admissions to the CCU, there has been an informal division of resources, human, and unit space, allocated to two programs with the CCU- (a) cardiac and (b) medical-surgical.

3.4. Sampling Method

The study examined the practice of 7 fulltime or part time expert nurses. Purposive sampling (Morse, 1998; Sandelowski, 2000; Thompson, 1999) was utilized to select participants who met the inclusion criteria, had experience in endotracheal tube

suctioning, were willing to participate, and had the ability to express themselves.

Participants in this study were required to meet the following inclusion criteria:

1. Staff nurses with at least 3 years clinical pediatric critical care experience.
2. Recognized by peers and supervisor as being a highly skilled clinician.
3. Able to recognize and communicate thought processes.
4. Currently engaged in direct patient care that demonstrates:
    a. Being closely attuned to the needs of patient and family.
    b. Having well developed physical assessment skills that include the ability to scan and come to rapid judgments about patient condition.
    c. Having the ability to make independent decisions about nursing interventions that may cross boundaries between another discipline and nursing.
    d. Paying attention to the outcomes of nursing care including the prevention of complications, purposeful recovery and humanistic care.

The first criterion was established to exclude other health care practitioners who make judgments about ETS, such as respiratory therapists, and to identify participants who had had sufficient experience to develop expertise. The second criterion enabled the unit educator to initiate the first contact with participants. Colleagues in close working relationships are best able to identify the expert practitioner (MacLeod, 1994). The third criterion was required because participants needed to be able to articulate their thoughts into a tape recording device. To assist the unit educator in identifying potential participants who were expert nurses, the fourth criterion was established. This description of the behaviours and actions of expert nurses is drawn from the research of Hanneman (1996) who proposed that expert practice is characterized by a holistic nursing process that is evident in the demonstration of presencing (being attuned to the specifics of the patient situation) and the ability of nurses to perform and act on focused patient assessments. Expert practice demonstrated the characteristic of practice independence that is evident in decisive and independent action on the part of the staff nurse and specific concern and attention to patient outcomes.

The Clinical Nurse Educator of the CCU initially approached potential participants whom she identified met the inclusion criteria. At this time, the study purpose and

methods were explained using an introductory letter (Appendix A). Once the individual had verbally indicated an interest to participate, the researcher was introduced to the nurse. Further explanation of the study was offered. No potential participants refused to participate at this point in recruitment. Consent was obtained for participation (Appendix B) and for sound recording (Appendix C) as per institution ethical requirements.

The researcher did not have difficulty in gaining access to participants or identifying key informants, as had been predicted in the literature (Hutchison & Webb, 1991). Networking with the unit manager and educator during the proposal phase of the research study by electronic mail and telephone conversation was one strategy that facilitated access to participants. As well, the researcher had the opportunity to establish a positive relationship with the unit educator, manager, and nurses during a clinical practicum for a nursing course completed in the CCU prior to the research study. These established links between the researcher and unit personnel enabled data collection to proceed efficiently over a period of two weeks.

In examining a narrowly focused question (cue utilization) with a specific event (ETS) in a homogenous sample of participants (expert pediatric critical care nurses), it was predicted that data collection would near saturation when between 8 and 10 participants had been studied. There is an inverse relationship between the amount of data obtained from each participant and the number of participants necessary, and between the degree of diversity in the research topic and the time to reach saturation (Morse, 1998). The study sample of 7 nurses was determined when the researcher noted that the nurses' words in the think aloud sessions and during the interviews were repeating similar ideas. Following a review of the last three participant tapes and a discussion with a qualitative research expert, it was noted that data saturation occurred with the sixth and was confirmed with the seventh participant.

3.5. Data Collection

During the observation periods, the researcher noted the nurses' actions and listened to their verbalizations from a chair located out of the way of activity near the sidewalls of single rooms or positioned at the foot of the bed in four-bed rooms. When nurses were actively engaging in suctioning, or other strategies related to airway management, the researcher stood to the side of the bed taking notes using the focused observation guide (Appendix D) attached to a clip board. The observation guide and demographic information questionnaire (Appendix E) incorporated factors identified as influential in the literature. The researcher recorded a written description of the activities of the nurses, other health care professionals, and family members present at the bedside prior to, during, and immediately after the suctioning intervention performed by the participant nurses. Observations were noted for approximately two to three minutes prior to the suctioning procedure and for up to fifteen minutes following the completion of the procedure. Distractions, interruptions, and other events concurrently happening in the vicinity of the patient bedside, or in the room, were noted on the observation guide as field notes. As the nurse was preparing the patient and the equipment, and performing the suctioning procedure, the researcher observed the context of the situation. Contextual notes were comprised of observations related to the surrounding activities, circumstances, and personnel involved in the procedure. The researcher avoided direct involvement in patient care activities during the observation time frames. The researcher was able to move around the bedside to keep the participant and patient within view and to note specific patient responses to the suctioning procedure.

For the collection of concurrent verbalized data, participants wore a lapel microphone, positioned with an alligator clip attachment approximately 6 to 8 inches below their chins, that was connected to a small cassette recorder placed in a small 'fanny pack' attached around the waist. Participants practiced using the audio recording

equipment and then were directed to turn the recorder on and start thinking aloud anytime that they considered ETS. When the researcher wondered if the participant was thinking about airway patency, as demonstrated by silent observation of the ventilator of the patient, the researcher initially prompted them to think aloud by saying "What are you thinking right now?" Once the nurses had started the think aloud process, they all quickly demonstrated evidence of comfort and initiative with starting and stopping the taping without prompting or reminding by the researcher. The researcher did not ask probing questions of the participant during the suctioning procedure.

The tape-recorded semi-structured interviews collected the retrospective verbalizations of nurses' thoughts about the suctioning episode. Retrospective verbalization entailed the narration of cognitive processes after task completion and required retrieval of information from past experiences (Ericsson & Simon, 1984). This information was gathered per the semi-structured interview guide (Appendix F), using open-ended questions and prompts adapted from Benner et al. (1996), Doyle and Thomas (2000), and Rubin & Rubin (1995). All interviews were completed on the day of observation and the think aloud data collection. The nurse participant determined the timing of the interviews in relation to the level of activity and her ability to interrupt patient care. The location of the interview was the patients' bedside for six of the participants. One nurse requested to have the interview in the staff lounge during her dinner break as the level of activity and number of interventions required by her patient were complex. This participant felt that she would be better able to respond to the questions of the interview if it was conducted away from the bedside. The timing of the interviews following the suctioning episode was negotiated with the participant. On several occasions, the interviews included discussions about two suctioning episodes, if the nurse had been unable to step away from patient care directly following the initial suctioning episode. The range in time between suctioning episode and interview was 5

minutes to 4 hours. Participants found that the brief duration of interview did not interfere with patient care or nursing activities. The nurses appeared comfortable in speaking into a desktop microphone that was placed on an overbed table between researcher and participant. Care was taken to make the tone of the interview informal with the researcher purposefully listening. The context of the situation, as per the focused observation guide and the researcher's memory, was shared with the nurse to recall the suctioning episode being discussed.

a. Pilot Study

Prior to the initiation of the main study, a pilot study of three expert pediatric critical care nurses was conducted in the Pediatric Intensive Care Unit (PICU) at the Children's Hospital of Eastern Ontario. The purpose of the pilot investigation was to enable the researcher to demonstrate the feasibility of the study design, to develop investigator competence in observing and interviewing the participants in the naturalistic setting, to refine the semi-structured interview questions and observation guide, to trouble shoot the audio-taping procedure and equipment, and to gain experience with the coding and analysis procedures of qualitative inquiry (Musil, 1999). Support for the pilot study at the home institution of the researcher was forthcoming from management and staff. A presentation to the multidisciplinary research committee and explanations of the study to groups of staff nurses were conducted to increase staff familiarity and comfort with the purpose and method of the study. Agency ethical approval (Appendix G) was received with minimal changes required to the research proposal. Three nurses consented to participate in the study (Appendix H). Data collected during the pilot study were not incorporated into the main study data, nor were they analyzed as part of the thesis.

b. Main Study

Following receipt of agency ethical approval at the main study institution (Appendix I) the researcher contacted the unit educator to negotiate timing of data collection and to initiate the identification of potential participants. The unit educator, who has worked in that unit for over 10 years and knew the staff well, identified potential participants who met the inclusion criteria and shared the introductory letter with these nurses. The educator contacted the researcher to arrange the dates for data collection once participants identified interest in the study. Two nurses, who had been approached to consider participation, indicated that although they were supportive of the study, they were uncomfortable with being audiotaped. The educator then created a schedule for data collection based on the nurse participants' rotations. For each day of data collection, the researcher arrived on the unit, identified the participant nurse's assignment, and met that nurse at the bedside to further explain the study, answer questions, and complete the written consent. It was stressed that participation in the study was voluntary and that refusing to participate would not be communicated to unit or agency staff. Once consent (Appendix J) was obtained, the nurse was outfitted with the audio taping equipment, assigned a pseudonym, and data collection started.

Basic demographic information was collected by an open-ended questionnaire (Appendix E) completed by the participant at the bedside prior to initiating the data collection. Seven full and part time female staff nurses agreed to participate in the investigation. One participant was less than thirty years old. Six participants were between the ages of 31 to 40 years. Two participants had completed university nursing education. Years of critical care nursing experience ranged from 8 to 18 years. One

participant had pediatric critical care experience at another institution. Two participants were cardiac resource nurses[1] and two participants were clinical support nurses[2].

The patients cared for by the study participants ranged in age from 4 days to 7 months. Four of the five patients were admitted to the CCU either pre or post operative cardiac surgery. Three participants on three different shifts cared for the same patient.

Privacy for patients and their families was considered during the conduct of this research. Pseudonyms for all patient and family names on audiotapes were substituted during the transcription of the verbalizations. Family members of patients receiving care from study participants were given a letter of explanation (Appendix E) that outlined the role of the researcher, the purpose of the study, and the method of audiotaping while thinking aloud. The researcher verbally explained the intent and method of the study to family members at the bedside during the data collection process. No family member expressed concern with the involvement of the patient's nurse in the study. No family member requested that the study not be continued at his or her child's bedside.

Data was collected during seven day shifts with the average duration of observation 7.65 hours (range 7.5 to 10 hours). A total of 27 suctioning episodes were noted for the seven participants (range 2-5). Duration of think aloud audio recording ranged from 11.5 to 25.5 minutes. Duration of interview audio recording ranged from 9.25 to 16.75 minutes.

---

[1] Cardiac resource nurse is a designation specific to this critical care unit identifying a core group of nurses who have received further continuing education and clinical practice in caring for children postoperative open cardiac surgery.
[2] Clinical support nurse is a designation specific to this critical care unit identify a nursing role designed to provide bedside clinical support and coaching for novice nurses as well as to assist experienced nurses in caring for complex patient assignments.

3.6. Data Analysis

Data analysis followed an interpretive content analysis strategy directed at describing the cues that expert pediatric critical care nurses use in making judgments about endotracheal suctioning. The classic content analysis approach has a fit with a quantitative, deductive, enumerative, and objective approach (Powers & Knapp, 1995, p. 28) but was not consistent with the intent of this study. As the goal of this study was a description of bedside clinical judgment by critical care nurses, the qualitative approach to thematic content analysis, as suggested by Burnard (1991), was the chosen analysis approach. The verbatim transcriptions of concurrent and retrospective verbalizations and the typed observation and field notes constituted the 181 pages of text that was analyzed. Transcripts were created using Microsoft Word with 1.5 inch margins to enable initial notes and memos to be written in the margins. The researcher listened three times to the audiotapes of the think aloud and interview sessions to gain a broad overall understanding of the nurses' words. During this listening time, ideas and initial impressions of the emerging themes were written on large yellow 'post it' notes and pasted on a poster board by the researcher's desk. This 'idea board' was added to as the analysis process continued. Following the 'listening phase' the transcripts were read and ideas about categories were noted in the margins. An initial coding list, drawn from ideas seen to be emerging from the data, was created from the handwritten notes made in the margins of the transcripts. Over four hundred notations were made on the transcripts at this time. These notations were typed into a rich text format file (rtf) and entered into the computer soft ware NUD*IST Vivo (Non-numerical Unstructured Data Indexing Search & Theorizing), a Computer Assisted Qualitative Data Analysis (CAQDAS) software package available from QSR International (Australia). The initial coding list A was then reviewed and coded for categories or repetitive ideas resulting in a second list (B) of 146 different categories. The coding list B was then reviewed three

times, like categories were grouped together, and common groupings were collapsed into single categories. The ongoing revisions created a coding list C of 100 categories. This coding list was then shared with a methodological expert who had reviewed the transcripts and had made notations of her coding ideas that emerged during the review. The two lists were then compared and minor rewordings of codes resulted in the formation of coding list D. Coding list D was used to create a coding system within the NVivo software. The source documents (observation notes, think aloud and interview transcripts) were then coded using the coding system. Categories were reviewed and combined into clusters and themes.

The researcher sought to discover patterns, within the participants' retrospective and concurrent verbalizations, during the development of an understanding of the data. The process of understanding the data came from multiple, purposive, and focused readings of the transcripts following the steps of thematic content analysis. An inductive process of interpreting the data, in which the researcher moved systematically from the whole to parts and back to the whole again, was employed. Coding document reports, representing the categories and themes that emerged from the data, were printed and reexamined to identify similarities, differences, linkages, and relationships between and among the categories and themes. Initial interpretations of the data were shared with methodological experts.

3.7. Enhancing Methodological Rigor

Strategies to promote the rigor of this study included specific appraisals of the data collection, analysis, and interpretation phases as proposed by Lincoln and Guba (2000), Miles and Huberman (1984), and Sandelowski (1993). All transcripts were reviewed to ensure accuracy of verbatim transcription. Field notes and audiotapes were transcribed as soon as possible following the contacts with the participants to promote

precision. Field notes included comments as to the context and nature of unit activity during the observation periods.

The criterion of credibility of qualitative studies represents the truth-value and internal validity associated with quantitative studies (Sandelowski, 1993). To ensure credibility, thick descriptions of observations and verbatim transcripts that illustrate and justify the inferences and analyses of the researcher are included in the text of the thesis. To promote credibility of the study activities such as peer debriefings (interaction with thesis committee members) and member checks (presentation of findings to participants to determine if inferences and analyses are congruent) were completed. Three participants from the main study were mailed a written summary report of the major findings of the study. Two participants returned written comments that supported the researcher's interpretations of their words and actions.

The transferability of a qualitative study relates to external validity and applicability of quantitative investigations (Sandelowski, 1993). To promote transferability of the study, techniques such as the use of thick description, reflective journal writing, and ongoing memoing during the analysis phase to document decisions were incorporated. Analytic decisions were shared with committee members (analytic experts) to protect the analysis from researcher bias.

To promote neutrality, the researcher crosschecked interpretations of data with specific personal beliefs to identify researcher bias that may have influenced the interpretation of findings (Sandelowski, 1986, p. 30). Identifying the potential for researcher bias is important in this project, as the researcher is an experienced pediatric critical care nurse who has developed personal values and beliefs about clinical judgment and suctioning. Clarifying personal beliefs and values with thesis committee members was valuable. In addition, the researcher shared interpretations of the data

with a doctoral student, experienced in qualitative methods and pediatric critical care nursing, to confirm neutrality on the part of the researcher's analyses.

Dependability is proposed corresponding characteristic of reliability when assessing the consistency of qualitative findings (Sandelowski, 1986). To ensure dependability, an audit trail (researcher field notes, tapes, transcripts, evidence of data reduction, analysis, and category construction) was maintained to facilitate the corroboration of the study findings. Accurate and comprehensive notes related to the contextual background of data (contextual documentation), the impetus and rationale for all methodological decisions (methodological documentation), the evolution of the findings (analytic documentation), and the researcher's particular orientation to the data (journal entries) constitute the audit trail for this study (Rodgers & Cowles, 1993).

3.8. Ethics and Human Rights

Measures to protect the rights of the participants were incorporated throughout the study. Ethical approval to conduct the pilot study (Appendix G) and main study (Appendix I) was obtained prior to initiating contact with potential participants. Once agency approval for the study had been received, participant selection followed. No negative consequences associated with participation in the main study appeared during the data collection. Studying the participants during scheduled shifts of work minimized inconveniences to participants.

Confidentiality has been respected and no information that discloses a participant's identity has been released. Real person names mentioned in the audiotapes were given pseudonyms that have been used in all verbal and written records and reports. All identifying information has been edited from the transcripts. The transcriptions of the audiotapes and field notes have only be made available to members of the researcher's thesis committee.

3.9. Summary

The three methods of data collection- focused observation, retrospective and concurrent verbalization- used in this study were effective in uncovering, first hand, how expert nurses use cues to make judgments related to suctioning. The study design met Holzworth and Wills' (1999) challenge for an in vivo study in which "a researcher could accompany nurses as they work, engaging nurses in a form of concurrent verbal protocol analysis of critical incidents and that the goal of this study would be to document the thinking and judgment process of nurses and the critical cues to actions used during actual patient situations" (p. 199). By examining cue recognition, the relationship of cues, the valuing of those cues, and the utilization of cues which participants identified as meaningful, the study was able to describe an aspect of nurses' practice that has not been previously explored.

Nurse participants were well able to verbalize their thoughts aloud while preparing for and completing the suctioning care of intubated critically ill children. The equipment involved in the audiotaping did not impede nursing activities and nurses did not view the equipment as a distracter to providing care. Family members and other health care providers at the bedside did not identify that the think aloud sessions were disruptive or annoying. No family member indicated discomfort or concern for the care of their child while the nurse was thinking aloud.

4. FINDINGS

This chapter presents the findings and is a description of how expert pediatric critical care nurses use cues when making clinical judgments about suctioning ventilated, critically ill children. To reiterate, a cue is a stimulus to perception or a signal for action. Cues act as triggers to making judgments and are derived from the context of the situation and interactions between the nurse and patients and between the nurse and health care providers.

The first section of this chapter will discuss the context followed by an overview of the process of cue utilization and the two core elements in the process. How nurses applied cues in making the judgments about endotracheal suctioning is presented in the final section. The findings are presented with supporting evidence using direct quotes from the participants' concurrent and retrospective verbalizations and researcher's field notes. The evidence is presented in a thick style to enable the reader to confirm or refute the researcher's analysis of the data. The excerpts from verbalizations are identified as to participant pseudonym, nature of verbalization (think aloud or interview) and are presented without grammatical corrections to the speech patterns. The evidence for findings drawn from the researcher's observations is noted in excerpts identified as field notes.

4.1. Context

Context is the social reality in which nursing is situated and is influenced by multiple factors within the nurse/patient interaction and the practice environment and has been shown to influence the way in which nurses make decisions (Benner et al., 1996; Greenwood et al., 2000). "The nursing needs of critically ill infants and children are staggering. Their inherent instability, the complexity of their care, and the procedural problems posed by the small size, all necessitate intense assignment of nursing,

respiratory therapy and other professional personnel" (Fuhrman, 1998, p. 7). This description of the context of pediatric critical care nursing is congruent with the reality in which the study participants practiced. It is relevant to discuss the context in which the participants practised in order to understand the process of cue utilization as seen and heard in the study nurses' words and actions. Judgments related to endotracheal suctioning entail an element of uncertainty that is characteristic of critical care nursing (Benner et al., 1999). Similar to the nature of other professional practices, including medicine and law, "complexity, uncertainty, instability, uniqueness and value conflicts" (Schon, 1983, p. 14) are central to the world of professional nursing. The following section describes the nature of (a) pediatric critical care patients, (b) pediatric critical care nursing, (c) the health care team in this critical care unit, and (d) the use of technology in endotracheal suctioning.

a. Nature of Pediatric Critical Care Patients

Characteristics common to the nursing of critically ill children and adults include the attention to close surveillance and monitoring, the consideration of family as the unit of care, and the influence of technology on patient care and outcomes. The specific nature of pediatric critical care patients, such as the pathophysiologies related to congenital anomalies, the pediatric responses to pharmacologic therapies, and the size of invasive devices mandated by the size of the patient, created a context for pediatric nurses that is not mirrored in the adult critical care world. The patients of the nurse participants were nasally intubated with either a 3.5 or a 4.5 mm diameter endotracheal tube (ETT). The size of the ETT was a concern for the nurses as they discussed the potential complications of blocked tubes associated with such tiny airways. As well, the size of the ETT appeared to be a factor that influenced some nurses' use of saline instillation as a measure to prevent tube blockage. One nurse verbalized how this

characteristic of pediatric critical care patients influenced her judgments about suctioning.

> "We try not to, we don't use saline on the bigger kids. And I know in some centers, it's, they say, 'you know we never use saline', but with us, our tubes are so little. So he has a three and half ETT tube. It's little and when kids have their sternum open, and we talked earlier about these thick secretions because the kids aren't moving around so much. So the secretions are thick, the tube's tiny, and the big concern is that the tube doesn't block. So that's why I go down with the saline." (Hannah interview)

As all the children cared for by the nurses in the study were infants, it was not surprising to note the degree of sedation, analgesia and restraints of hand and head that contributed to protecting the patient. Nurses appeared to have a high index of suspicion about pain and discomfort, and used pharmacotherapies to ameliorate the patient's discomfort. One nurse suggested that her patient could hear her getting ready to suction him and this caused him significant distress.

> "He's looking up, he's seeing me, he hears the suction and he knows I'm going to suction him and he's agitated." (Hannah interview)

The participants' patients were experiencing significant alterations in meeting basic life needs related to gas exchange and cardiac output. The nursing interventions required by the patients were complex and multidimensional. Patient treatments included, but were not limited to, the management of fluid balance by continuous renal replacement therapies; the management of comfort and anxiety by the preparation and titration of continuous analgesic and sedative infusions; the support of adequate cardiac output by the preparation and titration of continuous infusions of vasopressors (milrinone, epinephrine, nitroprusside, phenoxybenzamine), and the promotion of oxygenation and ventilation by chest physiotherapy, suctioning, and repositioning. These patients required significant levels of surveillance per monitoring technology, as well as close nursing attendance at the bedside to maintain the placement of intravenous and intracardiac lines as well as endotracheal and chest tubes.

b. Nature of Pediatric Critical Care Nursing in this Unit

The nature of pediatric critical care nursing in the unit is described in relation to (a) nursing resources, (b) the role of the nurse in coordinating activities of members of the health care team (physicians, respiratory therapist (RT), other nurses), (c) nurses' professional and ethical values, (d) scope of practice of RT and RN, and (e) unit specific suctioning routines.

The pediatric critical care nurses in this study cared for infants and children experiencing life-threatening illnesses, in conjunction with a multidisciplinary health care team. The unit is currently staffed with approximately 120 RNs who work 12 hour, or 8 hour shifts, on a self scheduled rotation. In the past year the turnover for this unit is estimated at approximately 20%, and at the time of the study the unit had 20 vacant RN positions, which represented approximately 15% of the RN staffing quota (personal communication, Unit Educator, January 2002). To ensure adequate direct surveillance of patients, nurses in support and leadership roles, such as the resource nurse (team leader) and the clinical support nurse, were frequently reassigned to direct patient care responsibilities. The reallocation of nurses in the unit reduced the availability of the support nurses to provide consultation to other staff. Nurses were observed to work creatively, in a team approach, to modify patient assignments and to support each other to provide safe nursing care to the critically ill patients. Adapting the nursing assignment to meet the requirements for nursing care in this unit was seen as a strategy to manage the staffing shortage that happened throughout the shift. Two respondents mentioned in their retrospective verbalizations that they considered the number of staff available and the workload of the other nurses in the room in determining the timing of suctioning for their patient prior to leaving the unit for an assigned break.

> "Because this is a pretty busy room and I don't want to leave the responsibility of having to suction while I'm away when I could have assessed before hand,

> suctioned before I went to lunch. However, saying that, I also didn't want to suction just for the sake of suctioning and distress the baby. So when I initially listened I actually thought she sounded okay and could be left. Um, but then she made some more coughing noises and I heard a little bit more. So I decided to suction. So that was my reason for doing that and I did not suction as much as I did last time. I just went down once, cleared her." (Irene interview)

Coordination of nursing resources was evident in the activities related to arranging for staff breaks. Nurses in four-bed rooms conducted an informal mini report in the morning before coffee breaks when they gathered their chairs into a circle in the center of the room. At this time, each nurse shared a brief update on the patient highlighting current issues, ongoing medication infusions, location of lines, ventilator parameters, and suctioning frequency. This sharing of information was intended to enable the nurses to be aware of the condition of nearby patients and to intervene if needed when nurses were absent from the bedside. When working in the isolation corridor, nurses commented that their ability to share information and assist other nurses was made more difficult by the separation of the patients. Nurses in the isolation corridor used a central monitoring system that was accessible to staff as a means of monitoring and maintaining surveillance of the patients while some nurses were on break. During the observation period, it was noted that less than half the nurses took scheduled coffee and lunch breaks in response to the need to arrange for safe coverage of their patients. Ellen identified that for breaks she needed to verbally negotiate time with another nurse who was caring for a ventilated patient in a separate isolation room to "listen and have an eye out for my patient while I am gone." Participants were observed to schedule breaks based on their patients' conditions, unit activity, and the projected duration of their absence from the unit.

> "Our hourly check for the chest assessment, the colour is good, she's breathing comfortably, sats are ninety-nine in twenty-five per cent and just putting my hand on her chest. I don't feel anything and so I'm going to just leave her because I'm going to go and have a coffee break." (Faith think aloud)

Coordinating the activities of other members of the health care team emerged as a dimension of nursing within this unit that influenced judgments related to the timing of suctioning. Nurses worked with allied health, physicians and others in planning and sequencing care, as well as facilitating the care of others. One nurse was observed to suction her patient prior to the portable chest x-ray, even though she knew she would need to suction following that intervention as well. Nurses sequenced specific care activities as a way of clustering care and giving children some recovery time.

> "I was hoping to get his x-ray done so we would only have to give him a one-time suction, but it is not going to help my pictures if I don't. So I'll just go down once and see if we can clear him in order to get his x-ray. Okay, (to x-ray technician) I am just going to give him a quick suction." (Jody think aloud)

Nurses were observed to reposition their patient; requisition, acquire and prepare equipment; prepare and administer blood products and medication infusions; and modify the environment by moving furniture and raising bed levels in preparation for a procedure to be performed by a physician. This component of nursing work was complex, unit specific, and time consuming. It was apparent that this background nursing work complemented the direct care activities of health care team members and was directed at protecting the patient. Nurses not only facilitated access to the patient by others but they also intervened to promote optimal outcomes from the care provided by others. Nurses attended to the patients' needs during procedures performed by others, such as ETT retaping done by RT and intracardiac line removal done by the cardio thoracic surgeon in order to prevent potential complications.

> "It was going through my mind at the time was that we were doing a major procedure on the patient i.e. closing the sternum. Patient hadn't been suctioned since sort of the wee hours of the morning. Not that, and there's a point with these hypoplasts stage one Norwood, that we don't do it routinely however because of it being such a big procedure we should at least go down once and make sure there's not a blockage forming cause, god forbid, something should happen during the procedure. And they'll say, 'When was the last time you suctioned' and it's been hours and hours and hours." (Diane interview)

Advising other nurses on aspects of care provision was a part of the nature of nursing in this unit. Nurses turned to each other for assistance and guidance when unfamiliar with a procedure or intervention. In the following excerpt Jody shared her expertise with another nurse preparing intravenous infusions and tubings for a patient to go to the diagnostic imaging department. At the same time as she was suctioning her own patient and noting the patient's responses, she was assessing that assistance was needed in the room to meet other patients' needs. This excerpt illustrates the ways in which expert nurses respond to multiple cues, contribute to multiple conversations, and perform complex nursing skills all at the same time.

> "One extra tubing [to nurse preparing a patient for transport]... why don't we page LL [to room intercom].... Well, she is going to have to help or do something until we get J back from break [to another nurse in the room]. My hands are tied over here.... Yeah, isn't she clinical support? Okay, little guy. Oh look at your PD[3] draining with all your coughing.... (manually bagging[4]).... Okay, big cough...There we go.... Five total. She said one more onto her morphine [to nurse preparing patient for transport]" (Jody think aloud)

Nurses' professional and ethical values emerged from the data as another part of the nature of pediatric critical care nursing in this unit. The professional values of accountability and autonomy of practice and the ethical values of beneficence and non-maleficence contributed to the ways in which nurses made judgments about suctioning. The participants acknowledged that making judgments about patient care was a feature of nursing practice for which they were accountable and responsible. The participants' attention to detail and close surveillance supports the notion that nurses felt it was important that their nursing care activities did not result in negative patient outcomes. An

---

[3] PD is the abbreviation for peritoneal dialysis- a form of continuous renal replacement therapy.

[4] The use of the term bagging to represent manual ventilation with a flow-inflating bag (MiE) is a usual practice in critical care units. Manual ventilation prior to suctioning with increased levels of oxygen (pre-oxygenation) is a recommendation in the most recent clinical practice guidelines (Brooks et al, 2001).

awareness of the fragility of the patient was evident in the nurses' acknowledgement of the significant implications of their judgments. Diane shared her concern for not suctioning the patient although she had previously identified this patient was at significant risk for a pulmonary hypertensive crisis when suctioned.[5] She expressed responsibility for the potential outcomes of the decision to postpone suctioning.

> "So, generally if it's six pm and you haven't suctioned, we'll try and say well what do you think in the next hour or so just to say we've been down the tube and know there isn't a clot forming. Cause, as I'm sure it's happened to all of us where they sound great and suddenly they block the tube and that's the last thing you want for these babies." (Diane interview)

Respect for the autonomy of nursing was a professional value held by the participants. Nurses demonstrated degrees of practice autonomy in implementing independent nursing actions (determining the timing for suctioning), interdependent actions (two person suctioning technique in collaboration with the RT) and dependent actions (manual ventilation with hypoxic gas mixture). The participants were observed to share their impressions and suggestions for care with respiratory therapists, other nurses and physicians. It was evident that the participants were viewed as health care team members who were valued by colleagues.

The participants' words and actions suggested that the ethical values of beneficence- to do the most good, and non-maleficence- to do no harm, were considered as the nurses made clinical judgments about suctioning critically ill children. Nurses appeared to consider that the procedure of suctioning was accompanied by a potential degree of pain, bodily invasion, and psychological burden to the patient and was not a benign nursing intervention. The value of beneficence demands that the nurse

---

[5] Pulmonary hypertensive crises can be initiated in infants with increased pulmonary blood flow lesions (such as following Norwood procedure for hypoplastic left heart syndrome) by activities such as suctioning that can cause increased CO_2 levels and decreased O_2 levels.

provide care that benefits the patient. The value of non-maleficence emphasizes that the nurse has a duty to avoid harming the patient. The apparent conflict between these two values, as nurses considered suctioning, was evident in the following think aloud. The participant voiced concerns for the patient's discomfort while at the same time acknowledging the need for suctioning in this concurrent verbalization.

> "There you go sweetie, okay, that's a girl. It's not nice, I know. Not nice... Yes there is loads of stuff down there. Put you back on the bag, give you some big breaths, okay? Okay, does that feel better? Oh, it has to feel so much better. Okay, good girl." (Irene think aloud)

Similarly, Jody identified that she would suction because of her concern about the size of the ETT even though it was so distressing to her patient.

> "...Okay, I know, not very nice.... That's a boy, cough it up... that's a good boy. Okay, One more time down.... Ah, that's better Jimmy. Does that feel better? It's such a tiny little tube you have.... Okay, honey. (manually ventilated). Okay hon, that's it... Hello (babe opened eyes).... There, that wasn't so bad." (Jody think aloud)

Participants acknowledged that the potential complications of not suctioning were significant even though the procedure was potentially distressing to the patient. The participants' verbalization illustrated a dilemma that considered the risks and benefits, positive and negative outcomes, of suctioning the patient. Nurses were observed to maintain close attendance at the bedside following suctioning as part of the protecting the patient from the negative outcomes of suctioning. Nurses were noted to maintain close visual and auditory surveillance of the patient for up to thirty minutes following the suctioning event in order to respond to negative outcomes or to confirm positive outcomes of the procedure.

> "First ten minutes after suctioning I tend to hang around the bedside a little bit more to make sure she's tolerated it okay and I'm going to have a listen to her chest and compare how she was before and how she is now (Faith think aloud)"

Respect for family was a value observed in the nurses' supportive approaches to family members. Nurses actively sought to include family members in the care of the child and acknowledged the family's need to be reconnected with the patient.

> When family members were stroking infant, RN encouraged them to touch in a developmentally sensitive way, with firm even pressure and explained that with the baby's increased bilirubin and jaundice that she may be experiencing pruritis, and that light feathery touching [as they had been doing] may be uncomfortable for the baby. (Faith field notes)

One nurse consulted with the Clinical Nurse Specialist (CNS) who had been involved in the care of the patient's family to identify the family member's knowledge and understanding of the child's problems, treatments, and prognosis.

> RN was very interested in talking with CNS and staff who had cared for this patient in identifying 'where are these parents'. CNS shared her perceptions of family- as this was a coping style for them at the present, and that they did appreciate the gravity of the situation. Faith identified then that she would support that coping style but be realistic when asked questions by the parents. (Faith field notes)

All patients had family members at the bedside for some period of time during the hours of observation. Family presence at the bedside influenced the time that nurses spent teaching, explaining and comforting family members. A valuing of family presence and involvement in the care of critically ill children was evident in the nurses' supportive and empathetic conversations with families, in the creativity that was part of the nurses' skill in manipulating the environment to facilitate family presence at the bedside, and in their explanations of treatments to families. Explaining the suctioning procedure when parents were at the bedside was one form of family education that was consistently demonstrated by all nurses. Nurses appeared to consider the risks of having family present at the bedside during suctioning but did not request family to leave during the procedure. As well, family presence influenced the timing of suctioning for two nurses. Ellen moved quickly to complete her suctioning of the patient, bring up a chair to the side of the crib, and explained to the mother, "Once I'm done, I'll get out of your way" as a

means of facilitating the connection between mother and child. Another nurse spoke to the family of the patient and explained she would quickly do the suctioning and then leave them alone to have time with their baby. Nurses appeared to accept family presence at the bedside during direct care activities.

> "I mean you have to be able to operate with an audience and that's someone else's child, so you have to learn to work under scrutiny and it's, that's kind of our thing." (Faith interview)

Endotracheal tube suctioning was within the scope of practice of both RNs and RTs. Judgments to determine the timing, implementation, and sequencing of the suctioning procedures were made both independently by the registered nurse (RN) and interdependently with the RT. Both nurses and RTs identified the need for and way of doing the procedure independent of physician directives. The practices related to ETS were guided by unit policies and procedures accessible via computers within the patient rooms. The agency policy for ETS stated that as suctioning is a traumatic procedure, frequency of suctioning requires recognition of indications, based on nursing judgement. The unit suctioning policy specified the following assessments associated with the need for ETS: (a) signs of airway obstruction and or increased respiratory effort, (b) cyanosis, (c) increased indrawing, (d) decreased chest movement, (e) decreased oxygen saturation/increased end tidal carbon dioxide levels, (f) increased ventilatory pressures, (g) increased apnea, (h) change in vital signs, (i) restlessness and agitation, (j) air entry and breath sounds, (k) history and clinical observations, (l) disease process, (m) results of previous suctioning, and (n) hemodynamic stability. (Hospital for Sick Children, 1996)

The researcher specifically observed for the presence of unit specific routines that would influence the judgments related to timing and frequency of suctioning. Routines in nursing are a collective way of acting and thinking in response to repetitive or usual patient needs that are specific to the context (Greenwood, et al., 2000).

Regularly scheduled suctioning according to a prescribed time interval was not seen as a normal practice for the study participants. The unit suctioning policy also did not specify a minimum suctioning frequency. In all suctioning episodes there was evidence that the nurse proceeded to suction the patient based on an identification of the patient's need for the procedure. The suctioning procedures occurred at a frequency of every two and half to three hours for all patients except for one patient who was identified as being at increased risk for pulmonary hypertension during suctioning. This infant was suctioned twice during the observation period of eleven and a half hours. No suctioning procedure appeared to be implemented solely on the basis of a minimum time interval. In the semi structured interviews, two nurses stated they would suction their patients routinely, on a three to four hourly interval, as an intervention directed at maintaining tube patency.

> "I think most times that he hadn't high pressured I would have chosen to suction him any way. At the four, kind of like the four hour mark." (Ellen interview)

> "Actually while I was at coffee I was thinking that I hadn't suctioned my baby so it was about time that maybe I should come back to have a listen to the chest and suction. Don't usually really like to go more than two, three hours without suctioning, although I'm not a great believer that you need to suction, suction, suction. I think it really depends on the child and if you can take your time and step back, it doesn't need to be done all the time." (Irene interview)

Although these two quotes suggest that the participants considered suctioning on a routine schedule, the observational notes and verbalized thought processes collected during specific suctioning episodes performed by these two nurses are replete with cues that appear to verify the patients' needs for suctioning. Pre extubation was a routine indication for suctioning identified by two other participants. Nevertheless, in the verbalizations accompanying those events, both nurses noted a justification for that suctioning as well.

> "Just prior to taking out the tube, I'm going to suction. Just a routine suction. Just her last chance for having a very good suck out. Put a little more saline down

> there and make sure she's clear. Taking off the machine and putting on the MiE. (bagging) Definitely has some secretions in there and I'll just put a bit of saline before hand. (pause) Switch the vent off so we don't get the noises. Oh, lots of secretions in there. We'll get rid of that." (Irene think aloud)
>
> "Well he sounds clear, no typical reason to suction, except that we were going to extubate. The protocol, we always do a suction before we extubate, just to make sure there is nothing sitting in the tube as we pull the tube up to fall into the lungs. So we always do one suction prior to extubation...but I put a little bit more saline in there just because, just to make sure he was clear. He sounds, like we had that noise... when you would bag him up, even though you wouldn't get anything up when you were suctioning, just do a couple of runs of saline just to make sure." (Jody think aloud)

c. Nature of the Health Care Team

Nurses cared for critically ill infants and children in conjunction with a health care team comprised of unit physicians (staff intensivists, critical care fellows and residents) unit respiratory therapists and allied health care providers including social workers and pharmacists. In addition, consulting medical and nursing staff from other departments liaised with the critical care team.

Nurses worked most closely with RTs[6] in implementing nursing care related to endotracheal suctioning. The notion of shared and independent scopes of practice with fluid boundaries between professions appeared as part of the contextual complexity within this unit. The nursing and respiratory therapy scope of practice related to caring for ventilated children was closely aligned and there were several areas in which responsibility was shared between these two professional groups. For example, although the respiratory therapist was solely responsible for the set up and manipulation

---

[6] Respiratory therapist (RT) are "allied health care workers who, under a physicians medical directive and supervision, plan and implement a variety of therapeutic and diagnostic procedures for patients suffering from a wide range of heart and lung disorders" (RTSO, 2002). As part of the health care team in an intensive care unit, RTs maintain and manage the provision of oxygen therapy, and respiratory support. Their scope of practice includes suctioning artificial airways to promote effective airway clearance.

of ventilator parameters, nurses were accountable for assessing and troubleshooting the appropriateness of the ventilation management for their patients.

> "So I'm talking to myself now, so the baby, the baby on the ventilators notice that the ventilation's not synchronizing correctly, so we just called the RT to have a little look at that to get his ventilation just sorted out there." (Ellen think aloud)

The nurses worked closely with the RTs in this unit in caring for ventilated children. The RTs were assigned to care for ventilated children in specific rooms or areas of the critical care unit. RTs were viewed not only as independent practitioners who had a specific and unique scope of practice that included the manipulation of ventilator parameters, but also as an interdependent team member sharing practices with nurses. The following example illustrates the collaborative nature of the practice of nursing and respiratory therapy.

> "And her tapes are such that I'm going to be talking to RT about retaping. I'd rather have secure tapes (ten minutes later)...So Mandy just had her ETT retaped and my task while it was being done was to ensure that she was tolerating it okay, watching her sats and her heart rate. At one point during the procedure, uh, probably about five minutes into it her sats did sag, just about seventy-three percent so I just asked the RT to maybe help us out there. So my job was to keep the tubes stabilized along with her head so that's a committed task and so I wasn't able to turn up any oxygen. So what he did is give her some oxy breaths, which are a hundred percent and the sats resolved nicely. We made sure, um, we verified the tube placement by comparing the chest x-ray and we both agreed that that was the spot to be. The tape is, are now done, the ETT's nice and secure and her sats are in the mid nineties." (Faith interview)

Both nurses and respiratory therapists suction patients as part of patient care, independently and in collaboration with each other. Both practitioners made the judgment to suction, however the respiratory therapist independently initiated only one suctioning episode of the twenty-seven that were observed during this study. Nurses were observed to directly access RTs for assistance in managing the equipment and in promoting patient safety for patients at especially high risk of negative consequences of suctioning.

> "...the first time I suctioned, just because of, of the mechanics of turning the hypoxic mix to the bag from the ventilator. I probably would have had that other person at least standing there if the vent, if the RT had time she could have bagged and I would have suctioned and done a two person suction the first time because I didn't know the patient and stuff and based on that suction I would've seen if I actually needed another person." (Diane interview)

Considering alternative treatments such as bronchodilators was part of the dialogue between nurses and respiratory therapists that attested to the collaborative working relationships between these care providers.

> "I'm not sure we just need to be suctioning or whether or not he look, he looks like he's working a bit harder, maybe we should just try some ventolin to see or maybe even ventolin and suctioning. I'll get the RT to come in and do an assessment too cause he just, he just looks like he chugging a bit there." (Ellen think aloud)

> "So the RT's come in and done her assessment and thinks this baby sounds tight which he does so we're gonna, once we've finished disturbing him, suction him and give him some ventolin to see how, if that improves his air entry at all." (Ellen thinks aloud)

Nurses asked questions of the respiratory therapist that indicated respect and value for the knowledge and skill of the RT as illustrated in the following excerpts in which the participants are speaking about the RT role in the CCU.

> "...but we do work together quite well in the rooms like we, we pod in our unit, all that terminology. But it depends whom you work with and how busy the room is. But it was actually great that she could do that for me because I was busy doing other things. Because the procedure was kind of earlier than we anticipated which ended up being delayed in the long run but that's okay. So you're, you know you were busy doing all the other things that you, a nurse, nice to have ready for when, when it comes to giving procedure. It was nice that she could do that cause she's as qualified as any one else in the unit." (Diane interview)

> "I let her bag. So I was bagging him and I had her continue to bag for me. And that way that's good for her too, so she feels exactly how compliant his lungs are and gives her a better idea of how he's doing, in ventilating him. And that way I was able to turn him. Because I knew where all his lines were, I knew how I wanted to position him. So while she bagged him, I was able to turn him. And then, we, so for his ventilator tubings, so it wouldn't be all kinked, I was able to sort of reposition that as well with the turn." (Hannah interview)

Nurses were observed to coordinate activities and to adjust care around the availability of the respiratory therapists for interventions that were not part of the scope of nursing

practice in this unit, such as the administration of bronchodilators and extubation. Two participants identified that the planning of their patients' extubation was determined based on the availability of the RT, as the RN did not electively extubate patients in this unit. An aspect of unit context was the current shortage of RTs that appeared to mirror the shortage of nursing staff. The relative availability of RT had an impact on the judgments made by nurses in the care of critically ill children. The availability of RT was seen to impact the timing of interventions and the work of nurses in coordinating aspects of care.

> "So post suctioning, he desaturated and looked like he was working more. He couldn't get any ventolin at the time to give him from the RT cause she was busy. Anyway, he seems to be making a bit more of an effort now than he was. But when he was bagged, his sats were down at ninety, anyway, he's rallied. Maybe he was just having a break. Who knows? He didn't need suctioning that's for sure. And his air entry diminished, diminished post suctioning which is kind of how he sounds post suctioning. But he seems to be back to where his base line is now and seems to be back to how he was looking previously. So we'll give him some ventolin and maybe do a gas and see how he is." (Ellen interview)

Nurses judged the need for continuous nursing attendance at the bedside based on an appraisal of the patient's relative stability. When they had developed a sense of the patient condition and confidence in predicting the patient's needs, they appeared comfortable in stepping away from the bedside to assist other nurses.

> RN noted to assist other nurses in the four-bed room following positioning monitor to be visible from across the room. RN was comfortable in assessing patient condition and making the decision that it was safe to assist another nurse in drawing up medications. RN prepared suctioning equipment and placed catheter and suction tubing at head of bed before going to other patient's bedside to assist other RN. (Glenda field notes)

As well, the sense of the patient's risk for deterioration was the basis for nurses to indicate to others in the room that they could not leave the bedside and that additional human resources were indicated.

> Diane noted that in the early evening (around 1600) many tubing changes, IV solution changes, med changes required for her patient. She commented that as well patient was just three hours post sternal closure she did not wish to leave for

> dinner, unless another nurse was able to stay directly at this patient's bedside. CRN (hospital clinical response nurse- who used to work in the CCU) came in and directly relieved RN. She then went for a 55-minute break (had not had coffee, and had 15 minute lunch at 1300 hours). (Diane field notes)

d. Nature of the Use of Technology in Endotracheal Suctioning

Technology is considered as an aspect of the context of nursing practice in the critical care unit. "Technology and critical care are tightly bound" (Ahrens, 1999, p 1). The term technology has been used in critical care nursing practice to include "any drug, instrument, device or machine that is used in the care or support of a critically ill patient" (Benner et al, 1999, p. 334). One facet of the nurses' practices related to suctioning appeared to be directed at managing the actual and potential hazards related to technology in this critical care unit. Safe use of devices, equipment, and machines was observed in the nurses' practices related to suctioning. Nurses purposefully used devices such as suction catheters and tubings; equipment such as oxygen flow meters and manual ventilating bags; and machines such as ventilators to promote oxygenation and ventilation in caring for the critically ill child. Safety work related to this technology was evident in the ways that nurses would verify the function of suction and oxygen equipment at the beginning of every shift, arrange equipment in specified placements around the patient bedside to ensure efficient access to the devices, and ensure adequate stock of suction catheters, gloves and saline for instillation at each bedside.

> RN performed safety check of unit, tested suction and oxygen, noted shortage of suction catheters, requested suction supplies over room intercom and verified solutions on IVs early on in the shift. (Faith field notes)

Nurses' safe use of equipment and devices in suctioning was influenced by specific cues the nurse identified in the patient situation. For example, nurses set the level of suction relative to the patient age and tenaciousness of secretions, chose specific size of suction catheters relative to the size of the endotracheal tube and nature of secretions, and used support cradles to position ventilator tubings relative to the

patient activity level. Risks to patient, noted in the participants verbalizations, included tension on the endotracheal tube and ridges created by the ventilator tubings on a child's chest. Nurses were observed deliberately positioning equipment and tubings to prevent pressure on an infant's face and body and creatively using stuffed animals to provide support for tubings around the patient's visual fields. As well, the participants implemented specific strategies to address the risk of spraying of secretions and water into children's eyes during disconnection from the ventilator.

> "So before I start to suction I always get everything ready. I put some covering over Mandy's eyes to make sure these droplets don't go in there and I have my saline and my suction catheter and bagging system ready." (Faith think aloud)

The use of monitors to provide for continuous patient assessments was evident in this critical care unit. All patients cared for by the study participants were continuously monitored for heart and respiratory rate, oxygen saturation, and systemic blood pressure via radial arterial lines. Two patients, who were postoperative cardiac surgery, also had continuous monitoring of intra-cardiac pressures. Nurses interpreted the validity of the measurements in comparison with a holistic patient assessment. When nurses noted measurements outside normal expectations, they looked for additional cues to explain those findings. If the measurement on the machine was not confirmed or explained by other findings, the nurses followed up with activities to troubleshoot the technology such as moving oxygen saturation probes.

> "...saturations are ninety-one but there's not very good tracing on the wave. His colour is still good though he hasn't had a colour change." (Glenda think aloud)

Nurses made specific judgments about the use of technology and equipment during procedures in order to protect the patient. Diane identified the use of a hypoxic

gas mixture[7] while manually ventilating the patient as an important facet of working with the technology of a specific ventilator system. To safely suction the patient, she judged the need for the assistance of another individual to move the gas mixture from the ventilator to the manual ventilating bag.

> "I remember saying to you that I probably would have, the first time I suctioned, just because of, of the mechanics of turning the hypoxic mix to the bag from the ventilator. I probably would have had that other person at least standing there if the vent, if the RT had time she could have bagged and I would have suctioned" (Diane interview)

As well, nurses were observed to protect their patient during procedures performed by others at the bedside by specifically positioning equipment and the patient to prevent inadvertent removal or bending of the ETT. Diane identified that being aware of how others were using equipment to position her patient for a procedure was part of her nursing care as is noted in this interview excerpt.

> "...so other than positioning the patient and making sure the tube wasn't, cause the CVS surgeons like the shoulders way up and the neck way back and that effects ventilation sometimes...So we just have to insure the tube is moved cause sometimes they'll just position and not realize the tubes have been kinked." (Diane interview)

Supplies and the emergency cart were positioned within the nurses' visual fields during bedside procedures. It appeared that the nurse considered the specific risks to the patient for a specific procedure and set up the environment and technology at the bedside to facilitate an efficient and effective response by the health care team.

> Diana spent time [over one hour] during the morning preparing the unit, bedside and patient for the upcoming sternal closure procedure- had inotropic drugs drawn up in infusions (e.g. epinephrine), albumin in syringes, had completed blood transfusion that morning but did ask MD if she wanted blood in the unit for the procedure, verified IV patency, verified ETT patency, verified MD (CCU fellow) was comfortable with pumps, IV access as he was to administer the

---

[7] Hypoxic gas mixture, oxygen at less that 21% (room air) concentration is used to induce some pulmonary vasoconstriction in an attempt to prevent over circulation of the pulmonary blood flow in congenital heart defects in which there is a significant left to right (systemic to pulmonary blood flow) shunt, such as hypoplastic left heart syndrome.

> sedation and analgesia during the procedure. Appeared very focused in having everything possible ready and at hand so that the procedure would go well and that the patient would "move forward to getting upstairs" after this procedure. (Diane field note)

It was noted that the nurses always suctioned from the side of the bed opposite to the position of the ventilator. The positioning of the ventilator on a specific side of the bed was in relation to the locations of the medical gas outlets on the wall behind the patient bed. The nurse suctioned from the bedside closest to the vacuum outlet that was on the side opposite the gas outlets. The positioning of the ventilator opposite to the nurse prevented the nurse from silencing the ventilator alarms in advance of disconnecting the patient from the ventilator. Rapid silencing of alarms did not appear to be an expectation of nursing practices in this unit. RTs within the room would respond to the alarms and silence the alarm for the nurse at times. Throughout the audiotapes the sounds of both cardiac and ventilator alarms were audible. Only one nurse verbally addressed the alarm to other staff in the room. "I'm suctioning so ignore the noise." It appeared that the nurses had developed a selective awareness to alarms that were related to the patient for whom they cared. Nurses did not identify that the continuous alarming of equipment at other bedsides interfered with their nursing care.

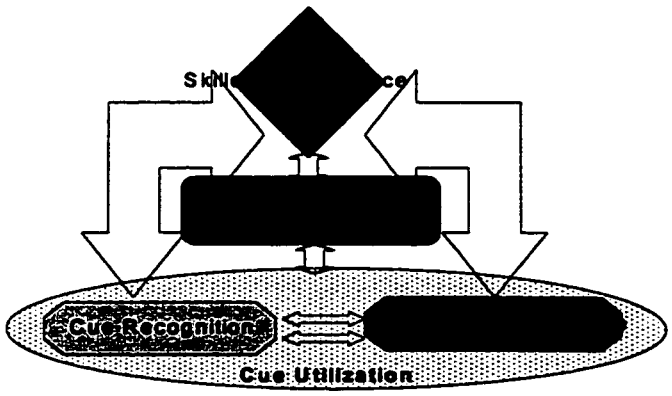
4.2. Cue Utilization in Making Judgments: An Overview

Prior to describing the findings in detail, the following section will present an overview of the core elements that contribute to the process of cue utilization by expert pediatric critical care nurses in making clinical judgments related to endotracheal suctioning. In order to understand the process in detail, it is worthwhile to first appreciate the process from a broad perspective, then to break the process down into the elements and aspects that contribute to the elements. Each of these elements is discussed in detail individually. However, the presentation of the elements separately does not mean that they are distinct entities. In fact, the findings support the notion that the process of

cue utilization is complex and interrelated. Distinctions between the elements are necessary to facilitate a deep understanding of the process.

Cue utilization emerged as the process, or course of action, that nurses carry out when considering the need for and the ways to suction an intubated child. Cue utilization is comprised of two elements that are cognitive processes. The two core elements of cue utilization have been labeled (a) cue recognition and (b) weighing the evidence. Cue recognition is the process of perceiving cues that nurses saw, heard, felt and/or knew in identifying the need to suction. Cue recognition is the *'sensing'* of cues that the nurse recognized in the patient and the situation. Weighing the evidence is the process of *'thinking'* about the cues that are sensed. The cognitive activities of cue recognition and weighing the evidence appeared to form a foundation for the nurses' judgments about the ways to implement the skill of suctioning. The skilled performance of suctioning, the *'doing'*, appeared to be closely interwoven with the cues recognized and the consideration of those cues. As nurses did the suctioning procedure they continued to sense and think about cues in ways that influenced how they suctioned the patient in the current and future situations. The process of cue utilization in making judgments related to endotracheal suctioning is depicted in Figure 1.

Figure 1: Cue Utilization in Making Judgments Related to Endotracheal Suctioning



Although the two elements of cue utilization, cue recognition and weighing the evidence, are discussed separately, they are not independent. Cue utilization is not a unidirectional process that starts with cue recognition and then proceeds to weighing the evidence prior to the enactment of the suctioning event. Although the suctioning procedure may only have lasted 5 minutes, the cognitive work involved in cue utilization related to suctioning appeared in the nurses' think aloud verbalizations up to one hour after they had actually stopped suctioning. The ongoing thinking about the completed suctioning episode had an impact on the judgments about subsequent suctioning episodes. There was a significant degree of interrelatedness between the elements of cue recognition and weighing the evidence. Consequently, aspects of one element have influence, and in turn are influenced by, the aspects of another element. For example, the reader will note that an appreciation of secretions by the nurse is discussed under more than one element, because it emerged as a cue that was used by the participants in multiple ways in making clinical judgments about suctioning. The multiple dimensions of cue utilization that emerged from the data attest to the complexity of the judgments related to suctioning made by the participants.

The nurses demonstrated the two elements of cue utilization before, during and after the suctioning episode in an apparently seamless manner. The following excerpt from a think aloud verbalization illustrates the interconnectedness of the process of cue utilization with the skilled performance of suctioning. The reader can appreciate that the nurse is sensing and thinking at the same time as she is doing the skill.

> "Okay the little one's chest x-ray's been done and her colour is a little bit more dusky, her sats are kind of dropping so I'm going to suction her. I had everything ready to save time, I have some saline ready because from the report on nights she does have clotty material, old blood down in the tube so I've got that ready. I'm going to try a dry run to see first if there's, uh, looser secretions. She's not sounding really gurgly so that may not be a factor (pause). I'm going to give her a few breaths with the MIE, get a feel for her chest compliance. (manually bagging, ventilator alarming)...Okay there's a little squeak there that I can hear.

> Now I'm going to try the suction catheter. (pause while suctioning). Okay, there's stuff down there but it's dry, I'm gonna use some saline, now bagging it. Usually about four or five good breaths with a longer I[8] time. Now going down with the suction catheter. Pulling up, and yes indeed, really thick kind of old blood quality with some clots coming up. Using more saline, (pause) another three or four breaths, you can really hear it. Her chest feels stiff as well with bagging. (pause). There's a fair amount down there so I may be here for a bit. Starting to feel better though. I'm gonna use a little bit more saline and go straight down behind it (pause, ventilator alarming). Okay and I'll listen to how she bags, much nicer. Sats are a hundred and they've been above ninety-five the whole time. Okay we're going to let her be for now and I'm going to have a listen to her chest. (pause while auscultating chest). The breath sounds have gone back to what they were with my initial assessment which is fine crackles throughout, breath sounds have been harsher before I suctioned her. And it's about four hours from the last time that she was suctioned so we may want to sort of check on her again in about three, three and a half hours to make sure she doesn't build up too much." (Faith think aloud)

The first element of the process of cue utilization is cue recognition- the process by which nurses perceive and attend to cues that are derived from the patient and the situation. Although each nurse shared a personal and unique perspective on the cues to which she attended in making judgments, two aspects of cue recognition emerged from the data: (a) perceptual awareness and (b) knowing. Perceptual awareness is comprised of the cues nurses perceived using visual, auditory and tactile senses. Knowing is comprised of the cues nurses identified from knowledge of this type of patient, knowing this particular patient and knowing this practice environment.

The second element of cue utilization, weighing the evidence, represents the ways that nurses considered the cues that they recognized. Weighing the evidence represents the thinking activity, or mental dialogue, that nurses used to formulate judgments related to suctioning. Weighing the evidence was apparent throughout the suctioning event as nurses attended to and responded to cues recognized, actively looked for additional cues and noted cues during the performance of the procedure. Two

---

[8] I time is the contraction of inspiratory time that represents the length of time, in seconds, that the ventilator delivers the inspiratory phase of a ventilated breath.

aspects of this element representing the nurses' thinking activities emerged from the data: (a) determining the significance of perceptions and (b) corroborating impressions. Determining the significance of perceptions is the way that the nurses attributed an importance to the perceived cues. Corroborating impressions is the way that nurses sought to verify, confirm or refute their thoughts about the importance of a cue to the patient situation.

When nurses made the judgment to suction the patient, there appeared to be a series of decisions related to the ways in which the nurse would implement the procedure that is represented by the element of skilled performance. It is important to note that skilled performance was not evident to be the final step in a linear process, but rather it is significantly interconnected to the process of cue utilization. The process of cue utilization- cue recognition and weighing the evidence- appeared prior to, during and after the skilled performance of suctioning.

In the following section, the two elements of cue utilization will be more fully discussed.

4.3. Cue Recognition

The cues that nurses verbally noted have been sorted into two categories that emerged from the data: (a) perceptual awareness and (b) knowing. Cues appeared to be drawn from within the nurse herself, from the patient situation and from the environment in a simultaneous and iterative process. In the following section, the two aspects of cue recognition will be discussed separately although they are significantly interrelated.

a. Perceptual Awareness

Perceptual awareness is the process of sensing patient cues that the nurses identified as they were making judgments related to suctioning. Three categories of cues, related to the senses of hearing, seeing, and feeling, emerged from the nurses'

words and actions and have been labeled (a) visual cues, (b) auditory cues, and (c) tactile cues.

Visual Cues

The cues that nurses visually perceived have been grouped into five categories of the patient condition: (a) patient activity, (b) colour changes, (c) breathing patterns, (d) nature of secretions, and (e) monitoring parameters (Table 1).

Table 1: Visual Cues

Aspect of Patient Condition	Cues
Patient activity	Distress
	Moving
	Coughing
Colour changes	Dusky
	Pink
	Cyanosed
Breathing patterns	Work of breathing
	Ventilator asynchrony
	Chest excursion
Nature of Secretions	Presence in ETT
	Qualities
Monitoring parameters	Saturation
	Vital Signs
	Hemodynamic parameters

The participants specifically adjusted the environment and bedside equipment, positioned themselves and patients, and moved monitors, blankets, and toys in the crib

to facilitate visual observations of the patient. Nurses usually noted visual cues in groupings rather than singly. Visual cues of one type appeared to trigger the nurse to look for additional cues to confirm or discount a singular cue as illustrated in the following excerpts.

> "As soon as I walked into the room, I saw her sats were eighty nine. So that was kind of trigger that maybe she was decompensating a little bit, so what I did was look at her breathing." (Faith interview)

> "He's just, saturations are just dropping down to eighty-nine, he usually sits around ninety-seven...Just putting the catheter on, he's still sitting around eighty-nine, still got bit high pressures but he's a bit more settled after the morphine. (pause while preparing equipment, cardiac monitor alarming). So he's just dropping to eighty-seven, I'd just got these gloves, he's fine. He still looks quite pink." (Glenda think aloud)

Visual Cues: Patient Activity

Visual assessments of patient activity included the recognition of the level of distress, moving, and coughing before, during, and after the suctioning episode. Patient distress appeared to be meaningful for the nurses in determining not only the need to suction, but also the ways in which the suctioning should be done, how long to suction, and what adjunct interventions to implement. Patients demonstrated distress in a variety of ways including grimacing, tearing, moving their head away from the nurse, stiffening, and outstretching four limbs even when receiving continuous infusions of analgesia and sedation. Distress was seen as a cue indicating the need for suctioning, as well as a side effect of the suctioning.

Patient moving, either spontaneously or as a consequence of a procedure such as positioning on a radiographic plate for a portable chest x ray, was identified as a cue to question the need for suctioning as well as a cause of the secretions that prompted the suctioning.

> "Okay it's been just over an hour since our last suctioning...we're just going to take a little listen to his chest, because in between he kind of moves and wiggles

> around a bit (pause while auscultating). Oh, rat, those coarse crackles are back." (Hannah think aloud)

> "I noticed after the procedure she was moving a little bit so she was not fully muscle relaxed any more. It was wearing off, and that's when she was kind of desating too. So that can be another variable as to why she's doing it. And sometimes of course when they move then can move something in the chest and you'll suddenly be bagging and you'll hear a bit of a gurgle or a something down there that needs to be suctioned out so that was all that I was doing." (Diane interview)

Patient coughing was a visual cue that was frequently heard in the participants' think aloud sessions. This cue was verbalized in combination with other visual cues including desaturation and auditory cues such as ventilator alarms. Nurses looked for rationale for the coughing activity such as irritation caused by the endotracheal tube (ETT), inadvertent water instilled in the ETT from the ventilator tubings and the presence of secretions. While the child was coughing, nurses would auscultate the chest, look for the presence of secretions in the ETT, and evaluate colour and saturation readings simultaneously.

> "I just heard him coughing again so I'm just going to have another listen to his chest, just changed his diaper so it could have been with just moving him around a little bit. Yeah he's got lots of secretions down there, just going to do another suction." (Ellen think aloud)

Visual Cues: Colour Changes

The participants made assessments about patient colour in relation to changes in both cardiac output as well in levels of oxygenation. The nurses appeared to use colour change as a cue to reassess the patient for other signs that related to the colour change. As such, colour change was never used as a single cue that triggered the judgment to suction but was often verbalized in conjunction with other cues. Participants described the colour of patient nailbeds and lips as dusky, pink, or slightly cyanosed during the suctioning procedure.

> "Her colour looks good, generally. Sort of a little bit of an almost cyanosed haze; she's kind of pale pink on her hands and feet. She's got sort of pink lips." (Faith think aloud)

Visual Cues: Breathing Patterns

The participants' verbalized assessments related to the work of breathing, ventilator asynchrony and chest excursion as visual cues related to the pattern of breathing. Visual cues for suctioning included assessments that: (a) the patient's breathing pattern was different from before, (b) the child was working harder to breathe, and (c) the child was spontaneously breathing at a rate greater than the set ventilator frequency.

> "...her breathing has a little bit of a shudder to it, where she is taking some breaths and then just sort of does an extra one that can also to me indicate that she might have some secretions." (Faith think aloud)

As well, several participants identified the breathing pattern described as fighting the ventilator as a cue that indicated a need for suctioning.[9]

> "I was detecting what I call more of a shudder. Which to me indicates that there might be some turbulence or something down there and that the kiddy and the ventilator are just having a little disagreement. So that's kind of a cue to sort of think okay she must be getting pretty close." (Faith interview)

Nurses observed a change in breathing pattern when the patient was not in synchrony with the ventilator and perceived an auditory cue associated with the ventilator alarms at that time.

> "...the baby is on the ventilator and notice that [ventilator's] not synchronizing correctly. So we just called the RT to have a little look at that to get his ventilation just sorted out there. Otherwise he's got prolonged expiratory time". (Ellen think aloud)

---

[9] When patients are coughing or spontaneously breathing against the ventilator they exhale while the ventilator is delivering a breath called 'out of synch' or fighting the ventilator. This breathing pattern causes the peak inspiratory pressure (measure of airway resistance) to increase, the tidal volume (volume of air moving in and out with each ventilation) and the minute ventilation (volume of air moving in and out over one minute) to decrease, and the associated ventilator alarms to be triggered.

> " And the things that I looked at first just looking at the child without touching her. Looking at the quality of her breathing and whether she's symmetrical with the ventilator or fighting it." (Faith interview)

An assessment of diminished chest excursion with each ventilator delivered breath was a breathing pattern associated with the need to suction. Noting asymmetrical chest movement and/or paradoxical movements triggered the nurses to consider the need for suctioning. The nurses compared the patient's breathing pattern from one time frame to another and commented that changes in breathing patterns prompted them to consider the possibility that the patient needed suctioning.

> "Presently the pattern of her breathing has changed from my first assessment and I suspect I'm going to have to suction her." (Faith think aloud)

Visual Cues: Nature of Secretions

Nurses described the nature of secretions in terms of the presence, absence and in terms of qualities, such as amount, tenaciousness and colour. Secretions that were visible in the endotracheal tube emerged as a single cue that nurses appeared to respond to as an indication for suctioning. When nurses saw secretions in the endotracheal tube they appeared not to need to verify the necessity of suctioning with other cues and regularly proceeded to suction the patient.

> "I didn't listen to his chest because he needed to be done. You could see the secretions." (Jody interview)

The visual noting of secretions not only contributed to the decision to suction, but also contributed to the judgments about the technique of suctioning including when to complete the suctioning procedure. In this following excerpt, the unexpected observation of continuing secretions prompted the nurse to adjust the plan to stop suctioning.

> "Last one for you hon, last one. Good boy, big cough. Good boy...Oh, that surprises us...look how much we're getting back up, one more time." (Jody think aloud)

Nurses considered the amount, colour, and tenacity of secretions in relation to the patient's condition and response to suctioning. This information appeared to influence the judgments as to how to do the procedure as well as the timing of suctioning.

> "I'm going to try a dry run to see first if there's, uh, looser secretions. She's not sounding really gurgly so that may not be a factor." (Faith think aloud)

> "I know that if they've [secretions] been lying there for a while, that the secretions are going to be thicker. So he is six, seven days post op now, you know, his secretions are thick, he is not moving around a whole lot on his own... we are letting him move around some...We just know that those secretions are just pooling there." (Hannah interview)

Blood in the secretions was noted as a cue that influenced judgments about the frequency of suctioning. In this following excerpt the nurse appeared to associate the presence of bloody secretions with a need to suction more frequently related to the potential for clotting of secretions.

> " ...for someone who has sort of nasty secretions like that, clump sort of ruby colour both frankish amount of blood That's not pleasant to have to try and pull up and, ah, it's worth the investment in it, in that way she'll be okay for a couple of hours. But it does make me keep an eye on her. Because that was about four hours or more that we left her for suctioning and I'll probably listen to her around eleven thirty and the window of eleven thirty to twelve and maybe we won't leave for four hours and we may just indeed be thinking around three hours that we will suction her." (Faith interview)

Visual Cues: Monitoring Parameters

Nurses visually noted oxygen saturation levels and vital signs including heart rate, blood pressure, intracardiac pressures, and respiratory rate via the bedside monitors in the unit. Changes in vital signs and hemodynamic parameters appeared to be considered in conjunction with other cues rather than as independent prompts to consider suctioning. The participants noted physiological indicators of stress including tachycardia, systemic hypertension, increased intracardiac pressures, pulmonary hypertension, and tachypnea via the monitor prior to, during, and following the suctioning

episode. The nurses used the cues to confirm or discount other recognized cues. The following excerpt illustrates how one nurse considered both the cues of elevated pulmonary artery pressure (PA) and coughing in making the judgment to suction.

> "Okay, so he's beginning to cough so what I'll do, I might just give him a little purge of morphine 'cause his PA pressures are just going up and then I'll do some suctioning on him, that's it. I'm just giving him a purge of morphine to settle him down cause I've got high PA pressures and then I will do some suctioning." (Glenda think aloud)

The observation of heart rate per the bedside monitor was a cue that was noted in conjunction with an assessment of patient tolerance and response to the suctioning procedure. Changes in heart rate were used as an indicator of the level of patient stress or discomfort following suctioning.

> "Jimmy is resting very comfortably. Heart rate has come down to 157, sats are 99." (Hannah think aloud, one hour after suctioning)

A relative absence of significant changes in hemodynamic parameters and vital signs before, during, or after the suctioning episode was noted. None of the suctioning episodes contributed to significant patient hemodynamic deterioration during the study.

Oxygen saturations below 92% were noted to precede suctioning in only six of the twenty-seven suctioning episodes.[10] In the following excerpt the nurse demonstrated a consideration of alternatives and potential causes of the desaturation prior to making the judgment to suction her patient.

> RN and RT responded to an acute desaturation in an unstable patient. As the respiratory therapist initiated manual ventilation, RN asked the RT if she thought the patient needed to be suctioned or if it was the change in the ventilator rate that was causing the desaturation. RN commented to the RT that it didn't sound like she had secretions and they agreed that suctioning was not indicated. (Diane field notes)

---

[10] Desaturation, a decrease in the oxygen saturations as monitored per a finger probe, was seen as an indication of changing patient condition that could be associated with ineffective cardiac output or ineffective gas exchange as well as with ineffective airway clearance and the need for suctioning. Hypoxemia is defined as oxygen saturations below 92% in children with normal cardiac anatomy (Curley & Moloney-Harmon, 2001).

Hypoxemia and desaturations were considered in making the judgment to suction in conjunction with other perceived cues.

> "The sats are also trending downwards, they're in the low nineties versus above ninety-five, so based and how she sounds and how's she's looking, I will [suction]." (Faith think aloud)

Auditory Cues

The nurse participants noted a number of auditory cues perceived during respiratory assessments conducted as part of routine systems assessment at the beginning of shift, as well as following the suctioning procedure. The cues that were perceived through the sense of hearing have been grouped according to the source of the sounds heard, as outlined in Table 2. Sources of auditory cues perceived included: (a) chest auscultation, (b) ventilator alarms, and (c) the sounds of secretions.

Table 2: Auditory Cues

Source of Sound	Cues
Chest Auscultation	Breath sounds
	Adventitious sounds
Ventilator alarms	Minute Ventilation
	Peak Inspiratory Pressure
	Tidal Volume
Sounds of Secretions	Audible with manual ventilation
	Audible during ventilator delivered breaths

Auditory Cues: Chest Auscultation

Nurses were observed to implement chest auscultation as a confirmation of visual or tactile cues that had been perceived. Chest auscultation included the

assessment of the presence and location of breath and adventitious sounds. One nurse noted the presence and quality of breath sounds in relation to the location of lung lobes.

> "...just going to listen to the right side, (pause), sounds clear upper lobe, (pause, cardiac monitor alarming), mid and lower clear (pause) and left side's clear as well, yep sounds good." (Glenda think aloud)

Adventitious sounds were described as crackles, rattles, gurgles, squeaks, and wheezes. A skill of auditory discrimination required to differentiate sounds heard on chest auscultation was evident in the words nurses used to describe the sounds they perceived.

> "Just going to have a listen to the chest and see what's going on. (pause). Oh, squeaks. Yep, that sounds awful. Big squeaks, probably warrants a suctioning. (pause). Okay, so time to suction." (Irene think aloud)

> " Okay, the breath sounds are getting a bit harsher, so I'm just going to get ready to do the suctioning...there's a barkiness which indicates to me there's still secretions in there..." (Faith think aloud)

In making the judgment to end the suctioning episode, nurses considered auditory cues along with other tactile and visual cues. The grouping of these cues appeared to form a pattern that was interpreted by the nurse to mean that the procedure had been successfully completed.

> "...can't hear any more secretions any more. Chest is pretty compliant. PA pressures have come down a little bit. Saturations are ninety-nine...I am going to put it [ventilator] back on." (Glenda think aloud)

> "And after the third pass, it was like you knew I had cleared her well. When I bagged her, the bronchial sound was real minimal and her, her compliance was just she'd opened right up. So those were my cues she'd done well." (Faith think aloud)

In some instances nurses did identify that the chest sounds did not improve following suctioning, but they judged that ongoing suctioning was not indicated for this patient.

> "There and I'm not choosing to listen to him post suction because to be honest he sounds worse post suctioning usually than he did before just till he recruits himself a bit." (Ellen think aloud)

As nurses suctioned, they noted auditory cues to indicate the need to continue to suction. The nurse interpreted the sound of secretions during suctioning as a cue that the procedure was progressing as expected in this following verbalization.

> "...she's still got a lot of secretions down there, just going to do another suction" and "...but then she made more coughing noises and I heard a little bit more. So I decided to suction again." (Irene think aloud)

When adventitious sounds were absent, the nurse judged that the suctioning episode had been effective and should be completed.

> " Earlier on I could hear I think on the, the upper right, there was, you could hear a few crackles there but the rest of it sounded clear and after suctioning him he was clear, all lobes were clear". (Glenda think aloud)

> " You're bagging him and you don't hear that gurgling. He's settling nice. You can hear the breaths going in and out." (Hannah interview)

Auditory cues used in determining the need for suctioning, such as presence of adventitious sounds and audible secretions, were also the cues used in evaluating the outcome of the suctioning. The evaluation of the suctioning episode appeared to happen in an iterative process during and after the procedure. Nurses used expressions including "all clear", "much better", and "sounds all gone" to indicate that the suctioning episode had been successful. The participants were observed to compare the sounds of their patients before suctioning and after suctioning as part of determining outcome, need to suction again, or need to institute an adjunct intervention such as the administration of inhaled bronchodilators. One nurse described that although she thought that her patient would have been clear following suctioning one hour previously, she perceived ongoing auditory cues indicating the need to suction once again.

> "The decision to suction afterwards [a previous suctioning] was that I could still hear as if there was secretions down there and then I listened. So I did a listen and after we'd done the retape to make sure the position of the tube and you could still hear secretions then." (Faith interview)

Nurses identified similar sounds that could be both associated and not associated with suctioning depending on the unique characteristics of the patient. Initially, one participant had identified wheezes as an adventitious sound that triggered her judgment to suction at the beginning of her shift. One hour after that suctioning episode, the nurse considered a change in the patient that she had interpreted to mean that the presence of wheezes was no longer associated with the need for suctioning. In response to recognition of that cue, she suggested an alternative approach.

> "He's been quite diminished air entry, with expiratory, the expiratory wheezes...and reasonably prolonged expiratory time...And there's some diaphragmatic abdominal breathing. He doesn't sound like he needs suction at the minute. We'll wait and see after he gets his IV done whether or not he's unsettled and moved secretions." (Ellen think aloud)

Then, ten minutes later she noted a similar sound (tight) and made the judgment to suction in sequence with the administration of a bronchodilators based on an ongoing appraisal of the patient.

> "Okay, so the RT's come in and done her assessment and thinks this baby sounds tight which he does, so we're gonna, once we've finished disturbing him, suction him and give him some ventolin to see how, if that improves his air entry at all."

It is unclear how the sound qualities of 'tight' and 'wheezes' were different in these two instances for this nurse.

Auditory Cues: Ventilator Alarms

Ventilator alarms presented additional auditory cues for the nurses to consider. Ventilator alarms that were noted by the participants included high pressuring (peak inspiratory pressure above alarm limit), minute ventilation (below alarm settings), and tidal volume (below alarm settings). The perception of ventilator alarms appeared to be a cue considered in conjunction with other cues. No nurse considered a ventilator alarm independent of other cues as an indication for suctioning.

> "Okay I'm just going to have a listen to his chest because, yeah because he looks like he's coughing and he's got high pressure alarms going here, maybe he needs a suction (pause while auscultating). His air entry may be a bit diminished, I can't hear because he's so tight, I can't hear too many crackles and stuff but maybe we'll just suction him and see if that's why he's setting off the high pressure alarm." (Ellen think aloud)

Auditory Cues: Sounds of Secretions

Sounds of secretions, audible while the patient was attached to the ventilator as well as when the patient was being manually ventilated, were auditory cues acknowledged by participants. Preoxygenation and manually ventilating (bagging) were identified as strategies to ameliorate one of the negative consequences of suctioning, transient hypoxemia, and to enable the nurse to perceive the presence of secretions through tactile and auditory senses.

> "I'm just going to start bagging him...oh, you can hear the secretions down there, there's quite a lot, sound quite loose." (Hannah think aloud)

Similarly, nurses' decisions to end suctioning also appeared to be based on auditory and visual cues perceived while manually ventilating the patient.

> "So we're getting near the end because the secretions are looking more just like saline. This time when I bag I'm expecting, yeah, she's cleared up really nicely." (Faith think aloud)

Tactile Cues

Tactile cues are the qualitative distinctions perceived through the sense of touch. Two aspects of tactile cues, (a) compliance and (b) resistance are outlined in Table 3.

Table 3: Tactile Cues

Aspects	Cues
Compliance	Secretions felt during I ventilation
	Ease of chest expansion with manual ventilation
Resistance	Resistance to suction catheter insertion

Tactile Cues: Compliance

The participants described the perception of tactile cues that indicated the presence of secretions in two ways. First, touching the child's chest enabled the nurse to feel the vibrations caused by secretions within the chest, as heard in one of Jody's think alouds. "You could actually feel it on the chest without even listening to it that time." This palpation of chest vibrations indicated the accumulation of secretions and the need for suctioning. Second, nurses also identified they could feel the presence of secretions when manually ventilating the patient and used this indicator to monitor the suctioning procedure. Nurses described the tactile perception, feeling the secretions, closely linked to the auditory perception, hearing the secretions, while manually ventilating. The feeling of a compliant chest, or ease of chest movement during manual bagging, was a cue that nurses used in validating the effectiveness of suctioning.

> "And there, he feels actually, feels better to bag now after suctioning him a little bit there. You can feel that the air is going in a bit better" (Jody think aloud)

Manual ventilation with 100% oxygen prevented hypoxemia and enabled the nurse to assess the chest compliance as illustrated by the following excerpts.

> "I'm going to give her a few breaths with the MiE, get a feel for her chest compliance". (Irene think aloud)

> "So then bagging in between is to bring a child's oxygenation up and it's also the opportunity to contrast and compare with how it felt before the saline went down. And again, it's that sensory mode where you know that there's still stuff down there." (Faith interview)

Tactile Cues: Resistance

Sensing resistance emerged as another aspect of tactile cues in the nurses' words and actions. Feeling resistance, a sense that something was impeding the introduction of the suction catheter into the ETT, appeared to prompt the nurses to consider an adjunct intervention, such as the instillation of saline to liquefy the secretions.

> "I've just put some more saline down. I can feel it right at the end of my suction catheter that there's some really thick secretions that just didn't come up last time" (Hannah think aloud)

> "You can just feel the pressure on the end of the catheters. So even as I moved it back a little bit to take it out, you could just feel the pressure on the end. So you know, it's down there but you're just not getting it." (Hannah interview)

In summary, perceptual awareness emerged as the process of sensing visual, auditory and tactile cues up to one hour after the suctioning episode was completed. Nurses considered a variety of cues in groupings to make judgments about the frequency, and the method of suctioning, throughout the suctioning procedure.

b. Knowing

Participants used the term 'knowing' to describe three types of knowledge that also contributed to the process of cue recognition, as outlined in Table 4: (a) knowing this type of patient- a knowledge of the typical patient with a specific condition (b) knowing this patient- a knowledge of the individual patient for whom they cared, and (c) knowing this practice environment- a knowledge of the unit practices.

Table 4: Knowing

Type of Knowing	Cues
Knowing this type of patient	Normal expectations for condition
	Risks with ETS
Knowing this particular patient	Previous responses
	Expected findings
	Forecasting planned procedures
Knowing this practice environment	Equipment
	Routines
	Timing of breaks

Knowing This Type of Patient

Knowing this type of patient is based on knowledge of anatomy, physiology, pathophysiology, clinical protocols, and therapeutics that are characteristic of the care of critically ill infants and children. Cues that appeared in the nurses' words and actions associated with a general knowledge of pediatric critical care patients were related to the normal expectations for the patient condition and the general risks of endotracheal suctioning (ETS). An understanding of how pediatric patients generally respond to airway secretions is an example of how knowing the normal expectations for a condition served as a cue for the nurse. Nurses identified that caring for children intubated with small endotracheal tubes was a cue that was generally associated with the need for frequent suctioning.

> "He's only got a three and a half tube, a really tiny little tube. So some children... the slightest little bit of spit in there. And they become very panicky. He doesn't desat with it. His chest itself doesn't sound noisy, but it is obvious that it frustrates him". (Jody interview)

The following passage illustrates how a nurse's knowing about expected patient activity (coughing) was compared with a change in the nature of the patient's secretions.

> "If anything, [they are] just less, depending on how upset he is when you are needing to suction him. Like I am sure next time when we suction him, because it has been a lull in suctioning, that he'll be a little bit thicker...Almost like a kid, who coughs. When the cough is weak the secretions are thick and hard to get up, and then when those kids have those very strong, productive coughs, they come up on their own, like blowing your nose. That same thing. So when he is really upset, he can cough those up." (Jody interview)

Familiarity with the normal expectations for this type of patient appeared to enable the nurses to create a mental image of expected outcomes for the patient. This mental picture was used as the nurses compared individual patient findings with the expected and determined if the patient was on the expected trajectory. In response to such cues, nurses refined the suctioning procedure to meet the unique individual needs of that patient. Knowing this type of patient enabled nurses to predict usual responses,

anticipate events, and propose interventions for the patient. The following excerpt illustrates how one nurse's knowledge of the behaviour of patients, who are successfully extubated, influenced her judgment about the timing for suctioning and extubation. This infant's behaviour did not fit the normal expected presentation and the nurse judged that extubation should be delayed until a later time in the shift.

> "This baby specifically has the chance of not doing well. Just because [she] started off the day with a very low respiratory drive and was very sleepy. Um, I would not probably extubate at the time we did if she would have been the same as she was this morning. I would have given her longer." (Irene interview)

Knowing the potential risks for suctioning of pediatric patients appeared to be recognized as a cue indicating a need for suctioning as well as indicating a need for nursing vigilance.

> "You could just physically see the secretions coming up in the tube, and if I didn't, [suction] then eventually I would be worried about it blocking the tube." (Jody interview)

The risks identified included ETT blocking, accidental extubation, hemodynamic compromise, irritation or trauma to the airways, stress, decompensation, the interruption of healing process following intracardiac line removal, and patient discomfort. One nurse noted her concern for the small size of the ETT and the nature of her patient's secretions when she stated she would be worried about blocking the tube if she didn't suction her patient frequently. "It's the size of the tube, it's fairly tiny and he's got some thick secretions" (Jody interview). Knowledge of this type of patient enhanced the nurse's awareness of the need to note specific cues that related to the potential threats to the safety of critically ill intubated children. Nurses made judgments about endotracheal suctioning to protect the patient from the consequences of hemodynamic compromise, distress, and pain that were associated with suctioning.

> "I might just give him a little purge of morphine cause his PA pressures are just going up and then I'll do some suctioning on him, that's it. I'm just giving him a

> purge of morphine to settle him down cause I've got high PA pressures and then I will do some suctioning." (Glenda think aloud)

The participants voiced that experiential learning was a source of knowing this type of patient. Why participants noted specific cues and did what they did was based on a knowing that came from caring for these types of patients on numerous occasions, as Hannah described in this excerpt.

> "...because I look after cardiac patients a lot, so, looking after kids with a sternum dam, I know that if they've been lying there for a while, that the secretions are going to be thicker." (Hannah interview)

Another nurse referenced her experience in caring for these patients as an important source of her knowing about this type of patient. In response to the researcher's question about how she knew this patient, "Well, basically just the, my experience with them." (Diane interview)

Knowing This Particular Patient

Knowing this particular patient is a component of knowing that encompasses the nurses' knowledge of the unique characteristics of the patient for whom the nurses cared. Knowing this patient was derived from a relationship between the nurse and the patient developed by noting patient rhythms and idiosyncrasies through a direct clinical, 'hands on' experience with that patient.

> "It felt smoother because I already know the child a little bit better. It's kind of like you get synchronized with the child and you get comfortable with doing, using the bag for when they naturally want to draw breath. I don't try to fight the child. I let them kind of breathe, give her some good PEEP and even let her do some of the work. And it's, it's, the real feel part of the procedure. Ah, you work with the child, so it's not just you. You're not in total control, you have to work with the child". (Faith interview)

Knowing this particular patient required the nurse to develop a sense of the patient's responses to suctioning, the feel of the patient's chest, and the nature of the patient's secretions through a visual, auditory, and tactile awareness.

Cues associated with knowing this patient that emerged from the data were the noting of previous responses, identifying expected findings and outcomes, and forecasting planned procedures. Knowing this patient was closely aligned to knowing this type of patient. With the general knowledge of knowing like types of patients, nurses were able to identify how a specific patient was like or unlike other similar patients.

> "...but for this little guy, because his sternum's wide open, that's why I am thinking he needs the pain management. His sternum is wide open, he's stented. Every time he moves I'm not comfortable with exactly how that stent is positioned. So I think, every time he moves he has that possibility of being in pain. So that's why I'd rather the morphine." (Hannah interview)

Nurses used comparisons such as higher, lower, better, worse, more, and less in describing a particular patients' findings in comparison with the expected findings for similar patients.

> "I don't know what [is his] normal CO_2 going to be, so I, they say it's not an issue but his CO_2's might be a little higher anyway. So I, I don't what his normal CO_2 is but, even, I don't know how much he was working [before]. CO_2's have stuck around sixties; there's not been a huge fluctuation to his CO_2s. Yesterday, sometimes they were up to seventies and I'm sure his next gas will be crummy." (Ellen interview)

An awareness of how this patient responded to care was an important facet of knowing this particular patient. Hannah noted that how her patient had responded in the past was different from the current response. She subsequently modified her interventions based on the recognition of the cue of knowing this patient's responses.

> "He tolerated his suctioning just fine. We put him back on the ventilator but again he was still moving around a bit after suctioning. And usually, every other time I have suctioned him this morning, after suctioning he was really settled and happy and comfortable. So following the suctioning I gave him another 40 mcg flush of morphine and that seemed to settle him right down." (Hannah interview)

It was evident that nurses would continuously revise and modify the timing and performance of suctioning based on a sense of the patient's responses to treatments that was acquired during direct care activities.

> "And the only reason we decided to suction now is because, um, why did we do it? Because we, she's still under the effects of the muscle relaxants...Yes so we wanted just to not have any, you know, might as well have a smooth afternoon instead of causing you know, potential problems." (Diane interview)

In the following excerpt, Faith appeared to judge the need for suctioning more frequently than the timing interval established on the previous shift, based on her knowing of this particular patient.

> "But it does make me keep an eye on her. Because that was about four hours or more that we left her for suctioning and I'll probably listen to her around eleven thirty and the window of eleven thirty to twelve and maybe we won't leave for four hours and we may just indeed be thinking around three hours that we will suction her....Now, because of the thickness of her secretions and the fact that they were so bloody, with the first suctioning, I didn't want to leave her much more than almost three hours." (Faith interview)

Nurses identified that how patients had responded on previous shifts influenced judgments on the present shift.

> " This is exactly what happened to her the other day actually, she had, um, we did some suction on her and could hear it on the end. It sounded like there was something rattling around at the end of the tube, yeah, right. Yeah, that's exactly like it was." (Glenda think aloud)

Participants modified their nursing interventions based on learning this patient's unique responses. Cues related to knowing this particular patient were evident when nurses described they knew how a patient would respond to suctioning and therefore would sequence and cluster care to minimize the patient's distress.

> "Like in general, it would have been fine to leave him, but from knowing him, it just leads to more suctioning, more agitation, and more chance of encouraging that spot to bleed." (Jody interview)

It is relevant to note that as nurses began to know this particular patient, the cues they looked for became more patient specific. In the following interview excerpt, it is evident that knowing of this type of patient, knowing this particular patient, and knowing the potential negative consequences of specific treatment were cues this nurse recognized.

> Researcher: "Is that normal that you always give kids a morphine flush pre-suction?"
>
> Hannah: "No, and it depends on the kids. But there was an idea about him, with an open sternum, that he is just not going to handle moving around. Now a lot of kids, when you're starting to wean the muscle relaxants, now we used to have kids completely muscle relaxed until it was time to close the sternum. And we realized from a respiratory point of view that this was just bad management, because then they have such a hard time getting off the ventilator. So now, as soon as the kids are stable enough, even if their sternums are stented open, we don't have them muscle relaxed but we have them really well sedated, so sometimes, we'll have midazolam infusion with the morphine infusion, or morphine infusion with ativan boluses as needed. But for this little guy, we... I didn't give him any ativan, and I actually looked prior to suctioning to see if that was the case, like if he was requiring ativan for sedation. He was given some chloral hydrate about six hours so I thought, you know, maybe he's completed that, and I figured it's not going to help me for an imminent suctioning, so...for the morphine, I thought he is going to need something, we just don't want him moving around too much. Because we like the kids moving a little bit, just taking a few extra breaths above the ventilator, just moving their secretions. But we don't want them out of bed, we don't want them in pain, and we don't want them moving so much that it's dangerous. (Hannah interview)

The participants used knowledge of procedures forecast for the patient as a cue to be considered in determining the timing of suctioning. Nurses planned suctioning to precede procedures including chest closure, blood drawing, and chest x-ray.

> "...we will probably end up suctioning her because of the procedure that's going to be on at eleven. We'll do her probably before that at some point, I just didn't want to do her right before the blood work of course." (Diane interview)
>
> "And I'll do a gas probably, I think actually an hour is too soon. Um, and if I, if you look at them and they are pink and they're breathing well, then in two to three hours is fine because then you get a real true picture of what's happening." (Irene interview)

Nurses used documentation by others, verbal report, and suggestions from colleagues who had previous experience in working with the patient as sources of knowing this particular patient until they had developed a knowledge of this particular patient. Verbal shift report, which happened at the child's bedside from the night nurse to the day nurse, was a valuable opportunity to share specific knowledge learned about this particular patient. The verbal report, which was a summary of nursing care and patient

responses from the night nurse, was often interrupted, as the day nurse would ask questions that were related to the particularly unique responses of this patient in this situation. The nurses valued the knowledge gained during this brief exchange.

> "So the greatest thing you can get is from your colleagues from the previous shift is how they like to be bagged and one of the classic rules is don't bag the heck out of them especially with hypoplastic babies." (Diane interview)

> "...actually the RT must have been passed on the same info because she was bagging the patient that way, be it her experience or, cause I would have bagged the patient that way any ways. But sometimes, sometimes they have their own quirky little right ways they like to be bagged so that's valuable stuff they're passing on." (Diane interview)

Similarly, Faith noted the information given to her at report when considering the nature of the secretions and whether or not she would use saline instillation as an adjunct intervention.

> "Well I was all ready giving thought to what my night colleague that shared with me about the fact that there were blood clots down the ETT." (Faith interview)

Nurses compared present findings with past information about patients learned at report.

> "...lots and lots, little bit blood tinged that secretion. That's like it's been over night." (Glenda think aloud)

Nurses considered knowledge about this patient learned from other nurses in predicting plans of care, including suctioning frequency, until they had created their own knowledge of this patient. As the shift progressed, the nurses developed an awareness of this patient and reconfigured the information learned from others with their experiences with the patient to create their own sense of this patient that was used to refine their technique of suctioning. Faith noted the time interval from one suctioning episode in her consideration of when to suction the patient again.

> "And it's about four hours from the last time that she was suctioned so we may want to sort of check on her again in about three, three and a half hours to make sure she doesn't build up too much." (Faith think aloud)

Hannah identified because her patient was very agitated and coughing following suctioning she would modify his dose of analgesic although that had not been done on the earlier shift.

> "He was more agitated following that suctioning, and maybe just because we gave, we gave, we gave him a 40 mcg flush of morphine but then did the dressings changes and then suctioned him. So because of the agitation after suctioning, we just gave him another 2cc flush of morphine." (Hannah interview)

Experience over time with this patient was a source of knowing this particular patient. Knowledge of this patient was derived from noting subtle changes and responses to treatments in this patient from day to day as well as over the shift.

> "So she's done well, that's three and I feel like I'm learning about her with each suctioning and she's working well with me." (Faith think aloud)

In response to the researcher's questions about noting changes in her patient, another nurse identified how her patient had changed from a previous time she cared for him and that this change was relevant in her knowing the way he responded to suctioning.

> "His personality. For one, he wasn't able to do really very much [on the previous shift]. He was so edematous I didn't know if he could even move a lot of things. Um, he is on half the morphine that he was on. He's on 20 mcgs where he was on 40 mcgs before... It's good to see him react that way...considering all that he's been through... it's good to see that." (Jody interview)

Knowing This Practice Environment

Knowing this practice environment was a form of knowledge that contributed to cue recognition in this study. The participants' judgments about how and when they suctioned the patient were based on the recognition of cues related to specific equipment, unit routines, and scheduling of nurses breaks. As with knowledge of this type of patient, it appeared that knowing the practice environment developed over time and with experience in the unit. Knowledge of the type of equipment and ventilator system used at the bedside was a cue in the nurse's judgment to access a respiratory therapist in suctioning a patient.

> "Yeah, it's all hooked up over there, and this other physical thing, I just can't reach the little knob that switches it from the ventilator to the bag. So that's why you always need at least someone [RT] standing there to turn the thing." (Diane interview)

Similarly, the nurse's judgment to consider two person suctioning technique was based on a cue derived from knowing about a specific ventilator.

> "...for the first time I suctioned, just because of, of the mechanics of, turning the hypoxic mix to the bag from the ventilator. I probably would have had that other person standing there if the vent, if the RT had time she could have bagged." (Diane interview)

Hannah spoke to the need for frequent suctioning for her patient based on her knowledge of the effect of the humidifying system within her patient's ventilator,

> "...but there were all kinds of water in his ETT and that happens with these ventilators and the particular ones we have with the humidifier, because it's humidified. So we have all the water sitting there. So I figured we're going to have to detach or else all that's going to give him a little lavage." (Hannah interview)

Knowledge of specific unit suctioning routines was used as a cue in judging the need for suctioning on only two episodes. Two nurses identified how suctioning before extubation was not only considered in response to patient condition, or as a measure to prevent problems post extubation, but also because it was an expectation of that unit.

> "Well he sounds clear, no typical reason to suction, except that we were going to extubate. The protocol, we always do a suction before we extubate, just to make sure there is nothing sitting in the tube as we pull the tube up to fall into the lungs. So we always do one suction prior to extubation." (Jody think aloud)

> "Just prior to taking out the tube, I'm going to suction. Just a routine suction." (Irene think aloud)

The participants discussed how they would determine the timing of suctioning in response to the availability of staff to cover their patient while they were away on break as part of the unit routine. Staff acknowledged the underlying unit expectation that the nurse would ensure the patient would not require other nurses perform interventions that could have been done prior to the nurse's departure for an assigned break.

> "Just in readiness for going for lunch, I'm just going to listen to the chest to make sure everything is fine and that I'm actually okay to leave (pause while auscultating). There's a few little squeaks in there, but I'm actually going to leave them because I think she'll be fine while I'm out and when I come back I'll be doing another chest assessment and I think that's okay. She's pretty settled right now, I don't want to go and upset her. It doesn't sound too bad. I think we can wait". (Irene think aloud)

Five minutes later, Irene revised her judgment to postpone suctioning until after she returned.

> "Actually I changed my mind. Baby has just waked up and sounds a little, um, like there are secretions in there. So, um, instead of breaks, I'm just going to go ahead and suction. She settled again now, it sounds okay, but I think I've changed my mind and I think I am going to suction. At least I'll know that while I'm away at break that nobody will need to step in and intervene." (Irene think aloud)

The nurses acknowledged the patient care demands on nursing and respiratory therapy staff as factors they considered in making decisions to temporarily transfer care of their patient during breaks.

> "I will tell the least busy person in this room, um, the last time I suctioned, that she probably won't need suctioning and because of the dynamics of this right now actually, I'll probably mention that to the RT." (Irene interview)

In summary, the process of cue recognition is comprised of two categories of cues nurses use in making judgments to suction. The first, perceptual awareness, is the (a) visual, (b) auditory, and (c) tactile cues nurses used. The second category of cues, knowing, is comprised of the cues nurses identified based on knowing (a) this type of patient, (b) this particular patient, and (c) this practice environment. In the following section, the second element of the process of cue utilization, weighing the evidence, will be discussed.

4.4. Weighing the Evidence

Weighing the evidence is the second core element of the process of cue utilization related to making clinical judgments about suctioning critically ill children. This process is the mental dialogue, or thinking activity, that represents the ways that nurses

considered the cues that were recognized. The nurse considered the overall relevance and importance of the recognized cues in making the judgment to suction. When the nurse considered the cue to be significant and pertinent to the patient situation, she regularly proceeded to suction the patient. At times, the cues recognized by the nurse were not considered to be as significant to the patient or the situation, and the nurse did not proceed to suction the patient. The large number of cues recognized by just seven nurses suggests that weighing the evidence is a process influenced and determined by the appraisal each nurse makes of the recognized cues.

Weighing the evidence appeared to be a process interwoven with the process of cue recognition. The aspects of cue recognition- perceptual awareness and knowing- influenced how nurses considered the cues recognized. For example, nurses identified that as they began to know this patient, they looked for specific cues that were meaningful for the patient and themselves. The verbalizations of the three participants who cared for the same patient during the study period are different. Each of these three nurses recognized cues, appraised the cues, and made judgments about nursing care in a pattern that was not replicated exactly for the three participants.

It became apparent that the nurses considered multiple cues in a short time frame in making the judgment to suction. They did not verbalize single, isolated findings as imperatives to implement suctioning except for the visual recognition of secretions in the ETT. The performance of the suctioning procedure was observed within about two to three minutes after the start of the verbalized recognition of and thinking about cues. It is relevant to note that no patient exhibited an acute sudden deterioration associated with ETT blockage that would necessitate immediate suctioning. As the suctioning episodes could then be considered relatively elective, nurses had time to appraise the cues as a process in making the judgment to suction.

The nurse determined the most appropriate nursing action for the patient in order to balance the risks and benefits of suctioning as part of the process of weighing the evidence. Nurses considered both the goals (airway clearance, improved alveolar oxygenation and ventilation) and the potential negative consequences of endotracheal suctioning (hypoxemia, tube displacement, physiologic stress and patient discomfort) when considering ETS for their patient. Prior to and during the suctioning event, nurses used information from multiple sources (the patient, the medical team, the respiratory therapist, unit policy and procedures) to arrive at the judgments to suction, to not suction, to implement alternative interventions, or to seek the assistance of other health care providers.

Two aspects of weighing the evidence, which represent the thinking activities involved in the consideration of the recognized cues, emerged from the data: (a) determining the significance of perceptions and (b) corroborating impressions. The ways that nurses considered the cues have been sorted into these two categories of weighing the evidence (Table 5).

Table 5: Weighing the Evidence

Thinking Activity	Attributes
Determining the significance of perceptions	Relative Importance
	Creating a fit
Corroborating impressions	Rationale for findings
	Consultation

a: Determining the Significance of Perceptions

Nurses did not respond to all recognized cues with the judgment to suction, even when the cue was congruent with the unit policy that outlines the indications to suction.

This apparent paradox can be explained by the notion that the nurse determined the significance of perceptions or cues in relation to other cues as part of the process of weighing the evidence. The same cues that at one time resulted in the decision to suction were also associated with the decision not to suction the same patient at another time. For instance, at one time, the nurse may have considered cues A and B significant for the need to suction and then proceeded to suction. But at another time, the nurse considered the same cues less significant to the patient, and as part of an appraisal of the cues, discounted the cues as prompts to suction. Determining the significance of the perception is based on a consideration of the (a) relative importance and (b) fit of that cue with other recognized cues.

Relative Importance

It appeared that the nurse recognized a cue and then assigned that cue an importance relative to an appraisal of all patient cues and the clinical context. Some cues appeared to be considered more important than others in certain situations. For example, the visual cue of secretions within the endotracheal tube and the auditory cue of hearing secretions when manually ventilating the patient were considered highly important and nurses regularly proceeded to suction the patient upon sensing these two cues.

> "Still sounds quite rattly so I'll still go down once more. (pause while suctioning). You can still see it in the tube so I'll have to go down one more time." (Glenda think aloud)

Not all cues were assigned a similar weighting. For example, patient coughing was a visual cue of patient condition that was considered relevant in prompting the nurses to suction at some times. However, at other times, coughing was considered in relation to other cues, such as patient moving, and interpreted as an effect of the suctioning procedure and discounted as an indicator to suction.

> "... when he starts to cough again, you usually think, Oh you know what you're going to start coughing... but then I had a listen to you, and you sound clear and your sats are maintaining...and there is not much of a noise down there, so we just let you cough and keep a clear tube. So you didn't need to be suctioned....eh, because you were fine... you were fine..." (Jody think aloud)

> "Okay I'm just going to have a little listen here to see how he sounds post suction (pause while auscultating). (ventilator alarming). He still has some. And he sounds respiratory and expiratory wheezes.(pause). But maybe a little bit clearer than he did pre suctioning. We'll just give him some time to settle down because he's still coughing." (Ellen think aloud)

One nurse identified that patient coughing was an important cue in her judgments to suction the patient earlier on in the shift. In a later concurrent verbalization, she considered the cue of coughing in relation to cues about the nature of secretions and judged that coughing was attributed to another cause.

> "...think that he's coughing more generally because he's just more awake than he has been and when she said the secretions were loose, quite blood tinged, but his weren't actually when I did that. It was just white but he's needed frequent suctioning." (Glenda interview)

In the following excerpt, a nurse considered a drop in oxygen saturations as a cue to continue to assess the patient more completely rather than to suction. Once the cue of desaturation had been recognized, the nurse considered how important, or unimportant, that cue was in relation to the other recognized cues and the context of the patient situation and made a judgment to give the patient time to recover.

> "She tolerated the suctioning well and her head being turned, sats have sagged a little bit but we'll see if she perks up just being left alone. It would be interesting to see what kind of reserves she has. She's on twenty-five percent oxygen and I haven't looked at pre oxygenating at this point but that might be an option if she doesn't want to tolerate handling." (Faith think aloud)

Irene acknowledged the auditory cue of the ventilator alarm in the following think aloud. This cue was considered not as important as the cues of patient activity, this type of patient, colour, chest sounds, and oxygen saturations and she made the judgment not to suction the patient.

> "Oh, the ventilator is ringing off apnea, but she's breathing quite nicely but sats were a little bit lower, dipped down to 95. She is pink, she is warm, she is well perfused. I think we just need to get that tube out. I'll have a quick listen of her chest and see if there's any changes from when I went (pause). Okay, so just listening to the chest. Oh, it sounds pretty good in there. I think it's just newborn stuff and she needs the tube out and she'll be much happier. I'm not going to suction. Just going to leave things as they are and just sit and watch things." (Irene think aloud)

In the following excerpt the nurse identified a number of cues (hemodynamic pressure changes, ventilator high pressures, oxygen saturations, patient coughing, and chest sounds) that she had associated with the need for suctioning in an earlier think aloud. She initially decided not to suction based on a comparison of the importance of those cues and the importance of administering the enteral feeding. Then, in response to a change in the auditory cue of chest sounds, which she regarded as important, she weighed the evidence and decided to suction the patient.

> "So Jimmy's RA pressures are just starting to up a little bit now, and he is starting to trigger his ventilator off. His pressures are 20 over 6, um, saturations are okay, they're 98. But he is doing quite a bit of coughing. I have just listened to his chest and there is a lot of secretions down there again. Initially I was feeding...holding off suctioning him and I was going to give him his feed. But, based on how he sounds right now, I want to make sure we suction him prior to him getting his feed." (Hannah think aloud)

The verbalizations illustrate that the participants reconfigured their considerations of the importance of recognized cues over time in caring for the same patient.

Creating a Fit

The findings of this study suggest that the nurses usually considered visual, auditory, and tactile cues in groupings or patterns as they appraised the cues in making judgments related to endotracheal suctioning. This process of comparing and associating cues has been named 'creating a fit'. When cues fit together, nurses created a mental image of a pattern of cues that appeared to be readily recognized and determined to be significant.

> "The same pattern, I'm listening to her, feeling her, felt the resistance, heard the sounds. "(Faith interview)

When multiple cues associated with suctioning were perceived to fit together and create a recognized pattern, nurses proceeded to suction without seeking confirmation for that assessment by looking for other cues. For example, when nurses noted the visual cue of secretions in the ETT in conjunction with hearing the patient cough, they did not routinely auscultate the chest for the presence of adventitious sounds before suctioning. The participants considered the fit of recognized cues with a pattern of cues they associated with the need for suctioning. When nurses noted discrepancies or lack of fit between the recognized cues and a holistic appraisal of the patient situation, they looked for rationale to explain that patient finding prior to discarding that cue in their thought processes.

> " Oh you know what you're going to start coughing... but then I had a listen to you, and you sound clear and your sats are maintaining...and there is not much of a noise down there, so we just let you cough and keep a clear tube. So you didn't need to be suctioned." (Jody think aloud)

The following excerpt from an interview illustrates how the nurse noted a cue, desaturation, which could have indicated a need for suctioning. In creating a fit between this cue and other cues, she considered the cue of desaturation not congruent with other cues and subsequently implemented an alternative nursing strategy.

> "When we first came in she was desatting a little bit and I just noticed on the monitor, usually the resps don't pick up this accurately, but I can tell for her they do and I can just see little breaths in between the ventilator breaths so that's what made me think, that's probably why she's desatting or at least there's something to rule out so that's why we muscle relaxed her." (Diane interview)

In the following excerpt, Faith acknowledged the auditory cue about the breath sounds as indicative of a need for suctioning. As well, she noted that the low oxygen saturations were not considered a cue to suction, but rather as a cue that her patient was physiologically unstable at that time. It appeared that the nurse considered the

potential consequences of suctioning when the infant's oxygen saturations were not optimal and made the judgment not to suction at that time.

> "Breath sounds sounding a little bit harsher but her saturations are such that I wouldn't want to add to any problems like stressing her out, so I'll probably, maybe, within the next half hour, I might suction her". (Faith think aloud)

The data suggest that nurses determined the significance of the cues perceived by considering the relative importance of cues and the fit of cues with other recognized cues. The process of corroborating impressions emerged as a second aspect of weighing the evidence and will be discussed next.

b: Corroborating Impressions

Corroborating impressions is the thinking activity that nurses performed when they sought verification of their assessments and judgments. Once the nurses had corroborated their impressions, it appeared that they made a case for their judgments and were able to confidently proceed with the nursing strategy they had chosen. When cues did not fit with each other in a grouping that the nurse associated with the need for suctioning, nurses appeared to look for rationale for the cue, to consult with other health care providers, and to consider research findings as a way of corroborating the impression.

Rationale for Findings

When nurses noted cues that did not fit the usual or expected pattern, they sought to identify rationale to explain those findings. The data suggest that the nurses sought rationale for changes in the patient findings as a step in affirming the appropriateness of the judgments they made in situations that they considered unusual.

> "Okay now I'm going to have another little listen here post suctioning and post ventolin just to see if there's any difference in the air entry (pause while auscultating). He still has a prolonged expiratory time. Actually his air entry on the right sounds way better and you can actually hear slightly better air entry on the left. Yeah, not so many inspiratory wheezes, still expiratory wheezes and

> forced expiration, but the air entry is quite a bit better. Maybe it's the suctioning and, and ventolin combination." (Ellen think aloud)

Similarly, when nurses could explain a change in a recognized cue, they appeared to entertain ideas about alternative strategies that had not been previously implemented with the patient. When the participants identified rationale for their findings and judgments, they tried new ways of working with that patient as illustrated in the following interview excerpt.

> "What I did differently this time was what I had sort of planned from the last suctioning. I bagged her, gave her good PEEP and then used the clamp to transfer her from the MiE's set back to her ventilator. And what was good about that was she didn't have that drop in her sats this time as she did in the previous two suctionings. So that tells me that she is PEEP dependent. So that's worth noting and passing that on to the incoming nurse for the tonight. So those are all the little things to, to sort of learn about. She tolerated it well she, there wasn't really any grimacing, she wasn't uncomfortable during it so that was good." (Faith interview)

As well, when nurses recognized a cue that was not congruent with the patient's condition, they looked to identify rationale for that cue that would support the decision to discount the cue. In this excerpt, Ellen identified that she would continue to look for rationale for the patient's condition by assessing arterial oxygenation with a blood gas measurement.

> "So post suctioning, he desaturated and looked like he was working more.... But when he was bagged, his sats were down at ninety, anyway, he's rallied. Maybe he was just having a break. Who knows? He didn't need suctioning that's for sure. And his air entry diminished, diminished post suctioning which is kind of how he sounds post suctioning. But he seems to be back to where his base line is now and seems to be back to how he was looking previously. So we'll give him some ventolin and maybe do a gas and see how he is." (Ellen think aloud)

Consultation

The nurses sought corroboration of their impressions by seeking information and opinions from other members of the health care team, most often the RT. Participants were observed to ask the RT for an opinion about cues noted by the nurse.

> Prior to suctioning RT suggested reducing frequency to allow for a longer exhalation phase and then discussed strategy to change PEEP setting on ventilator to enable autopeep and treatment PEEP to correspond. RT asked RN questions about secretions and whether RN felt the patient needed nebulized bronchodilators. (Ellen, field notes)

> "Okay, with the rate decrease the baby has just desaturated, so our RT is slowly bagging her because she seems to like that. I'm not sure exactly what's going on yet. Does it feel like she needs suction (to RT)?" (Diane think aloud).

In this following excerpt, the nurse recognized the cues of high ventilator pressure and breathing pattern (working harder) as significant to this patient situation. The cues were not interpreted to be consistent with the need for suctioning for this nurse, as they did not fit the normal pattern. She sought the impressions of the RT to confirm or refute her judgments about suctioning the patient.

> "So the high-pressure alarm keeps going off on the ventilator. I'm not sure we just need to be suctioning or whether or not he look, he looks like he's working a bit harder, maybe we should just try some ventolin to see or maybe even ventolin and suctioning. I'll get the RT to come in and do an assessment too cause he just, he just looks like he chugging a bit there." (Ellen think aloud)

Participants were also observed to consult with other nurses, but not with physicians, about judgments related to endotracheal suctioning.

In summary, weighing the evidence appeared as the second element in the process of the cue utilization in making judgments about endotracheal suctioning. Weighing the evidence is the mental dialogue of determining the significance of perceptions and corroborating impressions. It is relevant to note that aspects of weighing the evidence appeared to be interconnected with the recognition of cues. Nurses continued to look for and recognize additional cues as part of the activities of seeking confirmation and creating groupings of cues to support the judgments to suction. There did not appear to be a discrete stop to the process of cue recognition prior to a start to the process of weighing the evidence in the nurses' actions and words. Having recognized cues and weighed the evidence in the process of cue utilization, nurses

made the judgment to suction or not to suction. Once the judgment to suction was made, nurses implemented specific strategies in the process of skilled performance as they suctioned the patient.

4.5. Skilled Performance

Skilled performance is the term used to characterize the ways that nurses performed the skill of suctioning. Skilled performance, the doing, is derived from the process of cue utilization in the practice situation, and in turn, contributes to the process of cue utilization. It is evident in the data from this study that nurses did not separate the processes of sensing, thinking and doing. Although the processes of cue recognition, weighing the evidence, and the skilled performance of suctioning are interwoven, they have been separated only for ease of discussion. Within the think aloud verbalizations, the nurses spoke to specific ways that they were suctioning the patient in response to cues that were recognized in the patient and the clinical situation. It is relevant to note the 'doing' of the suctioning did not necessarily follow the two elements of cue recognition, the 'sensing', and weighing the evidence, the 'thinking', in linear steps. Rather, it became apparent that the ways in which nurses performed the suctioning procedure, evolved from an ongoing iterative consideration of the cues recognized. In doing the intervention of suctioning, nurses continued to recognize and appraise cues that they used to guide their actions during the current suctioning event. Just as importantly, the cues the nurses appraised as they did the procedure were used to continue to create the nurse's sense of knowing the patient that was important in making judgments about future suctioning interventions. Skilled performance does not represent a step-by-step procedure for suctioning a critically ill child. The actual time spent in performing the suctioning skill was short, an average of 5 minutes each. However, the

considerations that nurses attended to in making judgments of when and how to suction were numerous, complex, and interrelated.

The participants' skilled performance of suctioning focused on protecting the patient from potential complications associated with endotracheal suctioning. Nursing strategies employed in safely suctioning the patient emerged from the concurrent and retrospective verbalizations. The cues that nurses considered and the ways that nurses performed the suctioning appeared to be closely linked to the way the nurse was connected to the patient through sight, sound, and touch.

> "...there was a distinct difference when I was bagging. I could hear it and I could feel it and that unfortunately is not something you can actually always, um, that's a feel thing that comes with time and it, it really is the connection of the brain to the hands and the ears, so it's a sensory process."(Faith interview)

Nurses implemented specific strategies to facilitate this visual, auditory and tactile connection with the patient. Nurses were observed to specifically set the alarm limit parameters and the volume of monitor alarms and audible tones to facilitate a continuous auditory connection with the patient. Monitor screens were positioned within the nurse's visual fields to enable the nurse to visually perceive changes in vital signs, oxygen saturations and hemodynamic parameters. To ensure the visual connection necessary to note changes in patient colour and work of breathing, patients were not covered with blankets or clothed in pajamas. Thermoregulation was managed with overbed heaters and nurses were observed to position that equipment to prevent a barrier to visual surveillance of the overbed monitor. During the suctioning procedure, nurses positioned themselves standing at the head of the bed, facing the patient to maintain close visual scrutiny of the patient's chest movement during manual ventilation, and the colour extremities and lips during the procedure. Faith identified that the activities of surveillance are part of the suctioning procedure that may not be overtly visible, or even noted by the nurse.

> "So while that's going on, some of the other things that one has do as long, as well as being focused on the task of suctioning is how is the child tolerating, what's their colour like, what's their breathing effort like and taking in the monitor so my heads moving and, and I'm probably not even aware of that." (Faith interview)

The categories of kinds of nursing actions related to skilled performance evident in the data are: (a) protecting the endotracheal tube placement, (b) preventing hypoxemia, (c) reducing distress (d) accessing human resources (e) promoting secretion clearance and (f) minimizing the number of suctioning passes. The following section will describe the skilled performance of suctioning that emerged from the nurses' words and actions.

a. Protecting the Endotracheal Tube Placement

Nurses incorporated strategies to protect the placement of the endotracheal tube (ETT) in the technique of suctioning. Nurses were observed to restrain the patients' hands and head with their own hands when patients became restless and agitated during suctioning. During the suctioning procedure, nurses were noted to hold the ETT with the hand not manipulating the suction catheter in an effort to stabilize the tube. As well, when nurses attached the manual ventilating system to the ETT, they held the tubings to prevent tension on the ETT. When ETT tubes were not taped securely, nurses identified their concern about stability of the ETT and collaborated with the respiratory therapist to retape the ETT if the tapes were loose or slipping.

> "And her tapes are such that I'm going to be talking to RT about retaping. I'd rather have secure tapes...So Mandy just had her ETT retaped and my task while it was being done was to ensure that she was tolerating it okay, watching her sats and her heart rate." (Faith think aloud)

> "The ET tube, and this is a common problem, had slipped off the nose. The tape that we use, when it gets warmed by the overhead bed warmer, becomes very pliable. And the weight of the tube has caused the whole thing to slide off the nose. I'm concerned because to me if that settles, that the tube is not as secure as it can be. This baby is not very active so, in retrospect, it's actually okay. If this was a baby that was very active, like my other baby here, I would have got that tube retaped. I would have pushed to get it retaped." (Ellen interview)

b: Preventing Hypoxemia

The skilled performance of suctioning included specific nursing actions directed at preventing hypoxemia. One nurse was observed to manipulate the ventilator oxygen concentration setting to mitigate transient hypoxemia following one suctioning episode.

> "His sats have been down. We've been playing with his ventilation cause he looks like he's working a bit, quite a bit harder" (Ellen think aloud)

All nurses were observed to manually ventilate the patient with oxygen concentrations higher than the ventilator setting before and during the suctioning procedure.

> "So then the bagging in between is to bring a child's oxygenation." (Faith interview)

Desaturations were an expected consequence of suctioning and nurses regularly anticipated that the patient would require ongoing manual ventilations during and after the procedure.

> "What I, what I was doing was seeing that her heart rate went up a little bit so that's an indication of some stress load on her. Saturations actually sagged a little bit when we first started, they went from about ninety-five down to ninety and then when I bagged her, I bagged her up and then I had her like a hundred per cent." (Faith interview)

In response to a child's desaturations following suctioning, the nurse questioned whether the hypoxemia following suctioning was related to atelectasis caused by the loss of positive end expiratory pressure (PEEP) when the patient was disconnected from the ventilator. In this following excerpt she considers the implementation of a lung recruitment strategy to mitigate this negative consequence of suctioning.

> "Previous couple of times she sagged on her sats after suctioning, so I'm going to clamp her ETT and then hook her up. Okay, she's back on her ventilator and that time we didn't lose her PEEP and it will be interesting to see if she's able to maintain her sats higher than that this time around." (Faith interview)

c: Reducing Distress

Nurses considered the physiologic distress that accompanied the suctioning procedure in the judgments about the ways of suctioning. The participants verbalized that unnecessary suction was to be avoided. They timed the suctioning events to minimize the distress that the procedure induced in the patient and specifically implemented strategies to reduce the patient's discomfort and distress. Comforting the patient with pharmacologic and non-pharmacologic approaches was a strategy implemented by all the participants. The following excerpt illustrates how managing a child's discomfort associated with suctioning was also directed at protecting the stability of the ETT placement.

> "For the morphine, I thought he is going to need something. We just don't want him moving around too much. Because we like the kids moving a little bit, just taking a few extra breaths above the ventilator, just moving their secretions. But we don't want them in pain and we don't want them moving so much that isn't dangerous." (Hannah interview)

Nurses verbally supported and comforted the patients by touching the child's heads in a stroking manner, and speaking soothing, encouraging words. The nurses' consideration of patient discomfort associated with suctioning was evident in many of the concurrent verbalizations.

Nurses clustered the suctioning procedure with nursing activities to reduce the distress associated with suctioning. Nurses identified that clustering of care was part of the judgments related to suctioning to facilitate recovery time for the patient.

> "Because if I don't have to disturb the kids, I do everything every four hours. I take a temperature, turn, suction, diaper change. I do it every four hours and cluster care so that's it. Some people do it three, some people do it two. I choose four." (Ellen interview)

> "Well I try to plan my care, because it sounds like Jimmy's... soon as you irritate him or do anything to him, he'll cry, he'll produce secretions, and need to be cleared. So hopefully um, clustering his care, and keep him so you've got minimal suctioning and minimal trauma, and just let him be. When he's content...

> try to do things around his personality. If he was awake and crying and needs a temperature in an hour and a half, do it now, type of thing." (Jody interview)

All suctioning episodes were performed in conjunction with other nursing interventions that included repositioning, mouth care, eye care, and dressing changes.

> "And we have been bugging him. So he needs a suctioning now. He's been coughing. But we're going to turn him at the same time so since I only want to suction him once, I've just kind of give him a little lift (pause)... (to RT at bedside). Do you want to bag him for me, because what I think we're going to do is we're going to just turn him towards your side." (Hannah think aloud)

Sequencing care was observed as a decision nurses made to mitigate negative consequences of suctioning. Patient coughing and agitation were associated with all suctioning events for patients not receiving neuromuscular blocking agents. In the following excerpt, Hannah considered that patient coughing during suctioning, while the enteral feed was being administered, would increase the patient's risk for aspiration. The subsequent judgment to sequence suctioning prior to the administration of the feed is an example of this nurse's skilled performance directed at protecting the patient.

> "This little guy, nutritionally, we know he is compromised. So we're feeding him 30cc every 3 hours, which he's tolerating really well, he's got good bowel sounds. We want to make sure he tolerates that. So I just figured as soon as, if we feed him and then we have to suction him, he's going to cough, gag and maybe throw up the feed. We don't want to take any kind of chances at all. So it's really nice for him if we're going to feed him, we suction him, make sure he's nice and clear, he's not going to cough and then after we suction him, every time we suction, you notice, he gets all that air in his belly, so take the air out of his belly. And then he settled and then give him his feed, and so now, he's been suctioned what, forty minutes ago, and then I gave him his feed right after that. So this is nice. Now he's settled, he'll digest the feed." (Hannah interview)

d: Accessing Human Resources

Another characteristic of skilled performance evident in the participants' practices is how nurses judged the need for and accessed additional human resources during suctioning. For example, two-person suctioning was performed in collaboration with the respiratory therapist in response to the need to reduce patient risk for pulmonary hypertension. Diane explained that the patient needed rapid manual ventilation during

suctioning to offset the elevation in pulmonary artery pressures associated with suctioning this particular patient. She identified that suctioning this patient would be safest with the RT at the bedside to manually ventilate and to manage the manual ventilating equipment while the patient was receiving a hypoxic gas mixture. As well, nurses identified that positioning the patient and ensuring safe placement of ventilator tubings was facilitated when the respiratory therapist was at the bedside.

> "...the RT's going to give me a hand, so it's going to be two of us which makes it a lot nicer." (Glenda think aloud)

When nurses did not have knowledge of the patient's responses to suctioning, two person suctioning technique was considered as another strategy to protect the patient from potential negative consequences.

> "I probably would have had that other person at least standing there, if the vent, if the RT had time she could have bagged and I would have suctioned and done a two person suction the first time because I didn't know the patient and stuff and based on that suction I would've seen if I actually needed another person hanging around." (Diane interview)

When implementing two-person suctioning, the respiratory therapist was observed to initially manually ventilate the patient and the nurse to perform the suctioning. On two occasions, when nurses encountered the unexpected finding of resistance to the catheter insertion, the nurse and respiratory therapist switched roles. Respiratory therapists then suctioned the patient, made an assessment of the problem and confirmed or refuted the nurse's findings.

e: Promoting Secretion Clearance

Specific nursing activities directed at promoting secretion clearance during suctioning procedure contributed to the skilled performance of suctioning. The nurses' judgements about the ways to suction were related to the need to clear secretions as well as the need to maintain a patent ETT in order to protect the patient. "Although endotracheal suctioning is a potentially harmful procedure, inadequate or insufficient

removal of secretions can result in complications" (Simmons, 1997, p. 4). A variety of methods of suctioning related to promoting secretion clearance and preventing ETT blockage were evident in the nurses' words and actions.

> "...when I go down with the suction catheter that's not a time that you're doodling around. You're getting down there but don't be so quick that you don't actually allow time to get the secretions. Something that folks will do and that I notice when I'm, I'm guiding people when they're learning about suctioning, spend a couple of seconds at the bottom of that tube to at least give the suction catheter a chance and then do the twirling as you come out, to pull out the secretions. That way you may minimize the number of passes you have to make through the ETT and you will actually make it easier for the child in question." (Faith interview)

> "I needed to get it up. And you only want to that because if you leave it there, it may flap and it'll be like a ball valve and you end up having an ETT blocking." (Faith interview)

One nurse judged the administration of inhaled bronchodilators and chest physio in the form of vibrations as necessary to promote secretion clearance in one patient.

> " So we're doing some vibes with our suctioning here just to see if we're getting any air that might be trapped out. And he's coughing too and sounding certainly clearer than he was. (pause while suctioning). And we're not getting much out secretion wise now that we're pretty well done for the suctioning." (Ellen think aloud)

As well, nurses identified that the instillation of saline was a measure that was important in promoting the effectiveness of the suctioning procedure. It is relevant to note that each of the participants employed saline instillations during the performance of suctioning. It appeared that the purpose of the instillation of saline was related to liquefying secretions and promoting movement of secretions though stimulating the patient cough.

> "I went down the first time with just the suction catheter, and I could feel that there's something there. But obviously [it] wasn't coming up to the end of the tube. So using the saline to liquefy what was down there and then there was a distinct difference when I was bagging. I could hear it and I could feel it." (Faith interview)

> "Again he had those really thick secretions initially, so required us to put saline down, passed once and got lots of thick secretions and passed again and you

> could feel that the secretions were just at the end of the suction tubing but wasn't coming up. So I bagged him again, he settled really nice with the bagging. So bagged him until he settled, put more saline down. Bagged him again, really loosened anything up. Then went down and suctioned and got it up again. He gave a really good cough, bagged him again, settled nice after that." (Hannah interview)

> "But I think that if you have got any secretions down there, if you really truly want to do a good suction, you need to get them all up and you always need saline." (Irene interview)

f: Minimizing the Number of Suctioning Passes

The number of times the nurse passed the suction catheter appeared to be in response to both the nurse's appraisal of the effectiveness of the suctioning episode as well as knowledge of the negative consequences of unnecessary suctioning. There appeared to be no minimum or maximum guideline for the number of catheter insertions to be implemented when suctioning the patient. Each suctioning episode was distinctive in how many times the nurse passed a suction catheter based on the nurse's judgment of the patient's response and the outcome to the procedure. Judging that the suctioning event is completed was based on the perception and interpretation of visual, auditory and tactile cues.

> "Okay I'm just going to go down the tube once more and Hannah has very kindly just emptying out the water for me. Down the tube again. He's tolerating this quite well, already the pressure is around twenty but, okay so he's still got moderate secretions down there, still white and quite loose. (pause while bagging). Can't hear any more secretions anymore. Chest is pretty compliant. PA pressures have come down a little bit. Saturations are ninety-nine." (Glenda think aloud)

An absence of secretions produced on suctioning was a cue to stop the procedure.

> "And he's coughing too and sounding certainly clearer than he was. (pause while suctioning). And we're not getting much out secretion wise now that we're pretty well done for the suctioning." (Ellen think aloud)

As well, nurses judged that patient fatigue and distress indicated a need to stop the suctioning procedure. In the following excerpt Glenda, speaking with the RT, was

aware of the ongoing presence of secretions, however she judged the need to stop as they had been suctioning this patient for a long time.

> "Just going to go down again. (pause while suctioning). I think that was quite thick yeah. (pause while bagging). Still there but it's a lot thinner...But you know I think we'll just put it back on because it's been down awhile now. Put her on the vent (to RT)." (Glenda think aloud)

The above suctioning procedure continued for twelve minutes. However, it is unknown what cues were considered in the nurse's judgment that the length of the procedure was considered too long, or 'awhile', for this patient.

In summary, the skilled performance demonstrated by the nurse participants was built on the judgments nurses made using the process of cue utilization. The processes of cue recognition and weighing the evidence continuously influenced the skilled performance of suctioning. Nurses continued to recognize cues, and to consider those cues, during and after the suctioning procedure. As well, the knowledge of a specific patient that was learned from each suctioning episode contributed to the judgments about future suctioning episodes.

4.6. Cue Utilization in Making Judgments: A Summary

The findings of this study support the conclusion that judgments about ETS, made by expert pediatric critical care nurses, are dynamic, complex, and derived from a process of cue utilization. The process of cue utilization is comprised of two elements, cue recognition and weighing the evidence, that are interrelated in an iterative relationship. The participants' words and actions attest that the 'sensing' and 'thinking' of the process of cue utilization, are interwoven with, and integral to the 'doing', which is the process of skilled performance.

Cue recognition is comprised of two categories of cues nurses use in making judgments to suction. The first, perceptual awareness is the visual, auditory and tactile cues nurses used. The second category of cues, knowing, is comprised of the cues

nurses identified based on knowing this type of patient, this particular patient, and this practice environment.

Weighing the evidence, the second element of cue utilization, is the mental dialogue that nurses used to determine whether or not the recognized cues were congruent with patient need for suctioning. Weighing the evidence is comprised of two categories of thinking activities- determining the significance of perceptions and corroborating impressions. Determining the significance of perceptions is the way that the nurses attributed a value or importance to the perceived cues. Corroborating impressions is the way that nurses sought to verify, confirm or refute their thoughts about the relevance of a cue to the patient situation.

Skilled performance represents the ways that nurses suctioned the patient as a result of the judgments made. The foci of skilled performance are related to protecting the patient prior to, during, and after the suctioning event. As well, skilled performance influences the ongoing dynamic processes of cue recognition and weighing the evidence for future suctioning episodes. The nature of the skilled performance of suctioning appeared variable for every nurse and every patient situation. Nurses determined the persons involved, the timing, the frequency, and the duration of each suctioning episode to meet the specific needs of an individual patient in a unique situation.

5. DISCUSSION

This chapter presents the discussion of the research findings in relation to the two research questions initially posed:

1. What are the cues that expert pediatric critical care nurses recognize in determining the need for endotracheal suctioning (ETS) when caring for mechanically ventilated children?

2. How do expert critical care nurses utilize these cues in determining frequency and timing of ETS?

Following the discussion of the findings and method, recommendations related to nursing practice, education, and research are presented. As well, implications to the role of the Clinical Nurse Specialist are discussed.

5.1. Research Question 1

> What are the cues that expert pediatric critical care nurses recognize in determining the need for endotracheal suctioning (ETS) when caring for mechanically ventilated children?

The analysis revealed that all suctioning episodes were preceded by the judgment of patient need for the procedure. Nurses did not perform the procedure needlessly or routinely. This finding is congruent with Knox's (1993) suggestion that nurses should limit suctioning to when needed, because a priority of care for the intubated child should be to minimize the trauma associated with ETS. Knox extrapolated recommendations for nursing care based on a review of the adult, pediatric, and animal literature related to the negative consequences of suctioning. Knox proposed, "Bronchial suctioning should not be attempted as part of a normal nursing routine, but should be based on auscultation and assessment of the status of the child's airway" (p. 49). The findings of this study have identified that the assessments that nurses consider in determining the need for suctioning go beyond the recommendations

of Knox. This study found that nurses' assessments are based on more than the status of the child's airway and chest auscultation.

The cues that nurses recognized in determining the need for suctioning are similar to the criteria as suggested by Copnell and Fergusson (1995) for determining the frequency of ETS. These authors examined the knowledge and rationale for suctioning of twenty-four pediatric critical care nurses of varying levels of clinical expertise. No single criterion for suctioning was mentioned by all respondents. They concluded that the lack of consistency between the nurses' judgments to suction illustrated that these decisions to suction were complex and required the consideration of many factors. They concluded that because most of the nurses appeared to rely on a determination of patient deterioration (acute desaturation or altered hemodynamic parameters) to alert the nurse to the need for suctioning, they were not using assessment skills to full advantage in caring for the ventilated children. However, this current study, using a sample of expert nurses, multiple data collection methods that included concurrent and retrospective verbalizations, and thematic data analysis, has revealed that expert nurses use complex and multiple patient assessments in determining the need to suction. As well, no suctioning event in this study was preceded by an acute deterioration in the patient's condition. It may be that the absence of negative patient consequences, such as acute desaturations and altered hemodynamic parameters, were avoided because of the expert practices of the nurses in this study.

The findings of this study support the conclusion of Wood (1998b) that nurses are able to base the decision to suction on an assessment of patient cues. In a controlled experimental study, short term ventilated patients were allocated to receive endotracheal suctioning either when needed, as determined by an assessment of chest auscultation, or on a predetermined two hourly suctioning interval. Patients suctioned

when nurses' assessments indicated the need for suctioning, had fewer complications and better outcomes than the control group, as measured by peak airway pressures, heart rate, mean arterial pressure, and the amount of secretions obtained on suctioning. In contrast to Wood's research, no nurse in this study suctioned solely on the basis of breath sound cues. The findings of this current study revealed that the cues recognized by expert nurses are more numerous that the single assessment of chest auscultation used in Wood's study. It may be that by artificially limiting the nursing assessments to chest auscultation, Wood failed to address the full scope of the cues that nurses recognized in making the judgment to suction.

Some of the cues nurses recognized in this study were identified in a literature review examining the indications for suctioning (Simmons, 1997). Simmons proposed that nurses should consider both ventilator parameters (alterations in peak inspiratory pressure and minute volume measurements) and clinical assessments (decrease in oxygen saturations and changes in arterial blood gases) in determining when endotracheal suctioning is indicated. Although Simmons cautioned that the consideration of ventilator and technical parameters "must be assessed in conjunction with the clinical assessment of the patient" (p. 5), the specific clinical assessments that the nurse should consider in making the judgment to suction intubated critically ill children were not described. The findings of the current study provide information about the specific clinical assessments that nurses did consider in suctioning pediatric patients. The expert nurses recognized auditory cues related to ventilator parameters (alarms when peak inspiratory pressure increased or when tidal and minute volumes decreased) in conjunction with the clinical assessment of the patient that included the recognition of other auditory, visual, and tactile cues. No suctioning episode was performed in response to an assessment of changes in arterial blood gases in this study. This

indicates that the nurses in this study clinically assessed the need for suctioning and intervened before significant changes in oxygenation (hypoxemia or hypoxia) could occur.

The cues used by nurses in this study were compared with the major nursing texts that pediatric critical care nurses use to answer questions related to practice (Hazinski, 1992; Curley & Moloney-Harmon, 2001; Henneman, Ellstrom, & St. John, 1999; Slota, 1998). These nursing sources are consistent in advocating for endotracheal suctioning only as needed. Curley and Moloney-Harmon (2001) cited the AARC (1993) criteria as the basis for patient assessment indicating the need for suctioning. Hazinski specified "the frequency of suctioning required will vary from patient to patient and during the course of the patient's illness" (p. 439). Hazinski specified that suctioning should be performed whenever there is evidence of an accumulation of secretions, or whenever there is a question of tube obstruction. However, Hazinski did not specify the nature of the evidence of secretions. The American Association for Critical Care Nurses Protocols for Practice suggested that as suctioning is associated with adverse complication, ETS should "be performed when clinically indicated" (Henneman et al. 1999, p. 18). The protocol outlined the clinical indications for suctioning to include: "secretions in the ET tube, frequent or sustained coughing, adventitious breath sounds on auscultation (rhonchi), desaturation, increased peak airway pressures, sudden onset of respiratory distress, and whenever airway patency is questioned" (p. 18). The indications to suction from this current study's findings are congruent, but more numerous, than those identified in the above resources.

The American Association for Respiratory Care (AARC, 1993) practice guideline for endotracheal suctioning of mechanically ventilated adults and children states, "endotracheal suctioning should be performed whenever clinically indicated, with special

consideration for the potential complications associated with the procedure. Endotracheal suctioning may be required at some minimum frequency in order to maintain the patency of the artificial airway used" (p. 504). However no minimum frequency is specified in the guideline. Criteria to determine a minimum guideline are not specified. The guideline identifies 13 indications for suctioning that are derived from the literature and expert consensus:

1. Coarse breath sounds by auscultation or noisy breathing
2. Increased peak inspiratory pressure during volume-controlled mechanical ventilation, or decreased tidal volume during pressure controlled ventilation
3. Patient's inability to generate an effective spontaneous cough
4. Visible secretions in the airway
5. Changes in monitored flow and pressure graphics
6. Suspected aspiration of gastric or upper airway secretions
7. Clinically apparent increased work of breathing
8. Deterioration of arterial blood gas values
9. Radiologic changes consistent with retention of pulmonary secretions
10. Need to obtain sputum specimen for lab analysis
11. Need to maintain the patency and integrity of the artificial airway
12. Need to stimulate a patient cough in patients unable to cough effectively secondary to changes in mental status or the influence of medication
13. Presence of pulmonary atelectasis or consolidation, presumed to be associated with secretion retention" (p. 502)

Some indicators for suctioning identified in the AARC Practice Guidelines are not reflected in the findings of this study. Nurses did not consider changes in monitored flow and ventilator pressure graphics, or an assessment of radiologic changes indicating pulmonary atelectasis or consolidation, as cues to suction. At no time were nurses seen to suction based on the need to stimulate patient coughing due to mental status or the influence of medication. As previously identified, there were no acute respiratory events associated with tube obstruction that prompted a suctioning event in this study. Only two participants identified that the need to maintain patency and integrity of the artificial airway was considered in planning suctioning for their patients. However, as previously discussed, the nurses' verbalizations when they identified that they were considering routine suctioning, are replete with specific visual and aural cues supporting their

judgment. It did not appear that these two participants suctioned solely on the basis of maintaining endotracheal tube integrity. No nurse in this study appeared to associate a concern of aspiration of gastric secretions, radiologic changes consistent with retention of pulmonary secretions, or a deterioration of blood gas values with the need for suctioning, as suggested by the AARC guidelines. The absence of the AARC indicators in the participants' assessments may be due to the relatively small sample of patients, who were all infants, cared for by the participants.

Some cues used by nurses in this study have not been previously identified in the literature. For example, the practice guidelines and texts do not identify visual cues such as patient distress, patient coughing, or the quality of secretions (tenacity and colour) found in this study. Although changes in the patient's work of breathing is specified in the literature, the assessments that nurses made related to this indicator, such as increased respiratory rate, 'fighting' the ventilator, ventilator asynchrony, and breathing patterns are not described in the AARC (1993) practice guideline. This guideline identified that the assessment of airway resistance and lung compliance, which would be evident in ventilator flow and pressure graphics, should be considered an indicator for suctioning. Although the technology to measure these parameters with specific ventilator screens was not a part of the context of this practice environment, participants recognized changes in airway resistance and lung compliance through tactile assessments. It is unknown if nurses would have assessed those cues if the technology had been present in this practice environment.

Cues that are related to the context, such as the timing of nurses' scheduled breaks, the availability of nursing resources, or the availability of respiratory therapy personnel for two-person suctioning are not evident in the literature. As well, there is no discussion of the timing of suctioning in relation to nurses' judgments to cluster care in

order to give the patient recovery time. Nurses in this study identified that they considered the timing of suctioning in sequence with other patient interventions such as chest x-rays and extubation. These cues have not been previously discussed in the literature. It may be that previous research did not identify these cues because of methodological limitations. The current research, using think aloud data collection, has been able to uncover these cues.

In this current study, cue recognition was a process derived from cues that nurses recognize from perceptual awareness and from knowledge of this type of patient, this particular patient, and the practice environment. The findings that nurses made judgments to suction based on the recognition of groups of cues, rather than acting on the basis of one cue alone, and that the perceived cues are considered in relation to the nurse's knowledge, are congruent with the findings of Pyles and Stern (1983).

The finding that nurses attended to cues derived from knowledge of this type of patient and knowledge of this particular patient has been previously identified in critical care nursing research. Jacavone and Dostal (1992), in a study examining judgments that coronary care nurses make about cardiac pain, noted that subtle physiologic changes in the patient were important cues derived from an intense assessment of the patient's condition and noting of patient responses to interventions. For example, nurses noted changes in patient blood pressure and quality of cardiac chest pain in making the judgment about titrating vasopressor medication infusions. These authors reported that nurses identified a need for continual assessment of patient responses that required their maintaining a constant presence at the bedside when patients were at risk for rapid deterioration. In this study, nurses identified that knowing this particular patient's previous responses and expected findings were considered in making the judgment to suction. Participants identified the need to monitor the patient closely following the

suctioning procedure and to remain near the bedside in case immediate intervention was required based on knowing this patient's past responses to suctioning.

The finding that the perception of visual, auditory and tactile cues are integrated and influenced by the nurse's knowledge of the patient's responses, normal expectations of the patient's condition, and knowledge of the risks of endotracheal suctioning for this patient, supports the work of Benner et al. (1999). Benner and colleagues concluded that making qualitative distinctions is a crucial element in clinical judgment that is developed from experiential learning, knowing the patient, perceptual acuity, clinical knowledge, and theoretical knowledge. Qualitative distinctions are defined as the "judgments about qualities and changes in the patient that can only be made in the context of the situation" (p. 30). The elements of qualitative distinctions are apparent in ways that expert nurses made judgments about ETS in this current study.

This study found that perceptual awareness requires an intense involvement, on the part of the nurse, with the patient and the clinical situation. To assess, consider, and discriminate amongst multiple cues recognized in the patient situation nurses developed a connectedness to the patient that contributed to knowing this particular patient. Evidence that the processes of perceptual awareness and knowing are interrelated emerged when nurses verbalized how they looked for and recognized different cues to make judgments about care as they began to develop knowledge and a sense of this particular patient. This finding supports the premise of Stannard et al. 1996 that "intertwined with assessing the patient is getting a sense of how the patient responds to treatment" (p. 437).

Knowing the patient has been identified as a crucial element in nurses' judgment processes (Jenks, 1993; Jenny & Logan, 1992; Johnson & Ratner, 1997; Liaschenko, 1997; Liaschenko & Fisher, 1999; Radwin, 1995 a, b; Tanner, er al., 1993). Specific

cues that nurses draw from this domain of knowledge related to weaning the patient from the ventilator (Jenny & Logan, 1992) and managing cardiac pain (Stannard et al. 1996) have been identified. The new knowledge from this current study is the identification of specific cues related to knowing the patient that nurses use in making judgments to suction.

In this study, as nurses began to know this particular patient, the cues they relied upon became more patient specific. This finding supports the suggestion by Tanner et al. (1993) that "as the nurse knows the typical patterns of responses of the patient, certain aspects of the situation stand out as salient, others recede in importance." (p. 278). Nurses' thinking activities moved from the general rules and expectations to a more specific approach when the unique characteristics of the patient were learned. The influence on clinical judgments by nurses' knowledge of the particular patient in this study confirms the conclusions of Agan (1987), Benner et al. (1996), and Radwin (1996) who suggest that as the nurse increases her understanding of the patient through an involved approach, the nurse provides care that is increasingly individualized.

The study finding that nurses developed their knowledge of the patient over the shift, from one suctioning episode to the next, are congruent with previous findings that time spent with the patient is a factor that influences the nurse's knowledge of the patient (Benner et al., 1996; Jenny & Logan, 1992). Radwin (1996) concluded that 'knowing the patient requires the time to learn about the patient as a person and time constraints can inhibit the ability of nurses to know their patients" (p. 1144). In this study, nursing actions illustrated how learning about this patient over time was relevant to how each nurse individualized her nursing interventions related to a specific patient. The nurses' verbalizations included both temporal and contextual information that supports the premise that as the nurse spent time with the patient, she was able to recall specific past

experiences with that patient and make predictions about future responses with confidence.

Knowing this type of patient, this particular patient and this practice environment were forms of knowledge that nurses in this study used to make the judgment to suction. This finding is congruent with a framework of knowing the patient as put forward by Liaschenko and Fisher (1999). These authors proposed that nurses' knowledge of the patient is derived from four types of knowledge labeled: (a) case, (b) patient, (c) person, and (d) social knowledge. Case knowledge, defined as the knowledge of anatomy, physiology, and pathophysiology, is demonstrated in the participants' knowledge of the expected course for children following cardiac surgery, the potential risks of ETS, and the unique attributes of pediatric patients. Nurses used case knowledge- knowing this type of patient- to stabilize and to predict patient responses to suctioning. As well, nurses used case knowledge in sequencing and clustering suctioning with other nursing care activities. The findings support the conclusion of Liaschenko and Fisher that "for nurses, case knowledge serves as a code or cue that sets up expectations and actions that will be necessary" (p. 34).

The findings related to how participants described their knowing of the patient responses and knowing what procedures were anticipated for the patient, are congruent with the description of patient knowledge as proposed by Liaschenko and Fisher (1999). These authors suggested that patient knowledge included knowledge of how an individual becomes identified as a patient, knowledge of the individual's responses to treatment, knowledge of how to get things done for the individual, and knowledge of other health care providers caring for the individual. The aspects of knowing this particular patient identified in this study- previous responses, expected findings and forecasting planned procedures- are also consistent with the description of the typology

of knowing the patient as suggested by Tanner et al. (1993). These authors included knowledge of the patient's response to therapeutic measures, routines and habits, coping resources, and physical capacities as patient specific knowledge.

Person knowledge, knowing the patient as an individual with a unique self and with a personal biography (Liaschenko & Fisher, 1999), did not appear to be a part of participants' knowledge in this study. Nurses were not able to develop an awareness of personal knowing that would be derived from interpersonal communications as proposed by these authors. Verbal communication between the nurse and patients in this study was precluded by the age of the patient, which was less than eight months for all patients, and the treatment plan, which included continuous infusions of sedatives and analgesics.

Social knowledge, knowing the skills to be performed and the working patterns of the unit health care providers, linked case and patient knowledge in this framework. Within a working culture, nurses develop unit specific social knowledge that includes shared values, beliefs, expectations and assumptions that influence the judgments that nurses make. Liaschenko and Fisher (1999) suggested that social knowledge is essential for nurses to organize, coordinate, and use other human resources in caring for the patient. Social knowledge related to suctioning is evident in this study in the ways the nurses accessed human resources for two-person suctioning and in providing nursing care for patients of staff away from the bedside, as well as in how nurses coordinated pre extubation suctioning. Nurses' verbalizations about knowing this practice environment support the premise that social knowledge is a part of a nurse's clinical knowledge that enables the nurse to work as part of a team with shared goals. "In order for nurses to accomplish this work, they must know the formal rule of conduct such as who can talk to whom and under what conditions, what can be said, and what

are the risks and consequence of undertaking certain courses of actions" (p. 36). The ways that nurses integrated cues recognized in the patient, and in the context of the practice environment in this study, can be explained by the framework of nursing knowledge as proposed by Liaschenko and Fisher.

Nurses identified that they learned about their patient from sources that included (a) verbal report, (b) documentation, (c) information from colleagues who had previously cared for that child, and (d) experience with similar types of patients. This finding is congruent with nursing research about knowing the patient. Sources of knowing previously reported by Pyles and Stern (1983), Jenny & Logan (1992), Benner et al. (1996), Tanner et al. (1993) and MacLeod (1994) include information from the patient, from the family, from other expert nurses, and from experience with similar types of patients. Chase (1995) has suggested that verbal nurse-to-nurse communication during report conveys information differently from written notes and is an important source of patient knowledge. Similarly, participants identified that verbal report was a crucial first step in how they developed a sense of the patient that was instrumental in making individualized judgments about care activities.

Nurses perceived cues using the senses of seeing, hearing, and feeling in a process called perceptual awareness. In addition nurses used cues derived from knowledge of this type of patient, knowledge of this patient, and knowledge of the practice environment. The finding that the perception of cues preceded all suctioning episodes is congruent with the decision making frameworks of the information processing theory (Newell & Simon, 1972), and the hypothetico deductive model (Elstein et al., 1978). Nurses attended to a perceived stimulus as the initial step in beginning to make the judgment to suction. However, the finding that cues recognized from knowing- knowledge of this type of patient, this patient and the practice environment- is not

completely explained by these two models. As well, the finding of this study that cue recognition is a dynamic, iterative, and continuous process that is evident before, during, and after the nurse makes the judgment to suction is not predicted by these two models.

It is apparent that the cues used by nurses in this study to make the judgment to suction exceed the lists of indicators previously published. The qualitative discriminations and contextual cues identified have not been previously discussed in the pediatric critical care nursing literature examining endotracheal suctioning. The following section will discuss the findings of the study in relation to the second research question.

5.2. Research Question 2

How do expert critical care nurses utilize these cues in determining frequency and timing of ETS?

The participants of this study verbalized cues that contributed to a multidimensional assessment of patient need for suctioning. It is evident that nurses did not consider patient signs in isolation of their knowledge of the patient or of the practice environment in making the judgment to suction. As well, it is evident that judgments about timing and frequency are not based on predetermined schedules or nursing routines. Nurses based the judgment to suction not only on the cues recognized, but also on a process that has been named weighing the evidence. Weighing the evidence emerged as a process comprised of cognitive activities that include determining the significance of perceptions and corroborating impressions. The processes of cue recognition and weighing the evidence are dynamic and ongoing throughout the judgment and performance of suctioning. It is proposed that a process, named cue utilization, represents the interrelationship of the two processes of cue recognition and weighing the evidence, that forms the foundation for the nurse's judgment to suction. The proposal that experts do not implement a stepwise process of assessment, planning, implementing, and evaluating in making judgments about suctioning is

supported by the previously discussed conclusions of Brykczynski (1989), Corcoran (1986a,b), Einhorn (2000), Fowler (1997), and Holzemer (1986).

The finding that nurses considered cues in clusters, or groups, to determine the significance of the cue, and to corroborate impressions prior to suctioning, is not evident in the clinical practice guidelines or nursing texts related to ETS. The AARC practice guidelines (1993) and unit written procedure imply that any one of the criteria is indicative of the need for suctioning. However, the expert nurses in this study demonstrated that clinical decisions are based on a constellation of cues that was grouped together and considered relevant to the patient condition. This finding is congruent with the activity of coalescing of cues into clusters or chunks prior to hypothesis activation as proposed by the diagnostic reasoning process (Carnevali, 1984). Nurses considered a constellation of cues in a process that is also similar to pattern recognition based on tacit, or practical knowledge, as proposed by Tanner, et al. (1993). The tacit knowledge specific to experts' judgments to suction has not been reported previously.

The ongoing processes of cue utilization- cue recognition and weighing the evidence- explain how nurses use cues in determining the timing and method of performing ETS. The study finding that the seeing, thinking, and doing of suctioning are interrelated is consistent with the notion of 'knowing-in-action' as proposed by Schon (1983). Schon described 'knowing-in-action- as a dynamic continuous activity consisting of awareness, appreciation, and adjustment that is characteristic of the practice of expert nurses. This study supports the conclusion of Schon that thinking and doing are not separate entities in practice. The finding of the interrelationship of the seeing, thinking and doing in making judgments about suctioning also confirms MacLeod's (1994) research. In an interpretive study of British ward sisters, MacLeod identified three

processes that characterized the caring practices of the participants: noticing, understanding and acting. These processes were "inextricably intertwined in a non-linear, non-sequential process" (p. 364).

Nurse researchers have noted that clinical judgments, as demonstrated by expert nurses, are based on a form of intuition, in which a consideration of a pattern of cues seems to generate outcomes without conscious awareness of the process (Benner et al., 1996; Easen & Wilcockson, 1996; Fonteyn, 1998). The term intuition appears to have been used to explain expert nurses' use of unseen aspects of clinical knowledge that although known by the nurse, can be described only vaguely. "While they may describe recognition of particular responses and patterns, all that they know about the patient, and how they notice subtle changes and interpret responses, remains largely ineffable" (Tanner et al., 1993, p. 279). Similarly, Copnell and Fergusson (1995), in examining the practices of expert nurses in making the judgment to suction, have suggested that experts conduct their assessments so rapidly and routinely that they are unaware of their thought processes and therefore cannot describe them. In contrast, the verbalizations of this study's participants are replete with the identification of patterns of cues that are considered in making the judgment to suction. This study demonstrates that if the method of the research asks nurses to think aloud while making judgments, clinical judgment research can identify what cues are perceived, what nurses know about a patient, and how cues are considered.

The finding that weighing the evidence is a process of using cues derived from determining the significance of cues and corroborating impressions is supported by previous nursing judgment research. For example, nurses in this study, examined the significance of a cue by considering both the fit of that cue with other cues and assigning a relative importance of that cue to the clinical situation. Greenwood et al. (2000)

suggested that nursing is "not typified by the serial presentation of salient and non-salient clinical cues: rather it is typified by the simultaneous presentation of multiple salient cues and non-salient clinical and non-clinical cues" (p. 433). In addition, these authors concluded that the relative importance of cues would be a function of the nurse's definition of the situation in which the nurse finds her/himself. However, this specific finding has not been previously reported in the literature on suctioning.

Peden-McAlpine (2000) conducted a phenomenological study of fifteen expert critical care nurses and concluded that nurses use two types of information- universal and particular- in the unconscious activity of early recognition of patient problems. Universal information is abstract information, known to be true in most situations, that provides a basis for nurse's clinical assessments. Particular information is practical information that is relevant only to the context of each unique patient. Peden-McAlpine concluded that nurses identified situations in which ongoing and continuous thinking about both universal and particular information contributed to a development of a sense of the whole picture. Peden-McAlpine concluded that the assimilation of information, both universal and particular, is a continuous process over time. In addition, she suggested that as new information is continuously acquired, the nurse's understanding of the situation is changed. When changes of understanding signaled a discrepancy between what the nurse noted, and what she had expected to note, nurses searched for "appropriate missing or interrelating information that was needed to see or make sense of the evolving 'whole' of situational understanding" (p. 204). The cognitive processes identified by Peden-McAlpine are congruent with the activities of corroborating impressions that nurses, in this current study, did when cues they noted did not immediately fit with their expectations. As well, the finding of this study that cue recognition and weighing the evidence are dynamically interrelated and are present

before, during, and after the skilled performance of suctioning is supported by Peden-McAlpine's conclusions.

In two linked opinion papers exploring decision making in nursing, Buckingham and Adams (2000a, b) have proposed a psychological classification model as a framework, integrating research evidence from multiple disciplines, for interpreting all types of clinical decisions. This model accounts for the cognitive process of weighing the evidence that emerged from the current study. "Having identified the patient's relevant cues, measured them and generated a suitable internal (psychological) value for them, the time has come to assess their combined influences. This is the classification process itself whereby the clinician integrates multiple cues to generate a single likelihood judgment for each output class" (p. 986). According to Buckingham and Adams' model "deciding which attributes (cues) are most relevant to particular decision domains is one of the most important tasks in clinical decision making" (p. 985). Furthermore these authors concluded that nurses make a transformation of physical data and patient cues into a cognitive representation of the value of those cues. The finding that expert nurses in this study determined the significance of cues, as part of weighing the evidence, is congruent with the classification model as outlined by Buckingham and Adams (2000a).

The findings that assessing the relative importance of cues and creating a fit of cues as part of determining the significance of perceptions contributed to the process of weighing the evidence support the conclusions of Fonteyn and Fisher (1998) in the Thinking in Practice Study. These researchers identified twelve thinking strategies in nurses' verbalizations about situations they had encountered in direct practice. Judging a value, one of these thinking strategies, is defined as "forming an opinion or evaluation about worth in terms of usefulness, significance, or importance" (p. 82) and is congruent with this study's finding of determining the significance.

The findings of this study related to the cues used to determine the timing of endotracheal suctioning have not been previously reported. Thus, this study presents new knowledge that contributes to the understanding of how expert nurses make judgments about suctioning critically ill children. In addition, the findings related to cue utilization, cue recognition, and weighing the evidence are congruent with previously reported work about the process of clinical judgment in other nursing situations. In the following section, the findings about skilled performance of suctioning will be discussed in relation to the literature.

5.3. Skilled Performance of Suctioning

As congruent with other interpretive research (e.g. Benner et al. 1996), this study has generated findings that have gone beyond the original purpose of the investigation. It is clear that the quality and quantity of participants' verbalizations and researcher's observations collected in the study have uncovered specific judgments that nurses make about how to perform the skill of suctioning. The research investigation was not constrained by a priori or preconceived investigation tools that may have limited the scope of the data collected. This study has identified not only how nurses use cues to determine the frequency and timing of suctioning, but also how nurses used cues to determine how to perform the procedure of suctioning. Nurses performed the procedure in ways that protected the patient from the negative consequences of suctioning. This study found six nursing strategies: (a) protecting the ETT stability, (b) preventing hypoxemia, (c) reducing distress, (d) accessing human resources, (e) promoting secretions clearance, and (f) minimizing the number of suctioning passes.

These findings of this study are congruent with the suggestion of Bjork and Kirkevold (2000) that a well-performed nursing skill demonstrates more than manual precision and dexterity. These authors contend that effective practical skill performance

is characterized by complex "muscular activity, use of a specific knowledge repertoire, reflection, decision and thoughtful consideration" (p.629). They suggested a five-component model of practical skill performance in nursing that is represented by layers in a circle surrounding a core component. The core component of the model- substance and sequence- represents the motor and verbal behaviours of the skill. The final component of the model is called caring conduct, which relates to how the nurse creates an atmosphere that is respectful, accepting and encouraging. Layers depicting accuracy (exactness of movements), fluency (smoothness and ease of movements), and integration (timing of the skill in relation to others) lie between the components of substance and /sequence and caring conduct. "Skills are shaped by nurses' intentions, formed on the basis of factual knowledge and personal knowledge of the patient. Skills are also shaped by ethical, practical and theoretical nursing knowledge that directs us in helping human beings sustain and promote activities of daily living" (p. 621). Findings from this current research suggest that the performance of the skill of suctioning is focused on protecting the patient from negative consequences of suctioning. Expert nurses performed the skill in ways that are congruent with the findings of these authors. For example, nurses in this study logically ordered and sequenced suctioning with other care activities; choreographed the preparation of equipment and movement of their hands to maintain ETT stability while suctioning; and demonstrated caring and concern to the patient in their acknowledgements of the patient's distress, and use of soothing and calming words. As well, nurses demonstrated the practical skill performance model components of accuracy, fluency, and integration in the ways they suctioned critically ill children.

Clinical procedure manuals describe the step-by-step technique to suction endotracheal tubes (AARC, 1993; Henneman et al., 1999). However, these guidelines

do not take into account the variable contexts of the situation or of the patient that influence the ways in which nurses perform the procedure. Procedure guides do not appear to consider that skill performance is shaped not only by unit or hospital policy, but also by nurses' knowledge and nurses' intentions. Mancinelli-Van Atta and Beck (1992) recommended the following practice guidelines derived from an extensive review of the literature evaluating the effectiveness of various endotracheal suction protocols: (a) hypoxemia related to ETS should be prevented, (b) alterations in hemodynamic status should be minimized, (c) frequency of ETS should be minimized, (d) secretion removal should be maximized, and (e) patient distress should be minimized. However the way that nurses continually recognize and consider cues in judging the best way to implement these guidelines is not addressed in their literature review. It is relevant to note that the practice directives of Mancinelli-Van Atta and Beck (1992) are congruent with the ways in which nurses performed the skill of suctioning in this study. For example, nurses performed manual ventilation with 100% oxygen prior to suctioning to prevent hypoxemia; administered analgesics just prior to suctioning to minimize increases in pulmonary artery pressures; did not suction needlessly; and reduced patient distress with the administration of pharmacologic agents.

Although the literature has identified that the number of suction passes should be limited to reduce the risk to trauma (Mancinelli-Van Atta & Beck, 1992; Wood, 1995a), the question remains as to how many is just enough. Glass and Gap (1995), recommended limiting the number of passes to that absolutely required for secretion clearance based on a study describing the extent, prevalence, and distribution of narrowing of ETT related to the build up of secretions. An important finding of the Glass and Gap study is that the duration of intubation, but not endotracheal tube size or amount of secretions, was associated with the degree of ETT narrowing. This finding is

contrary to the opinions of participants of this study who identified that the size of the ETT in caring for pediatric patients was a factor that they considered in determining the timing of suctioning. In this study participants identified that they considered visual, auditory, and tactile cues but did not rely on predetermined guidelines to determine how many times to insert the suction catheter.

Greenwood et al., (2000) proposed that decisions considered stressful for experienced and inexperienced nurses to make, because of indeterminate or vague criteria and the potential for significant negative patient consequences, resulted in a routinization of nursing care. These authors suggested that nurses may resort to performing nursing care on a predetermined regular schedule such as 'every 2 hours', in order to "relieve the nurse of responsibility for clinical decision making with respect to critical aspects of care" (Greenwood et al. 2000, p. 1112). As the procedure of suctioning does have important negative patient consequences and the indications for the procedure vary with patients and context, it may be considered potentially stressful for novice and experienced nurses. However, a reliance on routines to direct nursing judgments related to the timing for, or the method of, suctioning was not a finding of this study. As well, the value that nurses' placed on their autonomy, responsibility, and accountability refutes the conclusion of Greenwood et al. that experienced nurses "resort to routinized nursing practices precisely to protect themselves from the risks associated with individualized clinical decisions" (p. 1107).

The study revealed that expert nurses were involved with the patient in ways that influenced the cues they perceived, their knowledge about the patient, and their consideration of cues in making not only the judgments to suction but also the judgments of how to suction. This study confirms the findings of Hanneman (1996) who concluded that a connection between the nurse and patient developed from the nurse's involved

and engaged approach to the patient. Hanneman suggested that being involved with the patient facilitates the provision of individualized and timely nursing care by expert nurses. Nurses in this current study demonstrated a way of 'being with the patient' that enabled them to know when to intervene, when it was safe to leave the bedside, and how to prevent potential complications. This finding is congruent with Hanneman's proposal that expert practice is characterized by the ways that expert nurses establish a presence with the patient and perform focused assessments of the patient situation. Participants of this study demonstrated nursing interventions that were determined on patient need, not on routine schedules or guidelines; that were individualized to the context of the patient and the situation in the unit; and that demonstrated the shared scope of practice between respiratory therapists and registered nurses. This finding confirms Hanneman's second proposal that expert practice is characterized by practice independence evident in decisive action and outcome orientation.

The absence of significant negative patient outcomes related to ETS attests to the skills of the expert nurses in this study. This finding confirms the proposal of Hanneman (1996) that expert critical care nurses' practices are characterized by early and aggressive interventions that "prevent patient complications, provide early detection and reversal of complications" (p. 333). Similarly, Benner et al. (1999) concluded that the role of safety work and protecting the patient is a crucial facet of expert nursing practice. The finding of this study that nurses' maintained a level of visual and auditory surveillance to promote early detection of patient problems supports the conclusions of Tanner et al. (1993). These authors concluded that expert practice is demonstrated in the nurse's "commitment to be vigilant in ensuring that adequate care is given, that early warning of patient change are attended to, [and] that medical therapies are given with the understanding of the particular patient's responses" (p. 278).

In summary, the specific ways that nurses used cues in order to protect the critically ill child from the negative consequences of suctioning have yet to be reported in the nursing literature. The process of cue utilization, which includes cue recognition and weighing the evidence, is the foundation upon which nurses base the judgment to suction the patient. Once the judgment to suction is made, the process of cue utilization is again employed as nurses make judgments about the ways to skillfully perform the procedure.

This study of nurses in direct clinical practice has described a dynamic and iterative cognitive process that is the foundation for the judgment to suction critically ill children. It is important to consider the appropriateness of the research design, methods of data collection, sample, and setting in order to appraise the methodological rigor of this study. In the following section the study strengths and limitations are presented.

5.4. Research Method: Strengths

The naturalistic and interpretive design of this study was appropriate in eliciting a real time image of expert nursing practice in making judgments to suctioning critically ill children. The premise that explorations of the phenomena of clinical judgment and knowing a patient mandate qualitative research methods has been supported by Holzworth and Wills (1999), Putzier et al., (1985), Tanner et al., (1993, 1994), and Van den Berg (1996). Copnell and Fergusson (1995) suggested that retrospective verbalization in an interview at the bedside did not elicit the full scope of the nurses thoughts about suctioning their patients. As well, these authors identified that a limitation of retrospective verbalization in their study was that nurses might not have been able to recollect all of their assessments that they made in deciding to suction, when interviewed after the fact.

Fundamental to the research design of this study is the assumption that both concurrent and retrospective verbalizations are considered effective methods of eliciting the cognitive processes involved in clinical judgment (Corcoran, Narayan, & Moreland, 1988, Fisher & Fonteyn, 1995; Henry, LeBreck, & Holzemer, 1989; Spence et al. 1999). It is evident that the concurrent verbalizations, collected through think aloud activities during direct clinical practice, did not inhibit the practices or behaviours of the participants. This finding supports the suggestion of Ericsson and Simon (1984) that verbalization of one's thoughts will not interfere with ongoing cognitive processes, nor will it affect the speed of task performance, unless the investigator probes cue verbalizations. The researcher did not interrupt or question the participants during the think aloud sessions. The audiotaped verbalizations are evidence that the nurses were thinking aloud and not talking aloud to the researcher during the data collection. The concurrent verbalizations do represent the thinking activities of the participants in direct clinical practice. This finding is congruent with Spence et al. (1999) who concluded that think aloud "accesses both the information that is acquired from the clinical environment (e.g. clinical cues) and knowledge gained previously which is stored in the long-term memory" (p. 28). The finding that the think aloud method of data collection was both safe and not disruptive to nurses, patients, or families supports the findings of a study by Fonteyn and Fisher (1995) of neurosurgical nurses thinking aloud during direct patient care. As well, the quality of the data collected using the think aloud method and the cognitive activities that emerged in the data analysis, confirm the value of examining clinical judgment in a real time, in vivo, investigation.

Another strength of the research method is the use of multiple data collection methods. The use of participant observation with concurrent and retrospective verbalizations has yielded a rich data set to be analyzed. Field notes and transcripts

about specific suctioning events were reviewed to note if there were discrepancies between what participants verbalized and what the researcher noted. The congruency between the notes and transcripts provides evidence that the data collection methods did capture a real time picture of nurses' words and actions in direct clinical practice.

Specific strategies to ensure the rigor of this study have been implemented. The number of verbatim transcripts and thick descriptions of the context presented support the credibility of the study. The research method included peer debriefings with expert researchers and member checks with participants to establish credibility and transferability of the analyses. To ensure dependability, an audit trail has been maintained.

5.5. Research Method: Limitations

The design of a qualitative study incorporating participant observations, retrospective and concurrent verbalizations that required the close attendance of the researcher in the study setting could not control for potential bias associated with researcher presence. It is not known if the participants did behave or speak differently due to the researcher's presence. However, the number of times that nurses initiated the audiotaping without the researcher prompting, the length of time the nurses would think aloud, and the nature of the nurses conversations with the patient while thinking aloud suggest that the participants were not greatly influenced by the researcher presence. The study itself may have influenced the findings such that nurse participants may have verbalized comments and thoughts that do not necessarily reflect daily practices and judgments.

Following the initial analysis of the transcripts of the interviews and of the think aloud sessions, it became apparent that there were some small discrepancies between the nurses' words in these two verbalizations. There are several potential explanations

for this finding. One explanation is the concepts of selective remembering and forgetting as proposed by Kassirer, Kuipers, and Gorry (1982). It may be that these expert nurses use multiple and complex cognitive processes in completing involved nursing interventions and that once the intervention is completed these thinking process are not readily accessible in immediate memory. Several of the participants did not remember what they thought aloud when asked about their words in the interviews, even though the interviews occurred on an average of 15 minutes following the suctioning episode. The researcher used the focused observation guide to cue the nurses to their comments and interactions with patients and other health care providers that the researcher had heard and seen. However, it is interesting to note that even with this prompting by the researcher, some nurses did not share the same cues, information, or judgments in the retrospective verbalizations. This difference between the concurrently and retrospectively collected data could also be explained by the premise of intuition, as a component of expert nursing practice, as proposed by Benner et al. (1999). Intuition, as a "form of understanding without conscious deliberation, awareness or articulation" (p. 568) may be a process that is a part of cue recognition, weighing the evidence, and making a judgment based on that evidence that expert nurses do not reveal in retrospective verbalizations. It may also be that the think aloud method brought these thoughts into the nurse's consciousness enabling the identification of the process of cue utilization in making judgments about endotracheal suctioning.

The findings of this study present the perspective of seven nurses from one quaternary pediatric critical care unit. As such, the findings cannot be considered as representative of the population of pediatric critical care nurses. However, the goal of this qualitative research was not to generate findings that can be generalized across the population, but rather to describe the perspective of one group from the population.

Another limitation of the study is the sample of patients for whom the nurse participants cared. All patients were less than eight months of age, intubated with small endotracheal tubes (3.5 and 4.0 mm tubes), and all but one patient was admitted to the CCU with a diagnosis of congenital heart defect. It may be that the cues recognized for this population of patients are unique and therefore the findings may not be generalizable to other patient populations.

The level of the researcher's expertise in interviewing and observing may have presented a limitation to the study. Another researcher may have seen, heard and interpreted the nurses' words and actions in different ways.

5.6. Recommendations

In the following section, recommendations to enhance nursing practice, promote nursing education and develop further research will be proposed.

a. Practice

It is recommended that nursing practice environments continue to support strategies that enable nurses to develop a sense of the patient that participants identified as important. Ways of knowing the patient that have been identified as important in this study, such as verbal face to face report between nurses and consistency in patient assignments, need to be incorporated into decisions about unit nursing practices. Nursing report sets the stage for learning about a patient and is an opportunity for nurses to share their sense of the patient with each other. As Chase (1995) has suggested, face-to-face report is an opportunity for the nurse going off shift to leave her sense of the patient with the nurse coming on shift, so that the first cue recognized can be considered within a holistic appraisal of the patient. Nurse/patient ratios need to take into account the time nurses need to appraise the unique attributes of that patient and to

develop a sense of how this patient will respond to nursing interventions. "When nurses work in situations where it is impossible to know their patients sufficiently to see changing relevance, recognize early warning, or protect patients from violation of patient/family concerns or threats to their vulnerability, then the very ground for safe and astute nursing care is undermined" (Tanner et al., 1993, p. 279).

It is recommended that critical care nursing leaders do not consider assigning skills such as ETS to non-regulated health care professionals. The complexity of the process of cue utilization in making the judgment to suction and in determining the method of performing that procedure mandate the knowledge and skills of a registered nurse. This recommendation is supported by the conclusions of Buckingham and Adams (2000a) who proposed, "Much nursing work is believed to be hidden from objective lay scrutiny, because of the subtle interpersonal nature of nursing interventions. Blindness to these aspects has led to nursing viewed as a series of tasks that can easily be delegated to less qualified personnel" (p. 982).

It is recommended that critical care units examine and support a collaborative working relationship between respiratory therapists and nurses. Nurses in the study were seen to use information and seek the opinions and assistance of respiratory therapists as a way of corroborating impressions and judging the best way to suction a specific patient. The requirements for care of critically ill children mandate collaborative practice by a variety of professionals as has been suggested by Fuhrman (1998).

It is recommended that future clinical practice guidelines consider the evidence from more than quantitative empirical studies. It is apparent in this study that there are discrepancies between current published practice guidelines and the ways in which expert nurses arrived at the judgments to suction and the methods of suctioning. Nursing practice guidelines must value and use the clinical knowledge of experts in making

recommendations for practice. This is not to say that nursing should not pursue empirical studies related to determining the optimal ways to judge the need for, or method of performing suctioning, but rather to recommend an inclusive consideration of evidence from a variety of approaches including the practical knowledge of expert practitioners. Clearly, the results of this study demonstrate an incongruity between guidelines and practice. Further work to address the knowledge transfer from research to practice and from practice to research is required.

b. Education

The findings from this study have implications to the orientation and continuing education of pediatric critical care nurses. It is recommended that expert clinical nurses be directly involved in the training and education of novice critical care nurses. Nurses unfamiliar with the care of the ventilated critically ill child can benefit from learning the processes of cue recognition and weighing the evidence related to ETS in direct practice as modeled by expert nurses.

The complexity of the skilled performance of suctioning suggests that expert performance of this skill cannot be learned in a laboratory setting. Therefore, it is recommended that student nurses learn how to make judgments about suctioning from an expert practitioner and educator during bedside clinical teaching. In addition, the use of unit clinical experts in teaching new critical care nursing staff at the bedside has been proposed as a strategy to enhance the development of clinical judgment skills essential to the skilled performance of procedures (Hanneman, 1996; Rashotte & Thomas, 2002).

Information or education alone is obviously not enough to change the behavior of clinicians (Ahrens, 1999). Simmons (1997) suggests that a policy based on patient need for the procedure, is insufficient unless accompanied by clear guidelines and staff education that assist nurses in learning how to make the judgment of patient need. If

complication rates, related to insufficient suctioning as well as too frequent suction, can be related to the inability of nurses to identify the need for ETS, then, as suggested by Simmons, clinical nursing education must address this gap. The findings of this study suggest that it is likely insufficient to outline the practice guidelines and unit procedures as the sole indications for suctioning in helping novice practitioners develop skill in making complex judgments related to suctioning critically ill infants. Therefore, it is recommended that critical care nurse educators utilize teaching-learning strategies such as case discussion in which nurses can identify the specific cues and judgments that they made. It is recommended that clinical debriefing sessions be incorporated into continuing education activities to allow nurses opportunities to discuss clinical problems as a way of uncovering the thinking behind specific nursing actions. It is recommended that educators promote the use of reflective learning by creating opportunities for nurses to think aloud while providing nursing care. The educator could identify the thinking processes that the nurse verbalized during these sessions, as a strategy to uncover the cues that the nurse recognized, to identify alternative cues that may not have been noticed and to support or challenge the ways that the nurse used those cues in making the judgment to suction.

c. Research

It is recommended that the judgments of nurses in performing ETS be examined with further quantitative and qualitative investigations. Ongoing examination of this phenomenon is needed to continue to develop a substantive understanding of this aspect of pediatric critical care. This study found that aspects of the context of the practice situation including the nature of nursing practices, the patients, and technology influenced judgments about endotracheal suctioning. Therefore, it is recommended that

the study be replicated in another pediatric critical care unit to verify these contextual aspects.

It is also recommended to examine the judgment process of nurses not practicing at an expert level, using a similar research design. For example, it is unknown if novice pediatric critical care nurses would recognize and consider cues in the same way as the expert nurses did in this study. Further questions to be explored include the following: is there a similar or different aspect of weighing the evidence within the judgment process of beginning critical care nurses; is the way in which less expert nurses perform the skill of suctioning interrelated to the processes of cue recognition and weighing the evidence as suggested by the findings of the expert nurses in this study; is the process of cue utilization in making the judgment to suction exclusively found in the practice of expert as opposed to non-expert nurses; and do expert nurses have a refined ability to weigh the evidence and implement suctioning procedures that are based on a sense of the patient that is derived from an involvement and connectedness with the patient?

It is recommended that studies using the think aloud method be conducted in order to continue to develop knowledge about the judgment process of nurses in direct practice. This study had revealed that the think aloud method was feasible and effective in collecting data about nurses' judgment processes while providing care to the patient.

As the nurses in this study said that their judgments about ETS were influenced by the size of the ETT and the perception of an associated risk of ETT blockage, it is recommended that this study be replicated with nurses caring for adult critically ill patients. It is unknown if a concern about ETT blockage is a cue that nurses consider in caring for patients in whom endotracheal tubes are not as small in diameter as was the situation in this study.

As the study findings support the premise that the thinking aloud method uncovers the thought processes of expert nurses, it is recommended that further studies examining nursing judgments related to other clinical procedures be conducted using this method of data collection. It is imperative that the ways in which expert nurses protect the patient by assessing for and preventing complications be not only valued, but also further described. Studies that add to the understanding of early recognition of patient problems will continue to legitimize the nature of clinical knowledge that is an essential component of expert nursing practice.

The ways that nurses responded to alarms, noted data displayed on monitors, and considered the measurements of tidal volume and peak inspiratory pressures displayed on the ventilator controls, are examples of how nurses in this study used technology to address the needs of the patient and to prevent negative complications. Little (1999) has suggested that technological competence is one of many components of proficient critical care nursing practice. However, little is known about how nurses directly use the technology in a critical care unit to make clinical judgments. Therefore, it is recommended nurse researchers examine how nurses use technology and interpret the data provided by the technology. For example, a study that examines how nurses use data from ventilator graphics and visual displays of measured lung compliance and airway resistance, would be useful in determining the efficacy of this technology in assisting nurses in making judgments related to the timing and method of endotracheal suctioning.

5.7. Role of the Clinical Nurse Specialist in Pediatric Critical Care

This section examines the implications of the study findings with the four major roles of the Clinical Nurse Specialist (CNS)- direct care provider, educator, consultant and researcher (Hickey, Ouimette, & Venegoni, 2000). It has been proposed that

advanced nursing practice roles provide an opportunity to improve patient outcomes, promote collaborative practice, and enhance nursing practice (Dunn & Nicklin, 1995). To achieve the suggested outcomes, it is essential that the CNS develop leadership skills within each of the four subroles. For example, reflective practice skills that include critical self appraisal and independent learning, and communication skills that include negotiating and delegating, are required if the CNS is to have access to and the ability to influence institutional decision-makers. The following discussion presents the implications of the study to a CNS role designed to enhance nursing practice within a pediatric critical care unit.

a. Direct Care Provider Role

"Advanced nursing practice is first and foremost characterized by excellence in direct clinical practice" (Hamric, 2000, p. 61). The findings of this study suggest that developing knowledge about this particular patient was important in how nurses made judgments about care activities for the patient. Consequently, it is recommended that the CNS negotiate sufficient time for direct care activities with critically ill children to develop a sense of knowing this patient that cannot happen in brief sojourns to the bedside to assist colleagues (Brown, 2000). It is suggested that time at the bedside should be scheduled to facilitate the CNS assignment to patients in blocks of two or three shifts as the study findings indicated that nurses developed patient knowledge over time. The CNS must communicate the need for protected clinical practice time with unit nursing managers, as well as bedside nurses, through face-to-face communications and through the sharing of pertinent research that describes the purpose and outcomes of CNS direct practice.

It is recommended that the CNS consider active reflection during direct caring for ventilated critically ill children as one strategy to enhance his/her clinical judgment

process. "Nurses in advanced practice roles should examine their own process for making clinical judgments. Active reflection can be utilized, both during practice and in retrospect, to explore the decisions made"(Van den Berg, 1996, p. 98). Szaflarski (2000) has proposed that the expert's knowledge is comprehensive, organized to enable easy information storage and retrieval. As well, she has suggested that the ways in which experts organize and understand knowledge is more important than the amount of information that is stored in the memory. By noting the cues recognized and considered when performing ETS in practice, the CNS can develop an awareness of the nature of cue utilization in his/her own practice. As well, the CNS would be in a position to illustrate, through action and words, different approaches to determine the need for, and the method of, suctioning the critically ill child. "Although assessments and interventions tailored to each patient may be thought of as the art of nursing, it is perhaps more appropriate to recognize this phenomena as the essence of skilled clinical judgment" (Stannard et al., 1996, p. 440)

b. Educator Role

The CNS Educator role provides opportunities for teaching and learning activities with nursing staff, in the pediatric critical care unit and in other clinical units, nursing students, and other members of the health care team. In response to the findings of this study, it is recommended that the CNS pursue opportunities to work at the bedside to support nurses new to pediatric critical care nursing units. Clinical expertise, well developed assessment skills, perceptual acuity, and knowledge of the illness trajectory are strengths of the CNS that could be shared during bedside clinical teaching. Working with staff at the bedside, verbalizing the cues recognized, and articulating the process of weighing the evidence by think out loud are recommended strategies to make explicit the judgment process of experts. The CNS educator role provides opportunities for

novice pediatric critical care nurses to reflect on the practice of expert nurses, to notice and appreciate what cues the experts recognized when suctioning, to discuss the considerations of those cues, and to note how those cues were used in determining the method of suctioning. The CNS is situated to facilitate reflective practice skills in staff through face-to-face discussion and unit nursing rounds. The CNS as the clinical expert at the bedside can demonstrate the 'reflecting-in-action' skills that are part of making sense of the uncertain and unique clinical situation of critically ill infants and children.

c. Consultant Role

It is recommended that the CNS pursue and develop opportunities to inform others of the complexity of nursing judgments related to suctioning. These activities are important, as hospital environments consider alternative care providers in critical care settings. The consultant role provides an opportunity for the critical care CNS to share a pediatric critical care nursing perspectives with other health care providers. As well the CNS can share an understanding of the interrelated nature of cue recognition, weighing the evidence and skilled performance, when suctioning procedures in the CCU are developed or revised. External consultation with other agencies examining clinical judgment, such as the Hospital for Sick Children Clinical Nursing Judgment Taskforce (Hospital for Sick Children, 2001), provides opportunities for the CNS to contribute to the ongoing development of nursing knowledge of this phenomenon.

It is recommended that the CNS examine the unit environment to identify contextual factors that potentially influence the process of nursing judgment. In order to enhance nursing practice in the unit, the factors that support expertise in nursing judgments should be identified and enhanced. Sharing an assessment of the nature of clinical judgment in the practice environment with unit leaders and management is one

way that the CNS can influence the development of units in which nurses can practice expert judgment skills that make a difference to patient outcomes.

d. Researcher Role

It is recommended that the CNS participate in research activities such as collaborating on multidisciplinary research projects and committees examining clinical questions related to ETS or cue utilization with bedside nurses during nursing rounds and daily patient rounds. The researcher role of the CNS is integral to the enhancement of nursing practice in the CCU. Maintaining a presence within the CCU environment would enable the CNS to be attuned to the research questions staff identify (problem and knowledge focused); to promote research activities that are considered relevant by bedside clinicians and to stimulate staff nurse involvement in research projects (Prichard, Norville, Oakes, Gattuso, & Howard, 1994; Chulay 2001). It has been suggested that nursing personnel are more likely to participate in and implement research findings from studies initiated by an agency insider (Pettengill, Gillies, & Clark, 1994).

It is recommended that the CNS actively disseminate nursing research findings related to ETS to the unit staff. The application of research findings related to ETS was not widely demonstrated by study participants. Only one participant mentioned a consideration of research findings as a cue in determining the method of suctioning a patient in this study. The participant appeared to relate evidence that the instillation of saline should not be used during the suctioning procedure. Following a consideration that these findings did not fit with the present patient situation, she discounted the findings and made the judgment to use saline instillations for the patient.

> "I'm a great believer in using lots of saline. Um, I know in the literature right now it is very interesting to say that there's, you shouldn't be using saline. But I think that if you have got any secretions down there, if you really truly want to do a

> good suction, you need to get them all up and you always need saline." (Irene interview)

It is recommended that the CNS explore opportunities to discuss the application of research findings to ETS practices. It is also recommended that the CNS explore the nature of expert nurses' judgments to discount research findings in the clinical situation. The critical care CNS role is well situated to disseminate current research to bedside clinicians through ongoing continuing education and bedside clinical discussions about suctioning practices.

5.8. Conclusions

The nature of nursing judgment in clinical practice situations remains incompletely understood. It is known that nurses make complex judgments related to the endotracheal suctioning of critically ill children. However, the ways in which nurses determine the need for, and the method of performing suctioning is not well understood. This research study was conducted to describe the cues that expert pediatric critical care nurses use in making the judgment to suction and to describe how those cues are used in determining the timing of endotracheal suctioning.

A qualitative naturalistic study was conducted in a quaternary pediatric critical care unit in Central Canada. A purposive sample of seven expert pediatric critical care nurses participated in the study. Data were collected using three methods- participant observations (field notes), think aloud (concurrent verbalizations) and semi-structured interviews (retrospective verbalization)- as participants cared for ventilated critically ill children. The audiotapes and focused observation notes were transcribed for analysis.

Content analysis revealed that nurses noted and identified cues in a process of 'cue recognition' that is comprised of 'perceptual awareness' and 'knowing'. Nurses recognized visual, auditory, and tactile cues that contributed to the category of perceptual awareness. Nurses recognized cues that were derived from the nurse's knowledge of this type of patient, this particular patient, and this practice environment that contributed to the category of knowing. Nurses considered the recognized cues in a process named weighing the evidence. Weighing the evidence was comprised of two cognitive activities that have been named 'determining the significance' and 'corroborating impressions'. Cue recognition and weighing the evidence contributed to an overall process of cue utilization, which is the foundation for making judgments related to endotracheal suctioning. Nurses use the process of cue utilization to

determine the need to suction and to determine the method of suctioning the patient. Nurses suctioned patients using a process named 'skilled performance' that is focused on protecting the patient from the negative consequences of the suctioning procedure. Nurses were actively involved in cue recognition (sensing cues) and weighing the evidence (thinking about the cues) prior to, during, and after skilled performance (doing the procedure). The relationships between the processes of cue utilization and skilled performance were intertwined and interrelated.

The finding that nurses use a process of cue utilization in making judgments related to the need for, timing of, and method of, endotracheal suctioning has implications for the teaching of this skill, the development of practice guidelines and procedures, and the conduct of further research examining the complexity of other nursing clinical skills.

REFERENCES

Abrams, C., & Johnson, B. (1984). Endotracheal suctioning of the neonate: An informal procedural study. *Neonatal Network,* 3, 18-21.

Abu-Saad, H., & Hamers, J. (1997). Decision making and paediatric pain: A review. *Journal of Advanced Nursing, 26,* 946-952.

Ackerman, M. (1985). The use of bolus normal saline instillations in artificial airways: is it useful or necessary? *Heart and Lung, 14,* 505-506.

Ackerman, M., Ecklund, M., & Abu-Jumah, M. (1996). A review of normal saline instillation: Implications for practice. *Dimensions of Critical Care Nursing, 15,* 31-38.

Agan, D. (1987). Intuitive knowing as a dimension of nursing. *Advanced Nursing Science, 10,* 63-70.

Ahrens, T. (1999). Role of technology in achieving clinical and cost impact in acute and critical care. *Critical Care Nursing Clinics of North America, 11,* 1-5.

American Association for Respiratory Care (AARC). (1993). Clinical practice guidelines: Endotracheal suctioning of mechanically ventilated adults and children with artificial airways. *Respiratory Care, 38,* 500-504.

American Philosophical Association (APA). (1990). *Critical thinking: A statement of expert consensus for purposes of education assessment and instruction. The Delphi Report: Research findings and recommendations prepared for the committee on pre-college philosophy.* ERIC Document Reproduction Service No. ED 315-423.

American Thoracic Society. (2000). Care of the child with a tracheostomy: The official statement of the American Thoracic Society. *American Journal of Respiratory and Critical Care Medicine, 161,* 297-308.

Angrosino, M., & Mays de Perez, K. (2000). Rethinking observation: From method to context. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research.* (2nd. ed., pp. 673-702). Thousand Oaks, CA: Sage Publications.

Baumann, A., & Bourbonnais, F. (1982). Nursing decision making in critical care. *Journal of Advanced Nursing, 7,* 435-446.

Baumann, A., & Bourbonnais, F. (1983). When the chips are down: Decision making in a crisis situation. *Canadian Nurse, 79* (5), 23-25.

Baumann, A., & Bourbonnais, F. (1984). *Rapid decision making in crisis situations: A case study approach for nurses.* Toronto: McGraw-Hill Ryerson.

Baumann, A., & Deber, R. (1989). *Decision making and problem solving in nursing: An overview and analysis of relevant literature.* (Literature Review Monograph 3). Toronto: University of Toronto, Faculty of Nursing.

Baun, M. (1984). Physiologic determinants of a clinically successful method of endotracheal suction. *Western Journal of Nursing Research, 6,* 213-228.

Benner, P. (1983). Uncovering the knowledge embedded in clinical practice. *Image: The Journal of Nursing Scholarship, 15,* 36-41.

Benner, P. (1984). *From novice to expert: Excellence and power in clinical nursing Practice.* Menlo Park, CA: Addison-Wesley.

Benner, P., Hooper-Kyriakidis, P., & Stannard, D. (1999). *Clinical wisdom and interventions in critical care: A thinking in action approach.* Philadelphia: W. B. Saunders.

Benner, P., & Tanner, C. (1987). Clinical judgment: How expert nurses use intuition. *American Journal of Nursing, 87,* 23-31.

Benner, P., Tanner, C., & Chesla, C. (1992). From beginner to expert: Gaining a differentiated clinical world in critical care nursing. *Advances in Nursing Science, 14,* 13-28.

Benner, P., Tanner, C., & Chesla, C. (1996). *Expertise in nursing practice: Caring, clinical judgment, and ethics.* New York: Springer.

Benner, P., & Wrubel, J. (1982). Skilled clinical knowledge: The value of perceptual awareness. *Nurse Educator, 7* (3), 11-17.

Bjork, I., & Kirkevold, M. (2000). From simplicity to complexity: Developing a model of practical skill performance in nursing. *Journal of Clinical Nursing, 9,* 620-631.

Boothroyd, A., Murthy, B., Darbyshire, A., & Petros, A. (1996). Endotracheal suctioning causes right upper lobe collapse in intubated children. *Acta Paediatrics, 85,* 1422-1425.

Boyle, J. (1991). Field research: A collaborative model for practice and research. In J. Morse (Ed.), *Qualitative nursing research: A contemporary dialogue* (pp. 273-299). Thousand Oaks, CA: Sage Publications.

Brodsky, L., Naviwala, S., & Stanievich, J. (1987). A quantitative comparison of the early histopathological changes from tracheotomy and endotracheal intubation on the distal trachea in fetal lambs. *International Journal of Pediatric Otorhinolaryngology, 12,* 273-282.

Brodsky, L., Reidy, M., & Stanievich, J. (1987). The effects of suctioning techniques on the distal tracheal mucosa in intubated low birth weight infants *International Journal of Pediatric Otorhinolaryngology, 14,* 1-14.

Brooks, D., Anderson, C., Carter, M., Downes, L., Keenan, S., Kelsey, C., & Lacy, J. (2001). Clinical practice guidelines for suctioning the airway of the intubated and nonintubated patient. *Canadian Respiratory Journal, 8*, 163-181.

Brooks, D., Solway, S., Graham, I., Downes, L., & Carter, (1999). A survey of suctioning practices among physical therapists, respiratory therapists and nurses. *Canadian Respiratory Journal*, *6*, 513-520.

Brown, S. J. (2000). Direct clinical practice. In A. Hamric, J. Spross & C. Hanson *Advanced Nursing Practice: An Integrative Approach* (2nd. ed., pp. 137-182). Toronto: W. B. Saunders Company.

Brykczynski, K. (1989). An interpretive study describing the clinical judgment of nurse practitioners. *Scholarly Inquiry for Nursing Practice: An International Journal, 3*, 75-104.

Buckingham, C., & Adams, A. (2000a). Classifying clinical decision making: A unifying approach. *Journal of Advanced Nursing*, *32*, 981-989.

Buckingham, C., & Adams, A. (2000b). Classifying clinical decision making: Interpreting nursing intuition, heuristics and medical diagnosis. *Journal of Advanced Nursing*, *32,* 990-998.

Burnard, P. (1991). A method of analyzing interview transcripts in qualitative research. *Nurse Education Today, 11,* 461-466.

Carnevali, D. (1984). The diagnostic reasoning process. In D. Carnevali, P. Mitchell, N. Woods, C. Tanner (Eds.), *Diagnostic reasoning in nursing* (pp. 25-57). New York: J. B. Lippincott, Co.

Carper, B. (1978). Fundamental patterns of knowing in nursing. *Advances in Nursing Science, 1* (1), 13-23.

Chase, S. (1990). Clinical judgment by critical care nurses: An ethnographic study. *Dissertations Abstracts International*, 51-06 (B), 3170.

Chase, S. (1995). The social context of critical care clinical judgment. *Heart and Lung*, *24*, 154-162.

Chase, S. (1997). Charting critical thinking: Nursing judgment and patient outcomes. *Dimensions in Critical Care Nursing*, *16,* 102-111.

Chulay, M. (2001). Clinician involvement in critical care research. *Critical Care Clinics of North America*, *13*, 53-62.

Cioffi, J. (1997). Heuristics: Servants to intuition in clinical decision making. *Journal of Advanced Nursing*, *26*, 203-208.

Copnell, B., & Ferguson, D. (1995). Endotracheal suctioning: Time worn ritual or timely intervention. *American Journal of Critical Care, 4*, 100-105.

Corcoran, S. (1986a). Decision analysis: A step-by-step guide for making clinical decisions. *Nursing and Health Care, 7,* 149-154.

Corcoran, S. (1986b). Task complexity and nursing expertise as factors in decision making. *Nursing Research, 35,* 107-112.

Corcoran, S. (1986c). The planning by expert and novice nurses in cases of varying complexity. *Nursing in Research and Health, 9,* 155-162.

Corcoran, S., Narayan, S., & Moreland, H. (1988). 'Thinking Aloud' as a strategy to improve clinical decision making. *Heart and Lung, 17,* 463-468.

Crow, R., & Spicer, J. (1995). Categorization of the patient's medical condition: An analysis of nursing judgment. *International Journal of Nursing Studies, 32,* 413-422.

Crow, R., Chase, J., & Lamond, D. (1995). The cognitive component of nursing assessment: an analysis. *Journal of Advanced Nursing, 22,* 206-212.

Curley, M., & Moloney-Harmon, P. (2001). *Critical care nursing of infants and children* (2nd ed.). Toronto: W. B. Saunders Company.

De Carle, B. (1985). Tracheostomy Care. *Nursing Times,* October 2, 50-54.

dela Cruz, F. (1994). Clinical decision making styles of home healthcare nurses. *Image: Journal of Nursing Scholarship, 26,* 222-226.

Doubilet, P., & McNeil, B. (1985). Clinical decision making. *Medical Care,* 23, 648-662.

Dowie, J., & Elstein, A. (Eds.). (1988). *Professional Judgement: A reader in clinical decision making.* New York: Cambridge University Press.

Doyle, J., & Thomas, S. (2000). Capturing policy in hearing aid decisions by audiologists. In T. Connolly, H. Arkes & K. Hammond, (Eds.), *Judgment and Decision making: An Interdisciplinary Reader* (pp. 245-258). Cambridge: University Press.

Drew, J. H., Padoms, K., & Clabburn, S. L. (1984). Routine instillation of saline down the endotracheal tube in infants with hyaline membrane disease. *Australian Pediatric Journal, 20,* 257.

Dreyfus, H., & Dreyfus, S. (1986). *Mind over machine: The power of human intuition and expertise in the era of the computer.* New York: Free Press.

Dunn, K., & Nicklin, W. (1995). The status of advanced nursing roles in Canadian teaching hospitals. *Canadian Journal of Nursing Administration,* (Jan-Feb), 111-135.

Easen, P., & Wilcockson, J. (1996). Intuition and rational decision making in professional thinking: A false dichotomy? *Journal of Advanced Nursing, 24,* 667-673.

Eddy, D., & Clanton, C. (1982). The art of diagnosis: Solving the clinico-pathological exercise. *The New England Journal of Medicine*, 306, 1263-1268.

Einhorn, J. (2000). Expert judgment: Some necessary conditions and an example. In T. Connolly, H. Arkes & K. Hammond, (Eds.), *Judgment and decision making: An interdisciplinary reader* (pp. 324-335). Cambridge: University Press.

Elstein, A. S., Shulman, L. S., & Sprafka, S. A. (1978). *Medical problem solving: An analysis of clinical reasoning*. Cambridge, Massachusetts: Harvard University Press.

Ericsson, K., & Simon, H. (1984). *Protocol analysis: Verbal reports as data.* Cambridge: MIT Press.

Facione, N., & Facione, P. (1996). Externalizing the critical thinking in knowledge development and clinical judgment. *Nursing Outlook, 44,* 129-136.

Facione, N., Facione, P., & Sanchez, C. (1994). Critical thinking disposition as a measure of competent clinical judgment: The Development of the California Critical Thinking Disposition Inventory. *Journal of Nursing Education, 33,* 345-350.

Fisher, A., & Fonteyn, M. (1995). An exploration of an innovative methodological approach for examining nurses' heuristic use in clinical practice. *Journal of Scholarly Inquiry, 9,* 263-276.

Fonteyn, M. (1998). *Thinking Strategies for Nursing Practice.* New York: Lippincott.

Fonteyn, M., & Fisher, A. (1995). Use of think aloud method to study nurses' reasoning and decision making in clinical practice settings. *Journal of Neuroscience Nursing, 27,* 124-128.

Fowler, L. (1997). Clinical reasoning strategies used during care planning. *Clinical Nursing Research, 6,* 349-361.

Fuhrman, B. (1998). What is a Pediatric Intensivist? In B. Fuhrman and J. Zimmerman, *Pediatric Critical Care* (2nd ed., pp. 6-7). Toronto: Mosby.

Glass, C., & Grap, M. (1995). Ten steps for safer suctioning. *American Journal of Nursing, 95* (5), 51-53.

Gordon, J. (1995). Congruence between nurse educators and critical thinking experts on the conceptualization of critical thinking. *Dissertation Abstracts International.* 57-09(A), 3842.

Greenwood, J. (2000). Critical thinking and nursing scripts: A case for the development of both. *Journal of Advanced Nursing, 31,* 428-436.

Greenwood, J., Sullivan, J., Spence, K., & McDonald, M. (2000). Nursing scripts and the organizational influences on critical thinking: report of a study of neonatal nurses' clinical reasoning. *Journal of Advanced Nursing, 31,* 1106-1114.

Grossman, S., Campbell, C., & Riley, B. (1996). Assessment of clinical decision making ability of critical care nurses. *Dimensions of Critical Care Nursing, 15,* 272-279.

Hagler, D., & Traver, G. (1994). Endotracheal saline and suction catheters: Sources of lower airway contamination. *American Journal of Critical Care, 3,* 444-447.

Hamers, J., Abu-Saad, H., & Halfens, R. (1994). The diagnostic process and decision making in nursing: A literature review. *Journal of Professional Nursing, 10,* 154-163.

Hamm, R. (1988). Clinical intuition and clinical analysis: Expertise and the cognitive continuum. In J. Dowie and A. Elstein (Eds.), *Professional judgment: A reader in clinical decision making* (pp. 78-105). Cambridge: Cambridge University Press.

Hammond, K. R., Kelly, K., Schneider, R., & Vancini, M. (1967). Clinical inference in nursing: Revising judgments. *Nursing Research, 16,* 38-45.

Hamric, A. (2000). A definition of advanced nursing practice. In A. Hamric, J. Spross & C. Hanson. *Advanced nursing practice: An integrative approach* (2nd ed., pp. 53-73). Toronto: W. B. Saunders Company.

Hanneman, S. (1996). Advancing nursing practice with a unit-based clinical expert. *Image: Journal of Nursing Scholarship, 28,* 331-337.

Hansen, A., & Thomas, D. (1968a). A conceptualization of decision making: Its application to a study of role and situation related differences in priority decisions. *Nursing Research, 17,* 436-443.

Hansen, A., & Thomas, D. (1968b). Role group differences in judging the importance of advising medical care. *Nursing Research,* 17, 525-532.

Hazinski, M. (1992). *Nursing care of the critically ill child* (2nd ed.). Toronto: Mosby Year Book.

Henneman, E., Ellstrom, K., & St. John, R. (1999). Airway management. In M. Chulay & S. Burns, (Eds), *Protocols for practice: Care of the mechanically ventilated patient series.* Aliso Viejo, CA: American Association of Critical Care Nurses.

Henry, S. (1991). Effect of levels of patient acuity on clinical decision making of critical care nurses with varying levels of knowledge and experience. *Heart and Lung, 20,* 478-485.

Henry, S., LeBreck, D., & Holzemer, W. (1989). The effect of verbalization of cognitive processes on clinical decision making. *Research in Nursing and Health, 12,* 187-19.

Hickey, J., Ouimette, R., & Venegoni, S. (2000). *Advanced practice nursing: Changing roles and clinical applications* (2nd ed.). Philadelphia: Lippincott.

Hodge, D. (1991). Endotracheal suctioning and the infant: A nursing care protocol to decrease complications. *Neonatal Network, 9,* 7-15.

Holl, R. (1994). Characteristics of the registered nurse and professional beliefs and decision making. *Critical Care Nursing Quarterly, 17,* 60-66.

Holzemer, W. L. (1986). The structure of problem solving in simulations. *Nursing Research, 35,* 231-236.

Holzworth, R .J., & Wills, C. (1999). Nurses' judgment regarding seclusion and restraint of psychiatric patients: A social judgment analysis. *Research in Nursing and Health, 22,* 189-201.

Hospital for Sick Children (HSC). (1996). *Critical Care Unit: Procedure for Endotracheal Suctioning.*

Hospital for Sick Children (HSC). (2000a). *Jury Verdict and Recommendations from the L. Shore Inquest.* [On Line], Available: http://hscweb/news/LisaShore/recommendations.asp.

Hospital for Sick Children (HSC). (2000b). *Critical Care Unit: Annual Report.*

Hospital for Sick Children (HSC). (2001). *Report of the nursing clinical judgement task force.*

Howard, R. (1987). *Three faces of hermeneutics: An introduction to current theories of understanding.* Los Angeles: University of California Press.

Hutchison, S., & Webb, R. (1991). Teaching qualitative research: Perennial problems and possible solutions. In J. Morse (Ed.), *Qualitative Nursing Research: A Contemporary Dialogue* (pp. 301-321). Thousand Oaks, CA: Sage Publications.

Jacavone, J., & Dostal, M. (1992). A descriptive study of nursing judgment in the assessment and management of cardiac pain. *Advances in Nursing Science, 15,* 54-63.

Janis, I., & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice and commitment.* New York: The Free Press.

Jenkins, H. (1985). A research tool for measuring perceptions of clinical decision making. *Journal of Professional Nursing, 1,* 221-229.

Jenks, J. M. (1993). The pattern of personal knowing in nurse clinical decision making. *Journal of Nursing Education, 32,* 399-405.

Jenny, J., & Logan, J. (1992). Knowing the patient: One aspect of clinical knowledge. *Image: Journal of Nursing Scholarship, 24*, 254-258.

Jenny, J., & Logan, J. (1994). Promoting ventilator independence: A grounded theory perspective. *Dimensions of Critical Care Nursing, 18,* 29-37.

Johnson, J. L., & Ratner, P. A. (1997). The nature of knowledge used in nursing practice. In S. E. Thorne & V. E. Hayes (Eds.). *Nursing Praxis: Knowledge and Action* (pp. 3-22). Thousand Oaks, CA: Sage.

Johnson, A., & Sackett, R. (1998). Direct systematic observation of behavior. In H. R. Bernard (Ed.), *Handbook of methods in cultural anthropology* (pp. 301-331). London: Altimira Press.

Kassirer, J., Kuipers, B., & Gorry, G.A. (1982). Toward a theory of clinical expertise. *American Journal of Medicine, 73*, 251-259.

Kataoka-Yahiro, M., & Saylor, C. (1994). A critical thinking model for nursing judgment. *Journal of Nursing Education, 33*, 351-356.

Kelly, K. (1966). Clinical inference in nursing. *Nursing Research, 15*, 123-126.

Kleiber, C. (1986). Clinical implications of deep and shallow suctioning in neonatal patients. *Focus on Critical Care, 13*, 36-39.

Kleiber, C., Krutzfield, N., & Rose, E. (1988). Acute histological changes in the tracheo bronchial tree associated with different suction catheter insertion techniques. *Heart and Lung, 17,* 10-14.

Knox, A. (1993). Performing endotracheal suction on children: A literature review and implications for nursing. *Intensive and Critical Care Nursing, 9*, 48-54.

Kuipers, B., Moskowitz, A., & Kassirer, J. (1988). Critical decisions under uncertainty: Representation and Structure. *Cognitive Science, 12*, 177-210.

Liaschenko, J. (1997). Knowing the patient. In S. E. Thorne & V. E. Hayes (Eds.), *Nursing Praxis: Knowledge and Action* (pp. 23-37). Thousand Oaks, CA: Sage.

Liaschenko, J., & Fisher, A. (1999). Theorizing the knowledge that nurses use in the conduct of their work. *Scholarly Inquiry for Nursing Practice: An International Journal, 13*, 29-41.

Lincoln, Y., & Guba, E. (2000). Paradigmatic controversies, contradictions and emerging confluences. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (2nd. ed., pp. 163-188). Thousand Oaks, CA: Sage Publications.

Little, C. (1999). The meaning of learning in critical care nursing: a hermeneutic study. *Journal of Advanced Nursing, 30,* 697-703.

MacLeod, M. (1994). 'It's the little things that count': The hidden complexity of everyday clinical practice. *Journal of Clinical Nursing, 3,* 361-368.

Mancinelli-Van Atta, J., & Beck, S. (1992). Preventing hypoxemia and hemodynamic compromise related to endotracheal suctioning. *American Journal of Critical Care, 1,* 62-79.

Matteson, P., & Hawkins, J. (1990). Concept analysis of decision making. *Nursing Forum, 25 (2),* 4-10.

McLean, P. (2002). Liability trends in nursing. *Canadian Nurse, 98* (6), 32-43.

Miles, M., & Huberman, A. (1984). *Qualitative Data Analysis: A source book of new methods.* Thousand Oaks, CA: Sage Publications.

Miller, M., & Malcolm, N. (1990). Critical thinking in the nursing curriculum. *Nursing and Health Care, 11,* 67-73.

Morse, J. (1998). What's wrong with random selection? *Qualitative Health Research, 8,* 733-735.

Musil, C. M. (1999). Pilot study. In J. Fitzpatrick (Ed.). *Nursing Research Digest* (pp. 41-42). New York: Springer Publishing Company.

Newell, A., & Simon, H. (1972). *Human problem solving.* Englewood Cliffs, NJ: Prentice-Hall.

O'Neill, E., & Dluhy, N. (1997). A longitudinal framework for fostering critical thinking and diagnostic reasoning. *Journal of Advanced Nursing, 26,* 825-832.

Peden-McAlpine, C. (2000). Early recognition of patient problems: A hermeneutic journey into understanding expert thinking in nursing. *Scholarly Inquiry for Nursing Practice: An International Journal, 14,* 191-222.

Pettengill, M., Gillies, D., & Clark, C. (1994). Factors encouraging and discouraging the use of nursing research findings. *Image: The Journal of Nursing Scholarship, 26,* 143-147.

Powers, B., & Knapp, T. (1995). *A dictionary of nursing theory and research (*2nd. ed.). Thousand Oaks, CA: Sage Publications.

Prescott, P., Dennis, K., & Jacox, A. (1987). Clinical decision making of staff nurses. *Image: Journal of Nursing Scholarship, 19,* 56-62.

Prichard, L, Norville, R., Oakes, L, Gattuso, J., & Howard, V. (1994). The natural connection: The Clinical Nurse Specialist and bedside nursing research. *Clinical Nurse Specialist, 8,* 307-310.

Putzier, D., Padrick, K., Westfall, V., & Tanner, C. (1985). Diagnostic reasoning in critical care. *Heart and Lung, 14,* 430-437.

Pyles, S., & Stern, P. (1983). Discovery of nursing gestalt in critical care nursing: The importance of the gray gorilla syndrome. *Image: Journal of Nursing Scholarship, 15*, 51-57.

Radwin, L. E. (1995a). Knowing the patient: A process model for individualized interventions. *Nursing Research, 44*, 354-370.

Radwin, L. E. (1995b). Conceptualizations of decision making in nursing analytic models and "Knowing the Patient". *Nursing Diagnosis, 6,* 16-22.

Radwin, L. E. (1996). Knowing the patient: a review of research on an emerging concept. *Journal of Advanced Nursing, 23*, 1142-1146.

Rashotte, J., & Thomas, M. (2002). Incorporating educational theory into critical care orientation. *Journal of Continuing Nursing Education, 33,* 131-137.

Respiratory Therapy Society of Ontario (2002). *Guidance Centre Occupational Information Monograph.* Retrieved August 29, 2002, from http://www.rtso.org/monograph/asp

Rivera, R., & Tibbals, J. (1992). Complication of endotracheal intubation and mechanical ventilation in infants and children. *Critical Care Medicine, 20,* 193-199.

Rodgers, B., & Cowles, K. (1993). The qualitative research audit trail: A complex collection of documentation. *Research in Nursing and Health, 16*, 219-226.

Rubin, H., & Rubin, I. (1995). *Qualitative interviewing: The art of hearing data*. Thousand Oaks, CA: Sage Publications.

Sandelowski, M. (1986). The problem of rigor in qualitative research. *Advances in Nursing Science, 8,* 27-37.

Sandelowski, M. (1993). Rigor or rigor mortis: The problem of rigor in qualitative research revisited. *Advances in Nursing Science, 16*, 1-8.

Sandelowski, M. (2000). Whatever happened to qualitative description? *Research in Nursing and Health, 23*, 334-340.

Scott, J., Sochalski, J., & Aiken, L. (1999). Review of magnet hospital research: Findings and implications for professional nursing practice. *Journal of Nursing Administration, 29,* 9-19.

Schon, D. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.

Seldomridge, E. A. (1996). The influence of confidence, factual, and experiential knowledge on speed and accuracy of clinical judgment among novice and expert nurses. *Dissertation Abstract International, 57007(B),* 4303.

Simmons, C. (1997). How frequently should endotracheal suctioning be undertaken? *American Journal of Critical Care 1*, 4-6.

Sims, K. & Fought, S. (1989). Clinical decision making in critical care. *Critical Care Nursing Quarterly, 12*, 79-84.

Slota, M. (1998). *Core curriculum for pediatric critical care nursing*. Toronto: W.B. Saunders Company.

Sonnenberg, F. (1997). Decision analysis in disease management. *Disease Management and Clinical Outcomes, 1,* 20-34.

Spence, K., Greenwood, J., McDonald, M., & Sullivan, D. (1999). Processing knowledge in practice: Preliminary findings of a study into neonatal intensive care nursing. *Journal of Neonatal Nursing, 5,* (2), 27-30.

Stannard, D., Puntillo, K., Miaskowski, C., Gleeson, S., Kehrle, K., & Nye, P. (1996). Clinical judgment and the management of postoperative pain in critical care patients. *American Journal of Critical Care, 5,* 433-441.

Szaflarski, N. (2000) Clinical reasoning. In J. Hickey, R. Ouimette & S. Venegoni, *Advanced Practice Nursing: Changing roles and clinical applications* (2nd ed., pp. 82-110). Philadelphia: Lippincott.

Tanner, C. (1987a). Teaching clinical judgment. *Annual Review of Nursing Research, 5,* 153-173.

Tanner, C. (1987b). Research on clinical judgment. In Holzemer, W. L. (Ed.). *Review of Research in Nursing Education* (pp. 2-32). Thorofare, NJ: Charles B. Slack.

Tanner, C. (1994). Provocative thoughts on critical thinking. *Journal of Nursing Education, 33*, 339.

Tanner, C., Benner, P., Chesla, C., & Gordon, D. (1993). The phenomenology of knowing a patient. *Image: The Journal of Nursing Scholarship, 25,* 273-280.

Tanner, C., Padrick, K., Westfall, L., & Putzier, D. (1987). Diagnostic reasoning strategies of nurses and nursing students. *Nursing Research, 36*, 358-363.

Thompson, C. (1999). Qualitative research into nurse decision making: Factors for consideration in theoretical sampling. *Qualitative Health Research, 9,* 815-828.

Thompson, D. (Ed.). (1998). *The Oxford dictionary of current English* (New revised edition). Oxford: Oxford University Press.

Titler, M., & Jones, G. (1992). Airway management. In G. Bulechek & J. McCloskey, *Nursing interventions: Essential nursing treatments* (2nd. ed., pp. 512-530). Toronto: W. B. Saunders Company.

Tolles, C., & Stone, K. (1990). National survey of neonatal endotracheal suctioning practices. *Neonatal Network, 9,* 7-14.

Tversky, S., & Kahneman, D. (1982). Judgement under uncertainty. In D. Kahneman, P. Slovic & A. Tversky (Eds.), *Judgment under uncertainty.* New York: Cambridge University Press.

van den Berg, R. (1996). *The integration of patient cues, nursing knowledge and clinical judgments by Intensive Care Nurses in simulated situations of urgency.* Unpublished master's thesis: University of Ottawa, Ottawa, ON, Canada.

Weinert, C., Chan, L., & Gross, C. (2001). Sedating critically ill patients: Factors affecting nurses' delivery of sedative therapy. *American Journal of Critical Care, 10,* 156-167.

Westfall, U., Tanner, C., Putzier, D., & Padrick, K. (1986). Activating clinical inferences: A component of diagnostic reasoning in nursing. *Research in Nursing and Health, 9,* 269-277.

Wigton, R., Hoellerich, V., & Patil, K. (1986). How physicians use clinical information in diagnosing pulmonary embolism: An application of conjoint analysis. *Medical Decision making, 6,* 2-11.

Wood, C. J. (1998a). Endotracheal suctioning: A literature review. *Intensive and Critical Care Nursing, 14,* 124-136.

Wood, C. J. (1998b). Can nurses safely assess the need for endotracheal suction in short-term ventilated patients, instead of using routine techniques? [On-Line] *Intensive and Critical Care Nursing, 14,* (pp. 170-178). Abstract from The Cochrane Library, Issue 4, Oxford: Update Software.

Woodgate, P. G., & Flenady, V. (2000). Tracheal suctioning without disconnection in intubated ventilated newborns. (Protocol for a Cochrane Review). In: *The Cochrane Library, Issue, 4.* Oxford: Update Software

APPENDIXES

Appendix A: Participant Introductory Letter

To Potential Study Participant (Staff Nurse in the CCU):

Margot Thomas, a graduate student in the Masters of Nursing Program at the University of Ottawa, is conducting a study in the Critical Care Unit at the Hospital for Sick Children. The purpose of this study is to examine the cues that expert pediatric critical care nurses, such as yourself, use in making judgments about the frequency and timing of endotracheal tube suctioning when caring for intubated, ventilated children. This study would involve observing you in direct practice in the CCU, and having you 'think aloud' to share your thought processes as you suction patients in the unit. As you think aloud, your verbal reports will be audiotaped. Following the suctioning event, the researcher will ask some questions about nursing actions and decision making about suctioning. Responses to this interview, to take place at the patient's bedside, will also be audiotaped.

You have been identified as a potential participant in this study as you meet the following eligibility criteria for respondents. You are:

- A staff nurse with at least 3 years clinical pediatric critical care experience.
- Recognized by peers and supervisor as being a highly skilled clinician.
- Able to recognize and communicate your thought processes.
- Currently engaged in direct patient care which demonstrates:
    - Being closely attuned to the needs of patient and family.
    - Having well developed physical assessment skills that include the ability to scan and come to rapid judgments about patient condition.
    - Having the ability to make independent decisions about nursing interventions that may cross boundaries between another discipline and nursing.
    - Paying attention to the outcome of nursing care including the prevention of complications, purposeful recovery and humanistic care.

If you are interested in hearing more about the study, and would consider participating in this research, you may contact the researcher directly (call collect to Ottawa home phone at 1-613-836-1700). The researcher will contact you to further explain the study, and obtain your consent for participation.

Your choice to participate in this research is voluntary. No employee of the Hospital for Sick Children will be informed if you choose not to participate or to withdraw from the study. Your choice to not participate in the study will not affect your performance appraisal. This study has been granted ethical approval by the Hospital for Sick Children Research Ethics Board, and should you require information about the ethical process please feel free to contact the chair of the Research Ethics Board (416) 813-6340.

Appendix B: Consent for Main Study

Title of Research Project: Cue Utilization by Expert Pediatric Critical Care Nurses in Making Clinical Judgments Related to Endotracheal Suctioning

Primary Investigator: Margot Thomas, R.N., B.Sc.N.
Graduate Student: Masters of Nursing Program, University of Ottawa
Address: 69 Winchester Drive,
Kanata, Ontario.K2L 2R3
Email: thomas_margot@hotmail.com
Home Phone: (613) 836-1700
Toronto Contact: (905) 279-1589

Co Investigator: Ms. Judy Burns, R. N.
Child Health Services Manager: Critical Care, Hospital for Sick Children
Email: judy.burns@sickkids.ca

Thesis Supervisor: Dr. Frances Fothergill-Bourbonnais, R.N., PhD.
University of Ottawa, School of Nursing.
Office Phone: (613) 562-5800 (8423)
Email: fbourbon@uottawa.ca

Purpose of the Research:
The purpose of this study is to describe the patient cues, signals and information that expert pediatric critical care nurses use in making clinical judgments about suctioning ventilated, critically ill children.

Description of the Research:
This study, to be conducted within the Critical Care Unit (CCU), will use observation of and verbalization by expert pediatric critical care nurses as they make the decision to suction a mechanically ventilated child. Specifically, the study is to discover what cues nurses use in making that clinical judgment. Involvement in the study requires you to be observed by the researcher during direct clinical practice, speaking into a tape recorder to say aloud what you are thinking when you make the judgment to suction your patient and sharing your thoughts about the suctioning procedure with the researcher during one assigned shift of work in the CCU. Following the suctioning procedure, the researcher will ask you questions about your decision to suction. Demographic data will also be obtained during this interview that will be tape-recorded. The observation

experience, the think aloud taping and the following interview will occur within the Critical Care Unit at the Hospital for Sick Children (HSC) during your patient care shifts. The researcher will write field notes on what is observed within the CCU, and what is noted to be happening with your patient when you make the decision to suction. These notes are to help the researcher remember the situations and to develop a deeper understanding of the processes involved in your nursing judgments. The researcher will contact you to set up a mutually convenient date and time for the data collection. You may choose to participate in the study during day or night, weekday or weekend shifts.

Potential Harm Injuries, Discomforts of Inconvenience:
There are no known harms associated with participation in the study. Risks to you and to your patients are not anticipated.

Potential Benefits:
Potential benefits to the nursing profession include the development of knowledge about judgment of expert critical care nurses that can impact practice, research and education.

Confidentiality:
Confidentiality will be respected and no information that discloses your identity will be released or published without consent unless required by law. This legal obligation includes a number of circumstances, such as suspected child abuse and infectious disease, expression of suicidal ideas, where research documents are ordered to be produced by a court of law and where researchers are obliged to report to the appropriate authorities.

Your real name will not be used at any point in the information collection, or in the written reports. Instead, you and any other person and place names mentioned in the audiotapes will be given pseudonyms (fake names) that will be used in all verbal and written records and reports. The transcription of the audiotapes and notes will only be made available to members of the researcher's thesis committee. All identifying information will be edited from these transcripts. You will also have the opportunity to review the initial findings and to confirm the researcher's interpretations if you wish.

Participation:
Participation in this study is voluntary. Your choice not to participate will not affect your employment. You have the right to withdraw at any point of the study, for any reason, and without any prejudice. Any information collected in audiotapes, transcripts of tapes and field notes pertaining to you, will be edited to remove any identifying information. Your decision to participate, withdraw or not to participate in this study will not be shared with any employee of the HSC.

You are encouraged to ask any questions at any time about the nature of the study and the methods being used. Your suggestions and concerns are important to the researcher. Please contact her at any time at the address/phone number/email address listed above.

The information from this study will be used to understand what cues expert pediatric critical care nurses use in making clinical judgments about suctioning intubated children. The findings will be examined by members of the researcher's thesis committee to check on the accuracy of the report. The information will then be used to write a thesis report. If

you wish, you will receive a summary of the final thesis report. As well, quotes from the written transcripts and tape-recorded verbal communications with the researcher may be used in future papers, journal articles and books that are to be written by the researcher. However, no identifying information will be included in the quotations.

Do you grant permission to be observed in clinical practice?
Yes_____No_____
Do you grant permission to be interviewed?
Yes_____No_____
Do you agree to be contacted later on after the initial data collection, to speak with the researcher about the findings and inferences from the study?
Yes_____No_____
If yes, how should the researcher contact you?
Work (phone number)_____
Home (phone number)_____
Do you wish to receive a summary of the final thesis report?
Yes_____ No_____
If so, to what address should it be sent?

Consent
By signing this form, I agree that:
The study has been explained to me. All my questions were answered. I have received a copy of this consent form. The possible harms and discomforts and the possible benefits (if any) of this study have been explained to me. I know about the alternatives to taking part in this study. I understand that I have the right not to participate and the right to stop at any time. The decision about whether or not to participate will not affect my employment at The Hospital for Sick Children. I am free now, and in the future, to ask any questions about the study. I have been told that my information will be kept confidential, except where release of information is required by law. I understand that no information that would identify me will be released or printed without asking me first.

I hereby consent to participate.

Name _____
Signature _____

Name of person obtaining consent _____
Signature _____

Date _____

The person who may be contacted about the research is Margot Thomas, who may be reached at (613) 836-1700 (Ottawa) or (905) 279-1589 (Toronto)

Appendix C: Consent for Sound Recording for the Main Study

VIDEOS, PHOTOGRAPHS, AND SOUND RECORDINGS CONSENT FORM
PARTICIPANTS 16 YEARS OF AGE AND OLDER

Title of Research Project:
Cue Utilization by Expert Pediatric Critical Care Nurses in Making Clinical Judgments Related to Endotracheal Suctioning

Primary Investigator: Margot Thomas, R.N., B.Sc.N.
Graduate Student: Masters of Nursing Program, University of Ottawa
Address: 69 Winchester Drive,
Kanata, Ontario.K2L 2R3
Email: thomas_margot@hotmail.com
Home Phone: (613) 836-1700
Toronto Contact: (905) 279-1589

Co Investigator: Ms. Judy Burns, R. N.
Child Health Services Manager: Critical Care, Hospital for Sick Children
Email: judy.burns@sickkids.ca

I hereby consent to be audiotaped in this research project. These tapes will be used to describe the patient cues, signals and information that expert pediatric critical care nurses use in making clinical judgments about suctioning ventilated, critically ill children. I understand that I am free not to participate in this part of the study and that if I agree to participate I am free to withdraw from this part of the study at any time, e.g., before or even after the audiotape is made without compromising my employment at the Hospital for Sick Children.

_____
Name of Participant

_____
Signature

The person who may be contacted about the research is: Margot Thomas who may be reached at telephone # (905) 279-1589, or (613) 836-1700

_____
Name of person who obtained consent

_____
Signature

Date:

Appendix D: Focused Observation Guide

Participant Pseudonym:_____Suctioning Event #_____

Date: _____ Tape Counter Numbers: _____

Time suctioning started: _____Time suctioning finished:_____

Situational Characteristics	Timing of Observation (before, during or after suctioning)	Observation
Negotiating timing of suctioning with respiratory therapist.		
Negotiating with physiotherapist		
Negotiating timing of suctioning with family members Conversing with family, explaining why timing of procedures		
Communication with physician MD identified need for suctioning MD identified change in patient status		
Communication with other nursing staff Negotiating timing of suctioning with other nurses in room (need for two person suctioning) Suggestion by other nurse that patient should be suctioned		
Evidence of nursing scripts Normal sequencing of activities for the unit Going off on coffee break/shift change requiring suctioning before leaving unit Timing of suctioning related to interval since last event		

Context of the Health Care Problem	Timing of Observation (before, during or after suctioning)	Observation
Evidence of stress within the nurse/patient situation Nurse requesting assistance from other health care providers Family members at the bedside who are expressing distress at patient situation. Patient situation deteriorating		
Patient Changes Desaturation Coughing Colour changing Ventilator alarming Fluids in ETT Vital signs changing		
Personal Characteristics of the Nurse	Timing of Observation (before, during or after suctioning)	Observation
Evidence of expertise Approached for advice by other colleagues Identifies comfort and ease with the patient situation No hesitation in making decision to suction Smooth, fluid movements Coordinated with equipment, patient bagging, silencing alarms Positioning of patient/nurse to promote ease of suctioning		

Equipment prepared in advance Attentive to patient condition Calming, soothing words to patient/family Patient situation not unfamiliar to nurse		

Patient Characteristics	Timing of Observation (before, during or after suctioning)	Observation
Patient Activities Patient transporting to another area Patient up in chair		
Prognosis Nature of the Illness/Prognosis Acute Chronic Immediate life threatening		
Patient signs and symptoms Saturation Heart Rate Respiratory Rate Blood Pressure Coughing Colour change ICP Hemodynamic parameters		
Response to treatments Requires two person intervention No unexpected events noted during suctioning Unexpected, unanticipated events requiring immediate interventions		

NOTES/COMMENTS: (Factors noted to be restraining/facilitating in nursing interventions related to suctioning)

Restraining Facilitating

Appendix E: Demographic Data of Participant

Participant Pseudonym_____

Age 20-30 31-40 41-50 >50

Sex M F

Basic Nursing Education

Diploma Degree

Post-Basic Nursing Education (Highest Level Attained)

Critical Care Certificate Masters in Nursing

Nursing Experience

Critical Care Experience _____yrs

Pediatric Critical Care Experience _____yrs at HSC,

_____yrs at other hospital

Position at HSC

Previous experience with this patient assignment?

Appendix F: Semi-Structured Interview Guide

(To be completed as follow-up to each suctioning episode)

Time of suctioning episode started: _____Time suctioning finished: _____
Date and Time of interview: _____
Time (in hours) between suctioning episode and interview: _____

Can you tell me what you were thinking **before** you suctioned your patient?
(Prompts to be used to assist informant in sharing thought processes if not shared during think aloud sessions)
What information did you use in deciding whether or not to suction your patient?
What did you notice about your patient?
What hunches did you have about your patient?
What did you anticipate about your patient? (use of saline, hyperoxygenation, frequency, response, results of suctioning)
What were your priorities at that time?

Can you tell me what you were thinking **as** you suctioned your patient?
(Prompts to be used to assist informant in sharing thought processes)
What did the patient look like to you during the procedure?
Did the patient respond to suctioning as you expected?

Can you tell me what you were thinking **after** you suctioned your patient?
(Prompts to be used to assist informant in sharing thought processes)
What information about the suctioning procedure did you chart?
How would you describe the outcome of this procedure for your patient?

How did you learn about this patient and his/her need for suctioning?
(Prompts to be used to assist informant in sharing thought processes)
Where did you get the information to suction the patient?
What did you learn from the shift report that helped you with this patient?
Did anyone suggest to you to suction the patient?
Did their suggestions influence your decision making?
Have you cared for this patient before this shift?

What did you learn from rounds, other health care team members that influenced you decision to suction this patient?

How is this patient situation similar to other situations you have experienced?

How is this patient situation different from other situations you have experienced?

If you had to do it over again, would you do anything differently?

Is there anything else I should have asked you?

Appendix G: Ethical Approval for Pilot Study

Children's Hospital of Eastern Ontario
Hôpital pour enfants de l'est de l'Ontario
401 SMYTH, OTTAWA, ONT. K1H 8L1 TELEPHONE (613) 737-7600

September 25, 2001

Ms. Margot Thomas
Clinical Educator
Pediatric Intensive Care Unit
CHEO INTRA

Re: Proposal 01/49E - A Pilot Study of Cue Utilization by Expert Pediatric Critical Care Nurses in Making Clinical Judgments Related to Endotracheal Suctioning

Dear Ms. Thomas:

Thank you for your letter of September 17, 2001, and revised Consent as requested by the Research Ethics Committee in our meeting of September 5, 2001 as outlined in our letter of September 10, 2001.

Please accept this letter as approval by the Research Ethics Committee to proceed with the above-mentioned study.

Kindly refer to the above-mentioned Proposal Number in all correspondence.

It is your obligation to notify the REC prior to the institution of any modifications to this study, or any adverse events which may occur during the course of this study.

To ensure that the REC is kept informed of the progress of clinical studies, we request a yearly progress report from each investigator.

Yours sincerely,

David Palframan, M.D., F.R.C.P. (C)
Chair
Research Ethics Committee

Appendix H: Consent for Pilot Study

A Pilot Study of Cue Utilization by Expert Pediatric Critical Care Nurses in Making Clinical Judgments Related to Endotracheal Suctioning

Study Description and Consent Form

The purpose of this study is to describe the cues that expert pediatric critical care nurses use in making clinical judgments about suctioning ventilated, critically ill children. This pilot study, to be conducted within the Pediatric Intensive Care Unit at CHEO, is the initial phase of a further study to be conducted within the Critical Care Unit at the Hospital for Sick Children. The research will use observation and verbalization by expert pediatric critical care nurses as they make the decision to suction a mechanically ventilated child to discover what cues nurses use in making that clinical judgment.

Involvement in the study requires you to be observed by the researcher during direct clinical practice, speaking into a tape recorder to say aloud what you are thinking when you make the judgment to suction your intubated patient and sharing your thoughts about the suctioning procedure with the researcher. Following the suctioning procedure, the researcher will ask you questions about your decision to suction. This interview will also be tape-recorded. The observation and think aloud taping and interview will occur within the PICU at CHEO during your patient care shifts. The researcher will write field notes on what is observed within the ICU, and what is noted to be happening with your patient when you make the decision to suction. The field notes and audio tapes will be transcribed word for word to allow for coding and analysis of the data to identify themes or categories of information that nurses consider in their decision making process. The researcher will contact you to set up a mutually convenient date and time for the data collection. You may choose to participate in the study during day or night, weekday or weekend shifts.

There are no known harms associated with participation in the study. Risks to you and to your patients are not anticipated. Potential benefits to the nursing profession include the development of knowledge about judgment of expert critical care nurses that can impact practice, research and education.

Confidentiality will be respected and no information that discloses your identity will be released or published without consent unless required by law. Any information collected in audiotapes, transcripts of tapes and field notes pertaining to you, will not contain any identifying information. Your real name will not be used at any point in the information collection, or in the written reports. Instead, you and any other person and place names mentioned in the audio tapes will be given pseudonyms that will be used in all verbal and written records and reports. The transcription of the audiotapes and field notes will only be made available to members of the researcher's thesis committee. All identifying information will be edited from these transcripts. If you agree, the researcher will contact you later on after your initial participation in the study, for you to review the initial findings and to confirm that the researcher's interpretations reflect your perspectives.

Participation in this study is voluntary. If you choose not to participate, you will continue to be on staff at CHEO. You have the right to withdraw at any point of the study, for any reason, and without any prejudice. Your decision to participate, withdraw or not to participate in this study will not be shared with any employee of CHEO.

You are encouraged to ask any questions at any time about the nature of the study and the methods being used. Your suggestions and concerns are important to the researcher. Please contact her at any time at the address/phone number/email address listed above.

You may contact the Chair of the Research Ethics Committee, for information regarding participant's rights in research studies at telephone 738-3272; however, this person cannot provide any medical information with regard to this study.

The information from this study will be used to understand what cues or information that expert pediatric critical care nurses use in making clinical judgments about suctioning intubated children. The findings will be examined by members of the researcher's thesis committee to check on the accuracy of the report. The information will then be used to write a thesis report. If you wish, you will receive a summary of the final thesis report. As well, quotes from the written transcripts and tape-recorded verbal communications with the researcher may be used in future papers, journal articles and books that are to be written by the researcher. However, no identifying information will be included in the quotations.

Do you grant permission to be audiotaped?
Yes_____No_____
Do you grant permission to be observed in clinical practice?
Yes_____No_____
Do you agree to be contacted later on after the initial data collection, to speak with the researcher about the findings and inferences from the study?
Yes_____No_____
If yes, how should the researcher contact you?
Work (phone number)_____
Home (phone number)_____
Do you wish to receive a summary of the final thesis report?
Yes_____ No_____
If so, to what address should it be sent?

Consent

By signing this form, I agree that:

The study has been explained to me. All my questions were answered. I have received a copy of this consent form. The possible harms and discomforts and the possible benefits (if any) of this study have been explained to me. I know about the alternatives to taking part in this study. I understand that I have the right not to participate and the right to stop at any time. The decision about whether or not to participate will not affect my employment at the Children's Hospital of Eastern Ontario. I am free now, and in the future, to ask any questions about the study. I have been told that my information will be kept confidential, except where release of information is

required by law. I understand that no information that would identify me will be released or printed without asking me first.

(Signature of participant)	Printed Name	Date
(Signature of Witness)	Printed Name	Date

I HAVE EXPLAINED THIS STUDY TO THE PERSON AUTHORIZED TO SIGN ABOVE AND I AM SATISFIED THAT IT IS UNDERSTOOD.

(Signature of Investigator)	Printed Name	Date

If you have any concerns or questions regarding this study, please contact the researcher, Margot Thomas, who may be reached at telephone number (613) 836-1700.

Primary Investigator:
Margot Thomas, R.N. B.Sc.N., M.Sc.N. (candidate)
Graduate Student: Masters of Nursing Program, University of Ottawa
Address: 69 Winchester Drive,
Kanata, Ontario.K2L 2R3
Email: thomas_margot@hotmail.com
Home Phone: (613) 836-1700

Appendix I: Ethical Approval for Main Study

THE HOSPITAL FOR SICK CHILDREN (HSC)
RESEARCH ETHICS BOARD(REB)

The HSC REB aims to adhere to the principles and practices stated in the Declaration of Helsinki, the World Health Organization and the Canadian TriCouncil Policy Statement (1998)

Approval & Terms of Agreement

APPLICANTS: Ms. Margot Thomas, J. Burns

PROJECT TITLE: Cue Utilization By Expert Pediatric Critical Nurses in Making Clinical Judgments Related to Endotracheal Suctioning

FILE NUMBER: 2001/401

MEMBERS OF THE BOARD*: Dr. Max Perlman, Chair

Dr. D. Bagli	Ms. M. Evans	Dr. M. Rossi
Ms. L. Brisbois	Dr. C. Fandino-Cirilli	Dr. L. Stermac
Mr. O. Browne	Dr. M. Freedman	Mr. R. Sugarman
Dr. M. Crawford	Ms. A. Hepburn	Mrs. R. Zlotnik Shaul
Ms. S. Davidson	Dr. L. Komar	
Ms. L. Dupuis	Ms. A. Manicat-Emo	

*Meeting may not have been attended by all members.

I agree to carry out the proposed research involving human subjects in accordance with the protocol approved by the REB using the approved consent form/s. I shall notify the division/department head and the REB prior to implementing any modifications in the protocol and of any adverse or unexpected events as soon as possible. I certify that the research contract and corresponding protocol are consistent (where applicable).

SIGNATURE OF INVESTIGATOR _____ DATE January 25/02

I agree to follow the conduct of the research on an ongoing basis, and to notify the Research Ethics Board as appropriate.

SIGNATURE OF
(DIVISION/DEPARTMENT HEAD)** _____ DATE 25 Jan 02

The REB of the Hospital for Sick Children has reviewed and approved the above-named project.

Chair, Research Ethics Board _____ DATE Feb 8, '02

DATE OF APPROVAL DEC 2 9 [illegible] **EXPIRY DATE** DEC - - 2002

***Division chiefs and department heads cannot signoff on protocols on which they are investigators. Department heads signoff for Division chiefs, and Division Chiefs for Department Heads. In the case of heads of departments without divisions, the Chair of the MAC acts as signatory.*

Appendix J: Letter of Study Explanation for Parents of Patients Cared for by Nurse Participants

Dear Family Member:

Margot Thomas, a graduate student in the Masters of Nursing Program at the University of Ottawa, is conducting a study in the Critical Care Unit (CCU) at the Hospital for Sick Children (HSC). We are trying to learn how expert pediatric critical care nurses make decisions for the child who needs suctioning while on a ventilator. She is interested in observing nurses in direct practice in the CCU, and having these nurses 'think aloud' to share their thought processes as they care for these patients. These nurses will be audiotaped as they tell us what they are thinking and doing.

The purpose of the study is to learn more about how nurses make decisions about the nursing care, in this case suctioning, that they provide in the critical care unit. The study is not to examine how your child's nurse does the care, but rather to understand how she/he came to make the decision to do the care. The knowledge gained from this study will be helpful in the education and training of new critical care nurses.

The researcher, an experienced pediatric critical care nurse, will be observing the nurse at the bedside, audio-taping the verbal 'think aloud' by the nurse when suctioning and following the suctioning procedures asking the nurse some questions about how he/she made the decisions. Several studies by other nurse researchers have shown that nurses can 'think aloud' while providing attentive nursing care.

The researcher will not be involved in any care of your child and the study will not interfere with care of your child. If at any time your child's nurse feels that the thinking aloud is disturbing you or your child, she/he will stop speaking into the tape recorder or to the researcher.

This study has been granted ethical approval by the Hospital for Sick Children Research Ethics Board, and should you require information about the ethical process please feel free to contact the chair of the Research Ethics Board (416) 813-6340. Should you wish to speak to the researcher directly, Margot Thomas can be reached by phone in Toronto at (905) 279-1589.