THE CLINICAL REASONING OF EXPERT, COMPETENT, AND NOVICE RESPIRATORY THERAPISTS WORKING IN THE ACUTE CARE SETTING

By

RHONDA BEVIS

Under the direction of John Schell

ABSTRACT

The purpose of this study was to identify the nature of clinical reasoning of expert, competent, and novice respiratory therapists while making decisions within acute care settings. Other purposes included the differences years and quality of experiences made, and determining the contextual factors, which either facilitated or hindered their development of ability to make good clinical decisions.

The theoretical framework for this study included clinical reasoning, the novice-to-expert continuum, and reflective practice. The nine well-documented methods of clinical reasoning used for this study were associated with these theories.

This qualitative study was designed to gain an understanding of therapists' decision making in the acute care settings of neonatal and pediatric intensive care, from the therapists' own perspectives. Data collection consisted of observations of therapists in the acute care setting followed by indepth interviews. Bracketing and constant comparative method analysis was used to capture recurring themes.

The findings of this study indicated that respiratory therapists used nine different methods of clinical reasoning as components of their work in the acute care units. Their use of these different methods allowed for almost every task or activity therapists performed in patient care to be associated with clinical reasoning. It revealed a difference

in the method of reasoning used to solve problems based on a therapist's years of experience and the quality of those experiences.

Therapists also used multiple methods of clinical reasoning almost simultaneously. The results of this study indicated that these respiratory therapists would rapidly shift from one method of reasoning to another, depending on which aspect of complicated clinical problems attracted their attention.

Therapists revealed the presence of practice contextual factors with they believed affected their development of expert clinical reasoning skills. The issues they identified as hindering their development of good clinical reasoning skills included; limited or lack of experiences, lack of time and staffing, and limited expectations and nonsupport of physicians. Those that facilitated good clinical reasoning, included previous similar experiences, good scientific base of knowledge, well written guidelines from which a strong system of unwritten protocols could be developed, collaborative reasoning, and the expectations and support of physicians.

INDEX WORDS: Acute Care Settings, Clinical Reasoning, Novice-to-Expert Continuum, Respiratory Therapists, Respiratory Therapy

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By

RHONDA BEVIS

B.S.B.A., Troy State University at Dothan, 1992

M. S., Georgia State University, 1997

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RHONDA BEVIS

Approved:

Major Professor: John Schell

Committee: Helen Hall
Juanita Johnson-Bailey
Roger Hill
Wendy Ruona

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
December 2002

DEDICATION

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CHAPTER ONE

INTRODUCTION

Clinical reasoning has become a common theme in the health care profession as represented in professional literature. Authors from the fields of medicine (Elstein, 1992a; Kovacs, 1999; Round, 1999), nursing (Benner, Hooper-Kyriakids, & Stannard, 1999; Case, Harrison, & Roskell, 2000; Greenwood, Sullivan, Kaye, & McDonald, 2000; Robertson, 1996a, 1996b) occupational therapy (Mattingly, 1998; Neuhaus, 1988; Rogers & Masagatani, 1982; Ryan, 1995; Schell, 1994; Schell & Cervero, 1993), and physical therapy (Higgs, 1990, Higgs & Jones, 1992, 2000; Payton, 1985) have provided information about clinical reasoning from a variety of health care disciplines.

There has been valuable research in the area of critical thinking among respiratory therapists (Mishoe, 1995; Thomas-Goodfellow, 1998) where reasoning was identified as a type of critical thinking. Mishoe and Thomas-Goodfellow's works revealed how respiratory therapists use critical thinking in solving complex problems. However, there was insufficient information concerning the methods or nature of clinical reasoning used by respiratory therapists on a continuous basis when solving the everyday problems associated with their clinical practice in the intensive care units.

Respiratory therapists work in a variety of different settings such as home health, research, education, surgery, rehabilitation, and acute care. This study investigated the different methods of clinical reasoning used by respiratory therapists in the acute care setting. Respiratory therapists are professionals who encounter many different patients,

problems, and solutions in their work in the acute care settings, which require decision-making. Their individual learning about clinical problems comes from a variety of different environments, interactions, situations, and other individuals. Through unique combinations of these, these therapists developed their own personal methods of reasoning about clinical problems.

This study provided a better understanding of the nature of clinical reasoning used by respiratory therapists, and the differences between those individuals who have developed a professional expertise at decision-making and those who, through limited experiences, are still considered competent or novice therapists. To understand the development of a respiratory therapist's clinical reasoning requires a review of the historical aspect of their practice.

History of Respiratory Care Practice

Respiratory therapists (practitioners) specialize in the evaluation, treatment, and care of patients with both chronic and acute breathing disorders. Their jobs are to intervene for patients when the "breath-of-life" is jeopardized. Their discipline has evolved from a low-technical, labor-intensive field of the 1950s, to a highly technical job of today, with the responsibility of identifying and intervening for patients when they loose their ability to breathe effectively.

The first jobs for individuals in the field of respiratory care were created in 1947, at a meeting of oxygen orderlies and physicians. The Inhalation Therapy Association was created out of a need for individuals to administer medicinal oxygen in hospitals. Frequent and successful use of compressed oxygen cylinders in hospitals following World War II resulted in the need for a staff of individuals who were capable of

transporting the heavy cylinders, and appliances to administer oxygen. Hospital-based respiratory therapy educational programs provided on-the-job training for individuals to fill the need (Dounce, 1992).

In the 1950s, job responsibilities of respiratory therapists again expanded due to the polio epidemic and the use of the iron lung to support breathing. Because of the demand for individuals to deliver, service, and maintain this massive equipment, on-the-job training and hospital-based in-service education expanded. Respiratory therapists' work responsibilities in the 1950s were considered low-tech and labor-intensive.

In 1965 the United States Congress passed the Social Security Amendment (Medicare), which provided health care coverage for those individuals over the age of 65. This resulted in the rapid growth of allied health care during the 1960s and 1970s, and more direct patient care by respiratory therapists. To meet the demand, educators developed educational programs using nursing and physician models, which were already established in the health care professions (Snyder, 1992).

Hospitals in the early 1970s had an occupancy rate of over 80 percent (Cullen, Sullivan, Bartel, Fuson, Rinker, Sheldon, Scoder, Wiezalis, & Wojciehowski, 1992). Realizing the monetary impact of health care reform on the economy, Congress passed the Social Security Amendment of 1972 giving the federal government more control over cost. However, the growth of health care and its rising costs continued. The 1970s brought respiratory therapists an expansion of tasks, such as life support systems and physiologic monitoring, resulting in the transfer of educational responsibility for respiratory therapists from hospitals to post-secondary educational institutions (Dounce, 1992).

In the early 1980s the escalating cost of health care for America's aging population and its effects on both the American health care system and the national economy became apparent. Government, insurers, and business attempted to control health-care cost by pressuring hospitals to operate within a much lower profit margin (Cullen et al., 1992). The result was managed care, hospital mergers, reduced duplication of services, and decline in the number of hospitals (and beds) and reduced the length of a patient's stay in the hospital. This meant that those patients who are still in the hospital are extremely sick, require increased monitoring, and additional care. According to Cullen and his colleagues, this also increased pressures on health care providers to "ensure that all elements of therapy are cost effective and efficient" (Cullen et al., 1992 p. 9).

Durbin (1996), believed that the "cost efficiency of therapy is often evaluated by the change produced in the length of stay in a special [acute] care unit" (p. 105). Acute care units are very expensive; he estimated that as much as "1% of the gross national product is spent on health care provided in acute care units in the United States of America" (p. 105).

In the acute care setting, "the most important skill a respiratory therapist has is that of clinical patient assessment" (Durbin, 1996, p. 108). Therapists are capable of making independent assessment and adjusting therapy to the changing needs of patients within acute care settings. The "effectiveness [of the acute care setting] is judged by measuring the outcome of both intermediate goals (does therapy achieve the desired physiological endpoint?) and long-term goals (does the patient do better, live longer, or live better with the therapy than without it?)" (Durbin, 1996, p.105).

In the 1990s the respiratory profession saw changes in the ways of alternative work sites, specialty credentialing, and therapist-driven protocols (Dounce, 1992). Schools saw a broadening in the base of knowledge required for an entry-level respiratory technician. These translated into more information taught in less time, at a time when therapist's assessment skills became increasingly important.

The assessment of health care needs and the direction of educational programs has been a point of concern for the profession since its inception. In the early 1970s the respiratory departments of the hospitals experienced personnel shortages. Respiratory therapy managers supported post secondary education because the work they did was no longer considered low-tech and labor intensive. This resulted in technician training programs changing their "educational orientation from an in-service educational enterprise to that paralleling licensed practical nurse training. They followed a vocational educational model and the number of respiratory technician school programs exploded" (Cullen et. al., 1992, p. 8). In recent years respiratory therapy programs have become more academic and are offered by universities, state, community, and technical colleges offering at least an associates degree, which is now the minimal requirement for entry into the profession.

The professional association for respiratory therapists has had four name changes: the American Association of Inhalation Therapists (1954), the American Association for Inhalation Therapy (1967), the American Association for Respiratory Therapy (1972), and the American Association for Respiratory Care (1986)(Cullen, 1992). These name changes reflect changes in the American health care system, the profession in general, and the growth in scope of practice for the practitioners.

Statement of the Problem

Therapist-driven protocols are technical rationalities or treatment algorithms, developed in the 1990s based on the Clinical Practice Guidelines from the American Association for Respiratory Care. They are well-referenced documents representing a broad national consensus on many important aspects of respiratory and non-respiratory care (Durbin, 1996). Individual protocols are written for particular aspects of patient care both inside and out of the intensive care units. According to Durbin, "they have been widely used to influence the application of respiratory therapy procedures outside of the intensive care units [acute care centers] which have led to more appropriate and efficient, less costly care, and possibly a reduction in hospital stay" (p. 105).

Durbin (1996) also suggested that the difficulty using these protocols in the acute care setting is affected by the severity, complexity, and complications of the illness, diagnostic uncertainties, and the need to reconsider and to change course rapidly for many of the patients. According to him, "this creates difficulty determining the best treatment algorithm and [causes] uncertainties for therapists trying to use them" (p. 107).

Therapist-driven protocols are written and taught as algorithms and serve as clinical guidelines. However, in complicated situations, they require clinical judgment and possible deviations from the recommended suggestions, much like the American Heart Association's Pediatric Advanced Life Support (PALS) and the American Pediatrics Association's Neonatal Resuscitation Program (NRP) algorithms.

According to Rogers (1983), clinical problems can become messy and complex, where many times the necessary data for solving the problem is unknown, missing, or flawed. Furthermore, Rogers stated, "Unlike the simple cause and effect problems

associated with basic science, clinical problems involve a complex interplay of multiple variables" (p. 614). She stressed that algorithms cannot be provided for every situation where the chief characteristics include uniqueness, uncertainty, complexity, and instability and there are no formulas or guidelines demonstrating how to use the cognitive process associated with perception, memory, reasoning, and argument. In handling these uncertainties of clinical practice, she believed, "therapists rely on their accumulated experiences, conceptual and judgmental heuristics, intuition, and insight to apply their knowledge to make clinical judgment" (p. 615).

Therapist-driven protocols allow clinical judgments to be made on research-based theory and techniques. Schon (1983) referred to this area of decision-making as "high, hard ground". Schell and Cervero (1993) suggested that this view of clinical reasoning is based heavily on a rational model of clinical processing that is demonstrated by the scientific method. Schon (1983) also described "a swampy lowland" as being situations which are confusing 'messes' and are incapable of technical solution" (p. 42). He emphasized that decisions made "in the swamp are the problems of greatest human concern" (p. 42). This is where clinical reasoning goes beyond the scientific reasoning of therapist driven protocols. Schon suggested:

> There are those who choose the swampy lowlands. They deliberately involve themselves in messy but crucially important problems and, when asked to describe their methods of inquiry, they speak of experience, trial and error, intuition, and muddling through. Other professionals opt for the high ground. Hungry for technical rigor, devoted to an image of solid professional competence, or fearful of entering a world in which they feel

the do not know what they are doing, they choose to confine themselves to a narrowly technical practice. (p. 43)

Respiratory therapists, working in the acute care settings, are faced with making decisions in both simple and complicated clinical situations. Patients who are sick enough to be admitted to the acute care setting usually involve multiple complex medical issues. It is because of these complexities that no single therapist-driven protocol can be written for each situation.

Decision-making in these situations is what Schon refers to as the swampy lowlands, and is of the greatest concern for therapists. These are not clinical situations where decision-making can easily follow the guidance of therapist-driven protocols. Instead, they are more complicated with problems that are not clearly defined or displayed, complex with multiple diagnoses, and problematic with multiple treatments. Over the past 50 years, respiratory care as a profession has progressively moved itself toward educating therapists to involve themselves in making decisions in these complicated situations.

The expanding scope of respiratory care from the 1950 to 2002 led to tremendous changes in the professional practice for respiratory therapists. There has been a shift in their practice from low-tech, highly laborious, hospital-based education of the 1950s to a high-technical, diversity of job sites of the 1990s. They now may find themselves working in new situation or with diverse types of equipment, and learning and implementing new procedures. Schon (1987) noted that many times professionals are called upon to perform tasks or make decisions for which they feel they are not fully experienced. The focus of this study was

determining in which task and activities respiratory therapists use clinical reasoning, which types of reasoning they used, and the differences in their uses of clinical reasoning within the acute care setting.

Purpose of the Study

One purpose of this study was to identify the nature of clinical reasoning of novice, competent, and expert respiratory therapists in making clinical decisions within the acute care setting. It also identified the task or activities associated with different types of clinical reasoning and explored the role contextual issues played in the development of expert clinical reasoning in therapists. In other words, in which clinical situations did respiratory therapists use clinical reasoning, which types of reasoning did they use when doing specific tasks, and which contextual issues lent themselves to development of expertise in clinical reasoning? This understanding of when, how, and why novice, competent, and expert therapists used clinical reasoning in the acute care setting is important to the therapists themselves, educators, and managers seeking to improve therapists' skills of clinical reasoning.

Assessment of patients having difficulty breathing requires that therapists make decisions rapidly and accurately and that they also take action quickly and precisely to alleviate the problems. According the American Pediatric Association's Neonatal Resuscitation Program, and The American Heart Association's Pediatric Advanced Life Support guidelines, this critical time is measured in only a very few minutes. Although not all of the work done by respiratory therapist in the acute care setting is as critical as the resuscitation or the delivery of each breath for a neonate or a pediatric patient. Their

call to actions in this critical care environment, at a moments notice, is present and should always be anticipated and for which they should be prepared.

Research Questions

At the beginning of this study, the research questions were:

1. In which task or activities do respiratory therapists use clinical reasoning as a method of decision-making while working in an intensive care unit?
2. Which methods of clinical reasoning do respiratory therapists use in their practice within the intensive care unit?
3. What are the differences in the methods of clinical reasoning used by novice, competent, and expert respiratory therapists?
4. What contextual factors encourage or discourage the development of expert clinical reasoning among respiratory therapists?

Because the methodology for this study was qualitative in nature, using constant comparative analysis, these questions might have changed as data was collected and analyzed. The results from a study of this type are unknown at beginning, and allowing for flexibility of question provided the opportunity for exploration of data as it developed. However, the questions remained the same from beginning to end of this study.

Supporting Theoretical Frameworks

Because this proposed study was qualitative by design, it was important to provide the readers an explanation of the researcher's conceptual paradigms in the forms of supporting theories or a theoretical framework. According to Camp (2000) theoretical framework can be defined as "a set of interrelated constructs, definitions, and propositions that present a rational view of phenomena by explaining or predicting

relationships among those elements" (p. 5). Merriam (1998) suggested that it is really the researcher's perspective. It was the "lens through which [the researcher] view[ed] the world" (p. 45).

The following presents the theoretical supporting frameworks of clinical reasoning, reflective practitioner, and the novice-to-expert continua. Each framework had a meaning in the clinical reasoning of respiratory therapists within the acute-care settings. They were the "lens" through which I looked at clinical reasoning.

Clinical Reasoning

According to Case, Harrison, and Roskell (2000), "Clinical reasoning is considered to be an integral component of clinical practice, and is a term used interchangeably with an assortment of synonyms such as clinical decision-making, clinical problem-solving, clinical judgment and clinical rational" (p. 14). The field of medicine more commonly used the term hypothetico-deductive clinical reasoning (Elstein, 1992a; Kovacs, 1999; Round, 1999); nursing literature primarily used the terms clinical reasoning or clinical problem solving (Benner, et al., 1999; Case, et al., 2000; Greenwood, et al., 2000; Robertson, 1996a, 1996b); and occupational (Mattingly, 1998; Neuhaus, 1988; Rogers & Masagatani, 1982; Ryan, 1995; Schell, 1994; Schell & Cervero, 1993) and physical therapists (Higgs, 1990; Higgs & Jones, 1992, 2000; Payton, 1985) seemed to favor the term clinical reasoning.

According to Higgs (1992), the expression "clinical reasoning can be defined as the thinking and decision-making process associated with clinical practice" (p. 575). Therefore, clinical reasoning is concerned with the cognitive elements of the clinical decision-making process and the contextual and pragmatic elements of the practice

affecting it. Case (Case et al. 2000), suggested that even though much literature on clinical reasoning has been written, "a unifying framework that incorporates all theories and concepts has yet to be established" (p. 14).

Elstein, Shulman, and Sprafka (1978a, 1978b) from the field of medicine were some of the earliest investigators of clinical reasoning. They focused predominantly on decision-making in diagnosis by exploring the clinical reasoning process of physicians, providing us with the hypothetico-deductive reasoning model of clinical decision-making. Taken by itself, it does not begin to provide a theoretical framework for all types of clinical reasoning. It does however provide a framework for scientific reasoning (Fleming, 1991). Elstein's early research conducted in the medical field was of great value in initiating an understanding of the clinical reasoning process of non-medical health care professionals.

Later, works from allied medicine's therapeutic fields, "suggested that this process …[of clinical reasoning]… appeared to have a number of additional components which had not been investigated in Elstein's initial research" (Case et al., 2000, p. 15). Several studies have shown that similarities did exist between the clinical reasoning involved in medicine and that of allied health care professions such as physiotherapy and occupational therapy (Fleming, 1991; Higgs & Jones, 2000; Payton, 1985). Case (Case et al., 2000) suggested that allied health professions include a larger psychosocial element in their practice as compared to their medical colleagues. An explanation for this may be that therapists placed less focus on diagnosis and seek to manage patients with a greater degree of holism (Payton, 1985).

Other methods of clinical reasoning drew from different theoretical frameworks. The following section provides the framework for these different types of reasoning. These included Schon's theory of Reflective Practitioner and Benner's theory of a Novice-to-Expert continuum.

Reflective Practitioner

Some of the earliest considerations of clinical reasoning were based on the works of Donald Schon (Schon, 1983), who studied the way practitioners think in action. His works suggested that much of what professionals did was guided by knowledge that has been gained from experience. He proposed that this practical knowledge was used in situations where individuals must make sense of and manage complex situations. His theoretical framework, of a reflective practitioner, formed the basis of practical reasoning.

Practical knowledge is considered the cornerstone of a reflective practice, allowing individuals to make decisions in complex and difficult situations because judgment is based on prior knowledge gained through experience. Also known as tacit knowledge about practice, it is knowledge individual use in their daily lives and without thinking about it. For Schon (1983), the key concepts to becoming a reflective practitioner were reflection-in-action and reflection-on-action. His work focused on the argument that clinical reasoning was not technical rationality, where reflection in action was seen as corresponding well with two major strands of research in the field of occupational therapy, scientific reasoning and narrative reasoning (Schell & Cervero, 1993).

Reflection-in-action is thinking about what you are doing, while you are doing it. Schon (1987) commonly used phrases such as "thinking on your feet" and "keeping your wits about you" to express reflection-in-action (p. 54). He suggested that recognition, movement, and gestures are so embodied in our daily use that an individual is barely aware of their presence (p. 53). Reflection-on-action is the process of thinking through a situation after it has happened.

According to Schon (1987), reflection on a situation results in behavior and commitments to action. In other words, by revisiting the situation an individual can reevaluate what should have been done differently, and then make plans to initiate what they would change the next opportunity if faced with a similar situation. Schon (1987) suggested that when "we think critically about the things that got us into this fix or opportunity, we may in the process of restructuring strategies of action, understand the phenomena, and…[new or different]… ways of framing problems" (p. 28).

Benner's work with novice and expert nurses also looked at reflection-on- action. She suggested that "this stepping back or being outside of the situation… [is]… important for the development of clinical knowledge" (Benner, et al., 1999, p. 9). This provides the opportunity for individuals to gain an understanding of what has just occurred, and to reflect on what could have been done differently or what can be done in an effort to learn from their experience.

Both Roger's (1983) and Mattingly's (1991a, 1991b) works on clinical reasoning closely followed Schon's model of cognitive processing. According to Schell (1994), "Reflective practice involves the use of theories and research based on knowledge to

consciously examine daily practice to identify ways to improve both the theories and individual practice routines" (p. 92).

Clinical reasoning from Mattingly and Roger's perspective is essentially' "the thinking that underlies the action taken in clinical situations and is based on facts, principles, and experiences" (Robertson, 1996b, p. 212). Today's health care individuals are expected to develop skills of reasoning within the clinical sites by combining theoretical information with clinical experience. According to Schell (1994), for health care givers, clinical reasoning is the point where theories and clinical practice meet.

Novice-to-Expert Continua

The Dreyfus Model of Skill Acquisition (1972) proposed that during the acquisition and development of skills, individuals pass through five levels of proficiency. Each level reflects changes in two general aspects of skilled performances. According to Benner (1982), the first is a movement from "reliance on abstract principles to the use of past, concrete experience as paradigms" (p. 402). The second involves a change in the individual's perception and understanding of a situation, so that it is "seen less as a compilation of equally relevant bits and more clearly as a complete whole in which only certain parts are relevant" (p. 402).

Several studies (Benner, 1982; Benner, 1984; Benner et al., 1999; Elstein, 1992a; Elstein, Shulman, & Sprafka, 1978a; Robertson, 1996b) have provided evidence to support the notion that performance differs between experts and novice. It is generally accepted that, "an expert is seen as having extensive knowledge and skill, but these attributes are elusive and difficult to measure" (Case et al., 2000, p. 15). Benner's works, (1982, 1984; Benner, et al., 1999) when considering the expert and novice performance,

described an expert as being one who has "enormous background of experiences, has an intuitive grasp of the situation, and zeros in on the accurate region of the problem without wasteful consideration of a large range of unfruitful possible problem solutions" (p. 405).

The novice-to-expert continua, as a theoretical or conceptual framework of clinical reasoning, has been used in several different disciplines of health care. Nursing (Benner, 1982; Benner, 1984; Benner et al., 1999), occupational therapy (Robertson, 1996b), physical therapy (Case et al., 2000), and medicine (Grant & Marsden, 1987) have all used this framework in work within their own discipline. These works were used as a form of guidance when evaluating respiratory therapist's clinical reasoning within the acute care setting. They provided a framework for looking at different methods of clinical reasoning used by therapists as they gain experiences and professionally move along the novice-to-expert continua.

Operational Definition of Terms

"Clinical reasoning", according to Higgs (1990) is defined as: the process of using thinking, interpersonal and clinical skills and knowledge in order to acquire, evaluate, and make sense of the mass of clinical information available to the health care practitioner during interaction with clients and thereby making, implementing and evaluating, in association with clients, clinical decisions which are relevant to [the] situation and the clinical problem (p. 13).

"Therapist" according to the medical dictionary, indicates one who is professionally trained in the practice of a particular type of therapy. Other than when a particular type (occupational, physical, or respiratory) is mentioned in this study, a

therapist designates ones who are concerned with the physical treatment of a disease or disorder (Dirck, 2001).

Significance of the Study

The results of this study have the potential to extend both knowledge and practice in respiratory therapy by contributing to the field's theoretical understanding of clinical reasoning and reflective practice. Such contributions are important because they: a) increased the field's understanding about higher order problem-solving, decision-making, and analytical skills in the clinical arena, b) provided a deeper understanding of types of critical reasoning skills required of therapists, and c) further explored of the nature of social context and effects on clinical reasoning.

The American Association for Respiratory Care's Education Committee in 1988 profiled an ideal respiratory care practitioner in terms of skills, attributes, and characteristics desirable by the end of the decade. Its purpose was to develop a strategy for educating respiratory care practitioners for the year 2001 and beyond. The Educational Consensus Conference Steering Committee (1992) believed the practice of respiratory care should be more patient-centered, requiring an improvement in such clinical skills as patient assessment and evaluation of therapeutics. Equally important for the respiratory care practitioner were improvements in "problem-solving, decision-making, and analytical skills" within the clinical arena (p. 68). The committee suggested that educators of respiratory therapists, whether post-secondary institutions or hospital developmental staff, should be mindful of the need to encourage the development of those skills.

Potentially, this study contributed to this educational need by identifying the methods of reasoning used by therapists, the difference clinical experience made, and the contextual issues, which facilitated or hindered the development of expert reasoning, thereby allowing reflection on decision-making skills by the therapists themselves, their manager, and educators. It also set in place the foundations for further research in these areas.

The social context of clinical reasoning has been addressed in several studies from the field of occupational therapy. Schell and Cervero (1993) suggested that when the learning and reasoning of a therapist are developed in an authentic context, they are more likely to be used. She wrote that this concept is consistent with situated cognition theory which is based on the concept that "mental activities are inherently shaped by the situation; learning that occurs in one context is not necessary transferred to another context" (p. 606). These findings are potentially important because of the alleged influence of social context on clinical reasoning in the fast paced acute care settings.

Mishoe's work (1995) suggested that respiratory therapists used critical thinking in their ability to prioritize, troubleshoot, communicate, negotiate, reflect, and make decisions. She defined respiratory therapists' critical thinking as "observation, experience, reflection, reasoning or communication as a guide to belief and action" (p. 13). Thomas-Goodfellow (1998) suggested that the therapists' experiences seemed to be the key to critical thinking among respiratory therapists, where both the personal and social nature of the experiences is equally important. This study expanded Mishoe's and Thomas-Goodfellow's work by defining the methods of reasoning used by respiratory

therapists as guided by their beliefs and actions, and by examining clinical reasoning from a more sociological aspect.

Summary

Respiratory therapists' practice is continually evolving. Theirs is a profession of changing scopes of practice, responsibilities, and technologies. Increasingly, their responsibilities require better patient assessment and more clinical-problem solving skills in critical situations within the acute care centers.

Therapist-driven protocols, which is technical rationality, are well written guidelines providing direction for reasoning in situations like that described by Schon's (1987) "high, hard grounds". However, it was clinical reasoning within the every-day practice that guided those decisions actually made in what he refers to as the "low, swampy grounds" where clinical situations are messy, confusing, and complicated.

Benner's novice-to-expert continuum provided a description of reasoning by novice, competent and experts. Her works (1982, 1984) presented characteristic descriptions of the reasoning processes for each stage. This theory provided a theoretical bases for research regarding clinical reasoning in both occupational and physical therapy.

The focus of this study was to determine if respiratory therapist used clinical reasoning in their practice, within the acute care settings, similar to that described in the literature. If so, then determine which types of reasoning they used with different task or activities, if there was a difference in the types of reasoning used by novice, competent, or expert therapists, and what contextual issues facilitate or hinder their development of good clinical reasoning skills.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

In this section, a review of professional literature related to clinical reasoning is presented. The literature reviewed in this chapter was salient to the study and the research questions identified at the beginning of this doctoral study. This chapter introduced clinical reasoning, considered its history, nature, different types, and proposed the theoretical underpinning of clinical reasoning, reflective practice, and the novice to expert continua.

History of Clinical Reasoning

Research concerning clinical reasoning began in the fields of medicine in the 1970s and later moved into nursing and the allied health fields. Occupational therapy began its inquiries as early at 1982, subsequently physical therapy and now respiratory therapy have followed. The jobs of health care workers, whether in medicine, nursing, occupational, physical, or respiratory therapies involves the reasoning required to solve clinical problems.

The terms clinical decision-making, clinical problem solving, and clinical reasoning have been used interchangeably and individually in literature. The term most often used in the medical educational literature (Kovacs, 1999; Round, 1999) is "clinical decision-making" which emphasized the diagnostic decision-making process. Nursing (Benner, 1984; Case et al., 2000; Greenwood, 1996; Greenwood et al., 2000), along with allied health professions in fields as occupational therapy (Barris, 1987; Robertson,

1996a, 1996b; Schell & Cervero, 1993) and physical therapy (Higgs, 1990; Higgs & Jones, 2000; Terry & Higgs, 1993) used the term "clinical problem-solving" more often in their literature. The term "clinical reasoning" was most frequently used in Occupational Therapy (Fleming, 1991, 1994; Mattingly, 1991; Mattingly, 1991b; Rogers, 1983; Rogers & Holm, 1991; Schell, 1994; Schell & Cervero, 1993) to focus on the cognitive process associated with the management of clinical situations (Higgs, 1990).

Clinical reasoning in its broadest sense is the internal thinking associated with the decision-making process related to clinical practice. It involves different methods of thinking for different purposes in response to particular features of clinical problems. Clinical reasoning according to Higgs (1990) is defined as:

> The process of using thinking, interpersonal and clinical skills, and knowledge in order to acquire, evaluate, and make sense of the mass of clinical information available to the health care practitioner during interaction with clients and thereby making, implementing and evaluating, in association with clients, clinical decisions which are relevant to [the] situation and the clinical problem (p. 13).

From this definition, it is more than the application of a theory, because it results in an action. It is the "figuring out" of how to act, or what course of action to take. It involves deliberation about a particular patient-related problem, what the appropriate action should be, given a particular case and at a particular time (Mattingly & Fleming, 1994, p. 10). A respiratory therapist has many clients in the acute care setting, such as the many physicians associated with a particular patient, nurses who are taking care of that patient, the patient's family members, and especially the patients themselves.

Mattingly and Fleming (1994) suggested that clinical reasoning is more than just the application of theory to a clinical problem, because it also results in an action. They described it as the "figuring out" of how to act, or what course of action to take in a specific circumstance. They believed it was more like wisdom than competence because it "involves deliberation about a particular patient related problem, what the appropriate action is, in a particular case, and at a particular time" (p. 10).

According to Fleming (1991), clinical reasoning involves several different forms of thinking. To add to the complexity of understanding clinical reasoning, she suggested it could not be reduced to a method (or even methods) of thinking, because it is also a "way of perceiving" (p. 1008). She believed that therapists use a variety of different "reasoning strategies" for different purposes or in response to particular features of the clinical problems they encounter (p. 1007).

One way to understand clinical reasoning is to differentiate it into its individual methods of reasoning. For example, scientific reasoning provides a grounding in the sciences, which is essential for practice, but does not begin to explain the intricacy of clinical interventions. Practical reasoning, although more elusive and less universal than scientific reasoning, may provide a better explanation of other reasoning strategies necessary for finding solutions to complex and difficult clinical problems. Collaborative reasoning explains the work of therapists working within teams. Narrative reasoning allows therapists to make sense and share the work they do with others.

These and other methods of reasoning are explained in more detail later in this chapter. First, it is important to understand the psychological and sociological constructs of clinical reasoning. Because at the present time no one theory has been developed

which incorporates all types of clinical reasoning and it is important to understand some of the salient theories from which it has risen.

The Psychological Constructs of Clinical Reasoning

This phenomena, whether called clinical reasoning, clinical decision-making, or clinical problem-solving draws from a combination of different disciplines, some of which are closely aligned and others which are more distant. The following portion of this chapter provided an overview of different theories of clinical decision-making from a psychological perspective. These theories included the Information Processing, Nuernberger's Structures of Mind, Intuition, Hypotheico-deductive, Elstein's Problem Solving, Schema, Constructivist Learning, Cognitive Strategies, Knowledge Storage and Retrieval, and Social Learning, all from the field of cognitive psychology. Over the years these theories of problem solving have evolved from the focus being on an observable, behavioral manifestation to that of an underlying cognitive process.

Information Processing Theory

Information processing, from the field of cognitive psychology, describes those areas of clinical practice not fully explained by the use of experimental and/or inductive decision-making theories. Rather it explains the differences in how novice and expert clinicians process clinical information. The work of Patel and Groen (1991) suggested that novice and expert reasoning involved a different cognitive process. They suggested that experts use strong heuristics and forward reasoning starting with a hypothesis, and then proceed to find the solutions to the problem. In contrast, novices use backwards or deductive reasoning where they start with a hypothesis, then search to find facts that support the hypothesis; and then they begin searching for a solution. Other researchers

from the fields of medicine (Schmidt, Norman, & Boshuizen, 1990), nursing, (Benner, 1982; Benner, 1984; Benner et al., 1999) and occupational therapy (Fleming, 1991, 1994) noted similar findings within their clinical settings.

Clinical reasoning, according to Schell (1994) suggests a process not purely scientific, but rather one that is more elusive and influenced by experience, and where different individuals have different expertise. Both Schmidt and Benner's works documented stages of development from novice to expert, which were similar to Fleming's procedural tracts (Mattingly & Fleming, 1994) where reasoning is heavily influenced by an individual's memory.

For the experienced clinicians, much of their work involves working with new patients who strongly resemble patients they have previously seen. According to Groen and Patel (1985) expert reasoning may be based on pattern recognition from a well-structured network of stored knowledge.

Nuernberger's Structures of Mind

Nuernberger's theory Structures of Mind (1994) a similar theory of development focuses on the power of reflection. He observed that the mind is typically scattered and through the process of paying attention, or focusing our mind, the concentration is increased and it becomes more powerful, and therefore more reflective (p. 240). Nuernberger's four types of reflective knowledge include, (a) spiritual knowledge, (b) intuitive knowledge, (c) instinctive knowledge, (d) analytical, or sensory knowledge. Spiritual knowledge, he considered almost mystical allowing for what he calls a "transformational experience" which can "alter the identity of the individual and

eventually lead to wisdom" (Nuernberger, 1994, p. 109). He believed that, through this modification of the mind "awareness" that knowledge and wisdom develop.

Nuernberger (1994) believed that "intuitive knowledge" occurs as one gains, "insight into the real consequences of our action" (p. 109). He suggested that it involves the power to discern cause/effect relationships and subtle movements of change; where both the formation and access of intuitive knowledge depends on the individual's ability to focus their attention. According to him, one of the critical factors of intuitive knowledge is that, "It does not depend on analysis, logic, or intelligent guessing. Thinking may facilitate or interfere, but is not a necessary component" (p. 110).

Instinctive knowledge, according to Nuernberger (1994) is based on "the subliminal perception, related to the essence of our own persona or being" and is "the knowledge we responded to long before we are even aware of any specific sensory information such as what we see or hear" (p. 110). Nuernberger cautioned that "we can be mislead by our instincts when we confuse them with emotional needs, wants, and fears" or through the lack of our "own awareness" (p. 110).

He suggested that "sensory knowledge", which is gained through hearing, seeing, and feeling, could be limited by "distorted emotions, poor memory, and even faulty sensory mechanisms" (1994, p. 110). Merriam (1999) cautioned that sensory knowledge "is influenced by the conventions of the world around us" because it is "contextual in nature" (p. 240).

Intuition Theory

Intuition theory, another theory with its roots in experience and recognition, primarily from the nursing literature, deals with the recognition and understanding of

patterns and similarities known as schema or illness scripts, within a clinical situation. This recognition and understanding of the relation of a present case to a similar previous case allows practitioners to make clinical decisions based on experience. Benner (1999) described intuition as the, "direct understanding of particulars in a situation without deliberation, awareness, or articulation" (p. 568). Schell (1994) suggested that this "commonsense understanding" allows for flexible understanding of many situations within the health care culture (p. 40). In other words, having an intuitive grasp of a situation is a subconscious awareness based on similar or dissimilar background experiences. This theory is also elusive, difficult to document, and is associated with the novice-to-expert continuum.

The Hypothetico-deductive Reasoning Model

Hypothetico-deductive theory, also known as hypothetical or prepositional reasoning, first described by Newell and Simon (1972) proposed that experts such as physicians use stages or sequences of events when solving problems. According to Higgs and Jones (2000) it "involves both inductive reasoning (moving from a set of specific observations to a generalization) and deductive reasoning (moving from a generalization to a conclusion) in relation to a specific case" (p. 5). In other words, inductive reasoning is used to generate hypothesis and deductive reasoning is used to test the hypothesis. According to Higgs and Jones, the strength of deductive reasoning is in the ability to reach a conclusion in clinical situations, which have vague data, and its weakness is the uncertainty of a conclusion.

Medical decision-making literature (Allen, 1998) suggested clinical reasoning is a process of generating and testing hypotheses by collecting and analyzing information

about the patient's condition. This occurs when a generated hypothesis is tested and the most appropriate diagnosis and treatment are determined on the basis of the data available at the time. Critiques of this early model (Elstein, et al., 1978b; Gale & Marsden, 1982) suggested that an alternative model exists; where clinicians began data analysis while they were collecting it rather than after data collection had been concluded (Higgs, 1992).

Elstein's Problem Solving Theory

Elstein and his colleagues (1978a) examined the decision-making theory while studying the problem-solving skills of novice and experts in the field of medicine. Elstein's team was among the earliest researchers of clinical reasoning. Initially, he thought that good clinical reasoning was effective problem solving though the use of critical thinking skills. In his work on clinical problem solving, he expected to identify general strategies in experts that could be taught to novices (Elstein, 1992a). Instead he found that experienced clinicians rarely used general problem solving strategies. According to Schell (1994), this led him to develop an "increased respect for domain specific knowledge, [when] combined with effective decision making skills" which led to his explanation of the expert clinical practitioner (p. 35).

According to Robertson (1996b), Elstein and his team focused on the diagnosis of patients, and did not take into account the reasoning surrounding management of treatment decisions. It is because of this, she suggested using caution when generalizing this theory as a basis for clinical reasoning to non-medical therapeutic health care professions, which may be less focused on diagnostic issues than therapeutic issues. Rogers (1983) and Fleming (1991) saw Elstein's perspective of clinical reasoning as

simply a method of applied science. Schell (1994) suggested his view was "prescriptive in nature" and "primarily a form of probabilistic thinking" (p. 36).

Robertson (1996a) suggested that the theoretical bases of probabilistic thinking or problem solving are simply information processing which focuses on "describing the components of the problem representation" (p. 178). In other words, a diagnosis is a calculated probability using a probabilistic description of the problem, where clinical therapeutics is the management of that problem.

She suggested that in any investigation of problem solving, such as clinical reasoning, it is important to understand how the individual constructs the problem. This representation of the problem is a product of both their personal and environmental factors. In other words, how therapists construct the problem determine which type of clinical reasoning they choose to solve it (Robinson, 1996a).

Schema Theory

Schema theory suggests that the human mind unconsciously and effortlessly constructs mental images or concepts of the experiences they encounter in repeated, everyday situations (Greenwood, Sullivan, & McDonald, 2000). This allows for recognition of these concepts as a type of stimuli, and thereby eases the planning and executing of the appropriate responses. According to Greenwood, et al., (2000) these concepts are then chunked together into larger bodies of knowledge known as schemata (singular: schema). Each person's schemata allows them to manage their worlds by knowing what their own appropriate responses should be, and permits them to predict the responses of others (Greenwood et al., 2000, p. 1107).

The schema theory has its roots in Vygotsky's dialectical constructivism, which focuses attention on the importance of social interactions in the development of knowledge and thought patterns. A dialectical perspective of constructivism centers on the interaction of both internal and external factors (Burning, Schraw, and Ronning, 1999). Furthermore, Schon's (1983) perspective on cognitive development placed importance on the construction of tacit knowledge, which he describes as a spontaneous intelligence, in the form of familiar scripts.

Constructivist Learning Theory

Constructivist learning theory, in its broadest sense, involves a process whereby the learner builds his or her own mental structures when interacting in a particular environment. It can be further defined as either "exogenous constructivism" based on the perception that knowledge exist at an abstract level and develops through cognitive activity, not necessarily mirroring external reality, or "dialectical constructivism" which places knowledge at the interactions between learners and their environments (Burning et al, 1999, p. 216).

According to Burning et al., (1999) the perspective of dialectical constructivism is closely linked to "contextualism", a philosophical point of view, which suggest that thought and experience are intertwined with the context in which they occur. It focuses attention on the interaction between internal and external factors, by placing a strong emphasis on the learner's social interactions in cultural context. This aligns it with social cognitive theories and Schon's (1983, 1987) theory of Reflective Practitioner.

Much of the work one does in the clinical setting is self-directed, and when actively searching for the solution to a clinical problem, the work is oriented towards

actual discovery of the problem. The aspects of cognitively searching for a problem and its solution involve thought within social context, the reflection of previous actions, and the construction of new knowledge when a solution is found. A therapist spends countless hours of their time pondering over clinical problems, searching for solutions. In fact, they routinely check on patients, consciously and unconsciously, looking for clinical problems requiring solutions.

Cognitive Strategies Theory

Case, et al., (2000), building on the works of others (Greenwood & King, 1995), has shown how organization of the knowledge base occurs with clinical experience. Greenwood and King (1995) reported that nurses construct their knowledge stores through the interaction of what they are currently experiencing. This results in thinking processes for experienced practitioners that are qualitatively different from those with less experience. Similarly, research from the field of occupational therapy (Robertson, 1996b), demonstrated that "novices had access to similar knowledge bases as advanced clinicians, but those of the advanced clinicians were more defined and structured with respect to the clinical problems they habitually encountered" (p. 213).

Knowledge Storage and Retrieval Theory

According to Case (2000), the discipline of cognitive psychology has promoted the belief that knowledge structure plays a significant role in the understanding of differences in behaviors. She believed that "expertise depends [not only] on knowledge but both the organization and quantity of knowledge are important" (p. 15).

It is a general conception among studies that experts have superior bases of organized knowledge (Glaser, 1984; Grant & Marsden, 1987). Case (2000) suggested that

the size of the knowledge base constitutes only one factor in clinical reasoning, and storage systems capable of permitting ready access to an extensive knowledge base are also important." (p. 16). According to Case this "ready access" is gained though extensive experience within a specific domain (p. 16).

Social Learning Theory

The social learning theory, from a psychological perspective, relates to social interactions within the clinical setting and calls attention to the interpersonal skill of imitation and modeling where the process becomes a source of learning. Bandura's social cognitive theory also considers how self-confidence, behavioral and social factors, affects an individual's learning.

Bandura's works (1986) suggested that learning was based on a relationship of personal, behavioral, and environmental factors. Personal factors such as an individual beliefs and attitudes, behavioral factors which take into account the individual's response in a given situation, and environmental factors that considers the roles played by others all influence learning.

According to Bandura (1986) learning occurs two ways. First, enactive learning occurs when an individual learns a task by doing it; where performing the task successfully over and over provides individuals a high-level of self-efficacy. According to Bruning (1999), self-efficacy is the "judgment of ones ability to perform a task within a specific domain" and should not be confused with self-esteem (p. 130). This type of learning enables individuals to develop the necessary skills to perform a task, and builds a repertoire of both good and bad experiences of task performance.

The second, vicarious learning occurs when individuals learn about a task from observation of others performing or discussing it. This learning facilitates the distinction of subtle differences in performances long before individuals are capable of performing the task themselves. He suggested that this type of learning provides an opportunity to view the task performed without interruption and it also provides motivation for less-skilled individuals.

These perspectives are by no means exhaustive of all the psychological constructs in which clinical reasoning may have roots. The previously mentioned theories provided an underpinning of clinical reasoning from the psychological perspective for the essential literature of clinical reasoning discussed later in this chapter. However, clinical reasoning also has a foundation in sociological constructs and the following portion of this paper provided a discussion of those.

Sociological Constructs of Clinical Reasoning

The following portion of this chapter provides an overview of different theories of clinical decision-making from a sociological perspective. These theories included the Domain Specific Cognition Theory, Situated Cognition Theory, Cognition and Social Language Theory. They provided an underpinning of clinical reasoning from the sociological perspective. A therapist's practice in an acute care setting involves many different people, different social interactions and situations, clinical problems and solutions. Schell's works (1993, 1994) were among the first to look at the sociological aspect of clinical reasoning.

Barbara Schell's (1994) research, focused on individual experience, institutional, and cultural contextual aspects of clinical reasoning. Clinical reasoning from a social

perspective is heavily dependent on the context in which it occurs. Gambrill (1990) cited the following point:

> Either a broad or narrow view can be taken concerning factors that influence clinical decision-making. The narrowest view focuses only on the interaction between clients and clinicians….an understanding of the variables that affect clinical decisions requires a much broader exploration of environments past, present, and future (p. 26).

Domain Specific Cognition Theory

Domain specific cognition theory proposed that an expert's broad knowledge base develops through extensive experience, which facilitates their recognition of patterns or themes (Allen, 1998). This theory suggests that an expert's more efficient cognitive process permits them to arrive at the solution to a problem much easier than a novice. Allen (1998) examined the differences between medical students, residents, and expert physicians to understand how clinical evidence is gathered and evaluated during diagnostic decision-making. His results showed that it was the "earlier generation of accurate hypotheses" in the medical experts that differed from the students and residents (p. 91). Their ability to generate an accurate hypothesis sooner was the result of more extensive and intensive previous experience.

Situated Cognition Theory

Cognition and context in activity theory of learning was conceptualized by Lave (1988) where learning and cognition are processes of a person interacting with in their environment. Her research of an individual's cognitive nature in everyday life challenged the traditional assumptions of learning transferred from school-based learning to

everyday environments. She believed that an individual's everyday activity was evidence of cognition that "stretched across mind, body, activity and setting" (p. 18). This dialectical approach went beyond the cognitivists, who looked only at a person, or the phenomonalists, who look only at the interaction, by looking at the environment or context as well.

Lave's levels of context (1988) suggest that context should be considered as at least two different constructs. Those constructs that were "physically, economically, politically, and socially organized space-in-time" she labeled an "arena" (p. 150). The "repeatedly experienced, personally ordered, and edited versions of the arena" she termed "settings" (p. 151). The cognitive interactions occurring between an individual and an arena is the setting, and this setting has an influence on reasoning. For example, a therapist's solid clinical reasoning may be accepted or rejected by individuals in different arenas, and the therapist's own edited version of that acceptance or rejection of their clinical reasoning defines the "setting" of their clinical reasoning.

Anthropologists Lave and Wenger (1991) conducted a number of ethnographic studies of apprenticeships in an effort to determine what it was about an apprenticeship or internship that was so compelling as a learning process. Their conclusions resulted in their coining the term "legitimate peripheral participation" to characterize learning, where an individual's participation and identity transformation are the result of participation. Wenger later expanded the meaning to include "characterizing the process by which newcomers become included in a community of practice" (Wenger, 1999, p.100).

Wenger believed that learning took place through modification, in the forms of individual participations, which open the practice to new nonmembers. He argued, the

two types of modification required to make actual participation in a community of individuals possible were "legitimacy" and "peripherality" (Wenger, 1999, p. 100). To open up practice for a new member (the learner), Wenger suggest, the community must provide the opportunity for newcomers to have mutual engagement with other members of the community, to be exposed to the members' actions, the negotiation of their activities, and provide a sense of how the community operates.

In order for a newcomer to become a member of a community, they must be on an "inbound trajectory", and granted enough legitimacy to be treated as a potential member (p. 100). Sometimes this legitimacy involves sponsorship or apprenticeship where a master in good standing is required to facilitate the movement of the newcomer into the practice. In the clinical environment of the acute care setting, this sponsorship can include, but is not limited to, fellow therapists, educators, supervisors, administrative or medical directors, physicians, and nurses.

Situated cognition theorists (Brown, Collins, & Duguid, 1989) agreed that the cognitive activity of clinical problem solving couldn't be separated from the social context in which it occurs. They argued that knowledge and the process of learning are viewed as "a product of the activity, context, and culture in which it is developed and used" (Brown, et al., 1989, p. 32). Schell's research (1994) in clinical reasoning suggested from this definition several concepts of cognition could be identified. According to her, these "include the dialectical nature of cognition and activity, conceptualizations of levels of context, and the relationship of cognition and language" (p. 48).

Cognition and Social Language Theory

Cognition and social language theory is the concept of the familiar commonalities within a group that shapes what an individual voice can say (Wertsch, 1991). According to Schell (1994), the concept of a social language is helpful in understanding how reasoning is socially determined (p. 52). There are many patient problems within the clinical settings, which do not require the involvement of a respiratory therapist. In these situations, it is common sense that a therapist has no say about the reasoning involved to solve the problems. However, there are also situations or arenas where a therapist may be the more qualified individual to make a clinical decision and yet it be socially determined that someone else do the problem solving and make the decision. Both of these situations help determine the types of clinical reasoning done by the respiratory therapists within these clinical setting.

Sociological constructs provide an underpinning for the social aspects of clinical reasoning. These provided the framework for much of the more recent works in clinical reasoning mentioned in the next part of this paper. It also provided the reader an insight into the essential literature about clinical reasoning.

Essential Literature of Clinical Reasoning

One cannot begin to talk about the essential literature that explains clinical reasoning in allied health without going back to the original works of Rogers and Masagatani (1982), and Mattingly and Fleming (1991). It was Rogers and Masagatani who originally acknowledged that an occupational therapist's approaches to clinical reasoning did not resemble the systematic steps used in scientific thinking (p. 215).

Rogers and Masagatani concluded that although scientific reasoning had contributed to the field, it did not fully explain a therapist's clinical practice. Furthermore, the clinical assessments done by occupational therapists moved from patient assessment to reviewing, selecting, and implementing a treatment option. Where their "scientific mode of reasoning gave way to nonscientific intellectual process" (p. 610). They saw clinical reasoning as "thinking that guides practice" where the goal was simply to recommend a treatment for a particular patient (p. 601). This view of clinical reasoning focused primarily on the cognitive processing model representative of scientific methodology.

Fleming (1991) later proposed a reasoning theory of occupational therapists with a three-track-mind. She believed that their clinical reasoning in practice involved the integration of three reasoning processes; procedural, conditional and interactive. Therapists would almost simultaneously use these types of clinical reasoning by rapidly shifting from one method of reasoning to another depending on which aspect of the clinical problem attracted their attention.

Mattingly (1991), unlike Rogers, suggested that clinical reasoning occurred throughout the treatment process instead of just at the initial assessment phase. As a student of Schon's work, she saw clinical reasoning as more than a reason for treatment; instead, she saw it as a form of practical reasoning directed toward an action. She suggested that clinical reasoning was a "largely tacit, highly imagistic and deeply phenomenological mode of thinking" (p. 979). She acknowledged that scientific reasoning was an important part, although a small part, of clinical reasoning when addressing the biomedical issues.

Mattingly (1998), building upon Bruner's works (Bruner, 1986), suggested that therapists utilize narratives when they need to understand or relate to events that require them to comprehend "inner worlds of desires and outer worlds of observable actions" (p. 258). Narratives offer explanations to clinical problems for therapists. Schell (1993, 1994) built upon the work of authors such as Lave (1988, 1991) and Wenger (1999) when looking at the social aspects of clinical reasoning. Her works combined both the psychological and sociological perspectives of clinical reasoning.

From the field of nursing, Benner (1984) like Schon wrote about the tacit nature of professional expertise. Mattingly (1991) repeated this concept when she suggested that many times "words fall short of practice" as she explained how the "gap between what we know and what we may actually say grows as we gain professional expertise" (p. 979). Therapists as professionals become socialized into their own culture; much of what is seen or done with patients becomes unconsciously embodied in their practice.

The Nature of Clinical Reasoning

Clinical reasoning always results in a clinical judgment, followed by a clinical action, even if the judgment is to do nothing at all. It requires that the therapist respond to situations as they unfold. According to Benner (Benner et al., 1999), clinical reasoning is considered a "clinical judgment" because certainty is missing. She suggested, it is here that, "reasoning and judgment are required, to act in situations that are ambiguous, somewhat underdetermined, unexpected, or markedly different from an assumptive set (preconceptions)" (p. 24).

Benner and her colleagues (1999) suggested that a therapist's best account of a clinical situation and best clinical judgment under circumstances of uncertainty is based

on that individual's own "interpretive process" (p. 6). According to them although certainty is sought in clinical reasoning, it is seldom achieved in actual clinical practice situations.

It is through extensive experience that the expert practitioners learn what it is like to have a good understanding or grasp of the clinical situation, or what it feels like to be confused or lack a grasp of the situation. Benner and her colleagues proposed that, "even a temporary loss of grasp of the situation [clinicians] initiate a search for clinical understanding or puzzle solving (p. 24)." This searching for a greater understanding of a clinical situation may be so imbedded in their daily practice that the therapists are unaware of their own reasoning and action.

Different Types of Clinical Reasoning

The major portion of work about clinical reasoning in the allied healthcare setting has come from the field of occupational therapy. Rogers (1983) first associated clinical reasoning with a single process. Subsequently, others followed (Mattingly 1993; Fleming, 1991; Neistaid, 1987, 1992; Schell & Cervero, 1993; Schell 1994), revealing several different types of clinical reasoning.

Fleming (1991) described clinical reasoning as "multiple modes of thinking" where each form of reasoning is for a particular purpose, or in response to a certain aspect of the clinical problem (p. 1007). Mattingly (1993) suggested that clinical reasoning is a type of practical know-how based on theoretical knowledge, and proposed "theory was not enough because clinical reasoning results in action" (p. 10).

Mattingly (1993) went on to suggest that clinical reasoning was actually closely related to Aristotle's ancient concept of practical reasoning, where reasoning resulted in

an action. It involves a process of considerable thought about "what an appropriate action is in this particular case, with this particular patient, and at this particular time" (p. 10). It more precisely is knowing how to rightly act in a particular case. Even though theories can direct practice in general, the necessity of an action is deemed by an individual case.

According to Mattingly (1993), the models of professional reasoning, when treated as an applied science, presumes that "the worker should simply identify which means will best get to the required ends [solution], and is often referred to as technical rationality" (p.11). Technical rationality occurs where "the ends" are not being questioned because they have already been decided. In real clinical situations "the ends" are not always known; at best they are strived for.

The following portion of this chapter provided an overview of nine different methods of clinical decision-making. Because the objective of this study was to determine which types of clinical reasoning respiratory therapists use, the following provides explanations of each type.

Scientific or Theoretical Reasoning

According to Mattingly and Fleming, (1994) theoretical or scientific reasoning is concerned with the general, … what is reliable or predictable in any given specific case or circumstances. It gives useful insight into a broad range of situations. It is concerned with the discovery of universal relationships, especially probabilistic laws. They suggested that this type of reasoning could be effectively gained from use of textbooks, didactic lectures, or classroom situations. Whether from the field of medicine, nursing, or allied health, a strong scientific knowledge base is important part in the reasoning that solves patient related clinical problems in the fields of health care.

According to Mattingly (1993), scientific or theoretical reasoning differs from practical or logical reasoning "because it is concerned with what one can predict" (p. 10). According to Benner (Benner et al., 1999) scientific reasoning is problem solving which yields an absolute "yes" or "no" answer (p. 5). Fleming (1991) also described scientific reasoning, some times termed theoretical reasoning, as being much like the rational model of cognitive processing where the development of hypothesis is followed by data collection to either prove or disprove the hypothesis. Rogers and Holm's (1991) described diagnostic reasoning as a type of scientific reasoning, in "being concerned with clinical problem sensing, and problem definition" (p. 98).

Fleming (1991) revealed that therapists use this form of clinical reasoning, but in different ways than physicians. Physicians used this method of reasoning to diagnose a disease, hence diagnostic or scientific reasoning of a clinical condition. While using this method of problem solving, both occupational and physical therapists already know the diagnosis or condition when they see the patient. Their task becomes knowing about the disease or clinical condition and the specific details of performance. Fleming (1991) also noted that the amount of clinical experience influences the use of this strategy.

This type of reasoning, whether termed scientific, theoretical, hypothetical-deductive, or diagnostic reasoning involves the collection of initial information, and the compilation of preliminary hypotheses, which results in impressions or interpretations of possible diagnoses and/or problems. The initial hypothesis is usually fairly broad and it guides further examinations, tests, or inquiries. The clinician's hypothetical diagnosis is either rejected, accepted, or the initial hypothesis is refined and followed by more examination, testing or inquiries. Hypothetical-deductive reasoning can be further

separated into two distinctive types of reasoning; inductive or forward reasoning and deductive or backward reasoning.

Forward reasoning, also termed inductive reasoning or probabilistic reasoning, involves the moving from a set of specific observations to a generalization. Higgs and Jones (2000) suggested that it is called probabilistic "since a conclusion is reached… [concerning a diagnostic hypothesis]… on the basis of the probability of that conclusion in relation to the evidence available at the time" (p. 5).

It is also pattern recognition, where initial cues elicit a solution or diagnosis. According to Elstein (1992), this requires a highly organized and structured knowledge base which enables experienced clinicians in familiar situations: bypassing the reasoning process to solve problems. This is considered to be a characteristic of expertise. It is considered efficient and fast, but it also relies on a sound, well-organized knowledge base. According to Mattingly (1993), expert clinicians quickly point out that they "know more than they can tell" and often could not explain or justify an elusive practical wisdom when ask about reasoning in their own clinical practice (p. 10).

Backward reasoning, or deductive reasoning, according to Robertson (1996a) is a method of clinical reasoning where the individual tries to solve problems by trying one solution at a time. Using hints from the problem, they start with "one step toward the solution, evaluating whether or not it works and then either rejecting it or attempting a further step towards the goal" (p. 180). According to her, this method of trial and error problem solving, which is primarily used by the novice, differs from that of experts because of their lack of clinical experience and ability to remember patterns or schemes of disease processes and treatment outcomes.

According to Case, the novice may also return to clinical data for support facts to prove their hypothesis (Case et al., 2000). This is also described by Higgs and Jones (2000) as "re-interpretation of data or the acquisition of new clarifying data in order to test a hypothesis" (p. 6). In this form of clinical reasoning, the therapist will only begin to search for a solution to the problem after the supporting facts have been found. Although the information base of a novice may be very similar as that of an expert, the process of finding a solution to a problem is different.

Roberts (1996) cautioned the use of Elstein's model, which focused on diagnosis as an overall theoretical framework for clinical reasoning among non-medical health workers, because it did not take into account reasoning surrounding treatment management decisions. Even though the discovery of a problem is an important part of the clinical reasoning, it is only a small portion of the reasoning to find a solution to that problem.

Procedural Reasoning

Fleming (1991) described procedural reasoning as a systematic strategy similar to the hypothetical reasoning typically described in the medical problem-solving literature. It is used when searching for "techniques and procedures that can be brought to bear on the physical problem" (Mattingly, 1994, p. 119). In this form of reasoning, therapists "think about the disease or disability and decide which activities (procedures) they might employ to resolve the person's performance problems" (p. 108). When they consider a person's physical ailments and what "procedures" might be taken to alleviate or remedy them, the identification and treatment selection results in an action, which is seen as the central task of clinical reasoning.

According to Fleming (1991) this method of reasoning requires that the therapist not only decide on a treatment; they must then take actions to solve the problem. While procedural reasoning is the most familiar reasoning strategy, in clinical practice it is usually combined with other strategies.

Inductive Reasoning

Inductive reasoning is also considered pattern recognition associated with both the hypothetical-deductive reasoning (Elstein et al., 1978) and schema theory (Greenwood, et al., 2000). It involves forward reasoning, only the first half of hypothetical reasoning, and does not include practitioners searching for confirming results of the hypothesis before beginning to solve the clinical problem.

According to Higgs and Jones (2000) this pattern recognition can also be thought of as pattern interpretation. They believed that the inductive reasoning, or forward reasoning, of experts resembled "pattern recognition or direct automatic retrieval of information from a well-structured knowledge base" (p. 6). They suggested that this method of reasoning is characterized by speed and efficiency, and more commonly occurs when experienced practitioners are dealing with familiar cases.

Pattern recognition involves the grouping of objects or events into large and larger categories or schemas. According to Higgs and Jones (2000) it involves the recognition of signs and symptoms or treatment options and outcomes from previous similar cases. They suggested that an important aspect was the "link made by clinicians between the context of the condition, events or situations of previous cases" (p. 6). They also believed that practitioners' experiences resulted in the development of "abstract associations which conveyed meanings assigned to symptoms and signs or schematic relationships

consisting of links between clinical features"(p. 6). The importance in this is that it allows the practitioner to interpret data, signs or symptoms or recognize patterns and match them against previously learned abstracts rather than a specific instant which would be difficult to match (Higgs and Jones, 2000).

Fonteyn and Fisher (1992) connected nurses' experiences with intuition or the use of advanced reasoning patterns or heuristics. According to Higgs and Jones (2000) the use of "intuitive skills in clinical reasoning and intuitive knowledge have been also linked to past experiences with a specific knowledge" (p. 7). They suggested that this intuitive knowledge is another way of describing instant scripts, which can be used subconsciously in inductive reasoning.

Inductive reasoning as script recognition, as mentioned earlier, also has both strengths and weaknesses. It lacks certainty in the conclusions reached, but it also allows for conclusion to be made from imprecise and limited data (Higgs & Jones, 2000). In the field of health care, practitioners would prefer to deal with medical and scientific exacts and certainties, unfortunately that is not always the case.

Interactive, Predictive, or Conditional Reasoning

Interactive or conditional reasoning involves shared decision-making between the therapists and their clients. Mattingly (1993) suggested reasoning of these types is a complex form of social reasoning used by occupational therapists to help the patient reconstruct a life, which has been permanently changed by an injury or disease.

Higgs and Jones (2000) suggested that this type of reasoning occurs as a deliberate dialogue in the form of a social exchange between therapists and their clients. It enhances or facilitates the assessment/management process by providing an "effective

means of better understanding the context in which the patient's problem(s) exist while creating a relationship of interest and trust" (p. 8).

Therapists must think about the condition as a whole, including the person, the illness; the meaning the illness has for the person, the family, and the social and physical contexts in which a person lives. Conditional reasoning first identified by Mattingly and Fleming (1994) brings together the whole picture, by enabling the therapist to imagine past, present, and future revised conditions for their patients. It involves both the logic and nonlogical methods (such as imagination and intuition) placing the patients in both current and possible future personal, social and cultural contexts (p. 1011).

This type of reasoning as described by Fleming (1991) occurs during therapist-client interactions in treatment sessions and increases the therapist's understanding of the client's situation (p. 1010). The therapist may simply want to know what the patient is like as a person, in an effort to understand the illness experience from the patient's point of view. Schell (1993) suggested this process serves many needs for the therapists by allowing them to "gain a phenomenological perspective of the patient's illness experiences, to more finely match treatment choice with patient preferences, gain trust, share meaning, and to check on the progress of the treatment" (p. 608).

Higgs and Jones (2000) used the term predictive reasoning synonymously with conditional reasoning. They suggested that it was the part of reasoning that also, "estimated patient response to treatment and likely outcomes of management, based on information obtained through patient interview, physical examination and response to management" (p. 8).

Narrative Reasoning

Narrative reasoning is considered one of the basic foundations of clinical reasoning in occupational therapy. Narrative thinking is intimately tied to our ways of making sense of our experiences. It involves the use of stories concerning past or present patients to help therapists understand and manage clinical situations. According to Schell & Cervero (1993), it occurs in two primary ways: "through therapists sharing stories and through therapists creating therapeutic stories with current patients" (p. 607). It allows a therapist the opportunity to see the whole picture, their part and the client's part, in a clinical situation.

It is a method of narratively puzzling out a problem whereby stories or bits of stories are used as suggestions for the building of strategies (Merriam, 1993). She hypothesized that "storytelling enlarges the practical knowledge of the group…[and]…is a central way of building and enlarging meanings that comprise the culture" (p. 19). It provides a way for the clinical experience of one therapist to become part of the collective experience of the whole group. Higgs and Jones (2000) suggested that these real-life stories bring credibility to advice or explanations.

Benner and her colleagues (1999) suggested that experiential learning in clinical situations and memory itself is structured narratively. Clinical learning is both experienced and shared as stories. In her words "where to begin the story, what to tell, what to leave out, and where and how the story ends provides the storyteller an understanding of the situation" (p. 18). This method of reasoning provides a way for therapists to make sense of a clinical situation and share it with others.

Pragmatic Reasoning

Schell and Cervero (1993) were among the first to look at both the psychological and sociological constructs of clinical reasoning. They believed that clinical reasoning was a "multifaceted process" which involved the therapist, the practice environment, the therapist-patient interaction, and the therapist's previous experiences. Schell further examined sociological constructs of clinical reasoning in her subsequent work (Schell, 1994) with occupational therapists, which she termed Pragmatic Reasoning.

Pragmatic reasoning as described by Schell (1992) concerns contextual factors that inhibit or facilitate therapy of both the therapist and the client. She used this term in considering two perspectives: the personal context and the practice context of clinical reasoning. The practice context includes, but is not limited to, environmental issues, hospital and departmental issues, personnel and budgetary issues (p. 606). Personal issues that influence individual decision-making and behavior include therapist motivation, problem definition, issues of power relations, experience, the nature of the problem they expect to find, clinical competences, preferences, commitment to the profession, and "life outside work" (Schell & Cervero, 1993, p. 94).

When considering the issues of power, Schell (1994) concluded that, "lack of perceived authority to act on the basis of clinical reasoning, as well as the tendency to devalue more tacit forms of clinical reasoning (such as intuition) and the repetition of this cycle would, "eventually short circuit even the consideration of some action" (p.43). This is important when considering the definition of clinical reasoning used in this study, where taking action is considered an essential part of the meaning.

Practice issues that influence individual decision-making and behavior include reimbursement regulations, equipment or treatment resources, patient population, hospital settings, and departmental traditions. Schell (1993) found that issues such as "patient populations, hospital setting and departmental traditions" had a tendency to be more influential in a therapist's clinical reasoning than their "beliefs and attitudes" (p. 608).

Practical or Logical Reasoning

Practical reasoning requires searching for a particular solution to a single problem, and is concerned with the most appropriate solution, at the proper time, and for the correct reason. This is the reason they (Mattingly and Fleming, 1994) suggested that practical reasoning more closely resembles a clinical wisdom than a clinical competence (p. 10).

Schon (1983) described practical knowledge as the knowledge individuals use in their daily lives without thinking about it. According to Mattingly and Fleming (1994) practical reasoning is practical wisdom, is it "knowing more than you can tell"(p. 10). They also believed practical reasoning required finding the right solution for a particular problem, at the correct time, and for the correct reason. Clinical competency is knowing what to do in a specific clinical condition; clinical wisdom is knowing what to do, and when and how to intervene in that same clinical condition. Therefore, this type of reasoning is closely associated with the principles of Aristotle's logic (Meyers, 1986). It is the fine tuning of treatment to patient, knowing more than what will work; it is knowing what will work best, and when it is appropriate to do best thing.

Ethical Reasoning

Ethical Reasoning is a type of reasoning that regard less recognized moral dilemmas of health care. Rogers (1983) suggested that clinical reasoning should terminate with the process of ethical reasoning. She said, rather than scientific reasoning, the "ethical nature of the goal of clinical reasoning projects itself over the entire sequence" (p. 602). She believed that ethical decisions should not be made isolated from scientific knowledge, but that ethical considerations could override scientific ones.

Benner et al., (1999) suggests that in practice it is not possible to separate ethical reasoning from other types of clinical reasoning, "because good clinical judgments reflect good clinical practice…[and]…good clinical judgments requires understanding what are considered good outcomes the patient" (p. 17). Biomedical ethics, in the clinical settings, focuses on clinical issues such as the autonomy of the patient, justice, beneficence, and nonmaleficence (Beauchamp & Childress, 1994). Although these are ethical issues, they do not explain the ethical reasoning of expert practitioners. The notion of good guides their actions and helps them recognize ethical threats to patients (Benner et al., 1999). She suggested that "expert practitioners are motivated by their ability to do good, to do one's duty to uphold the standards of good practice, and the direct human pull to alleviate another's suffering" (p. 17).

Collaborative Reasoning

Collaborative reasoning from the field of physical therapy refers to the shared decision-making that ideally occurs between the practitioners and their patients (Higgs and Jones, 2000). In this type of reasoning the patient's opinion and information about the patient are actively sought and used by the therapists. They suggested that the patient's involvement in their own therapeutic process is encouraging because it enhances

their understanding of the problem and is consistent with the notions of patient responsibility and self-management.

Jones, Jensen, and Edwards, (2000) suggested that collaborative reasoning incorporates the therapists own ideas about the nature of the problem, their own personal experiences, and advice from other personnel. In their work with physical therapists, collaborative reasoning referred to a therapeutic process which valued and utilized the patient's own capacity to contribute.

The following portion of this chapter provides an overview of two different theories of decision-making that have been significant in the research of clinical reasoning from the fields of medical, nursing, and allied health care. They are Schon's Reflective Practice and Benner's Novice to Expert continua. Schon's theory of reflective practice is considered one of the cornerstones of clinical reasoning. Mattingly's earliest works (1991a, 1991b, 1991c) were heavily influenced by Schon's theory of a reflective practitioner. It is for this reason that the following section provided a look at this theory.

Reflective Practitioner

The theory of practical knowledge is central to the American pragmatism philosophy of John Dewey (1910). The root philosophy of American pragmatist suggested that all things could be explained by reasoning (Lerwick, 1979, p. 51). Dewey's (1910, 1938) earliest works on the principles of progressivism in education reflected the importance of experience in learning. He believed that once learners experience and connect with a situation, they can then progressively develop a fuller, richer and more organized form of knowledge, and that this new knowledge becomes

instrumental for further learning and the development of practical knowledge (Dewey, 1938).

Schon's concern with the gap between "professional knowing" and the knowledge presented in academic textbooks, scientific papers, and journals resulted in his examinations of the tactful nature of professional knowing. Schon (1983, 1987) suggested that a practitioner's knowledge was gained through the interactions of professionals and their clients, and even though a professional's education was important. He believed it was their ability to reflect in action, to think in the midst of doing, which ultimately determined the quality of the practitioners work.

According to Merriam and Caffarella (1999), Schon's work has three major assumptions, which are considered the underpinnings of reflective practitioner:

> *Assumption One*: Those involved in reflective practice are committed to both problem finding and problem solving as part of the process. In problem finding, the assumption is that often problems with which we are presented in practice are murky and ill-defined. Therefore, we need to be open to discovering new problems or different ways of looking at old problems.
>
> *Assumption Two*: Reflective practice means making a judgment about what actions will be taken in a particular situation. Because these actions usually involve seeking changes in ourselves, other people, or in systems, there is an ethical dimension to reflective practice.
>
> *Assumption Three*: Reflective practice results in some form of action even if that action is a deliberate choice not to change practice. Without this action phase, the reflective practice process is incomplete. The lack of

> attention to this phase as a critical part of reflective practice endeavors when nothing tangible results. (Merriam and Cafferella, 1999, p. 233)

Schon (1983) proposed "professional knowledge occurs in the spontaneous, intuitive performances of the everyday life" (p. 49). Tact knowledge, which is difficult to describe, implies pattern accumulations, and according to Schon has the "feel for the stuff with which we are dealing"(p. 49). This knowing-in-action, when reflected on or thought about while doing is what Schon (1983) refers to as reflection-in-action. He suggests that phrases such as " 'thinking on your feet,' 'keeping your wits about you' and 'learning while you are doing' suggests that we can think about doing something while we are doing it" (p. 54). He believed that reflection-in-action does not depend on an individual's ability to completely describe their own tactful knowledge; instead, they may be unable to describe it at all (p. 277).

Reflection-on-action occurs when a person consciously reflects on a situation or phenomena that has already happened, and consciously reevaluates the experience. It is the result of individuals reflecting on what was familiar or different, how the problem was framed, or what was puzzling or interesting about recent phenomena. Merriam and Caffarella (1999) suggested that this mode of reflection, results in new perspectives on experiences, changes in behavior, and commitments to action…[because]…we consciously return to the experiences we have had, reevaluate these experiences, decide what we could do differently, and then try out whatever we decided to do differently (p. 235).

Nature of Reflective Practice in Clinical Reasoning

The Schon (1983) theory of reflective practitioner was central to Mattingly's ideas of clinical reasoning. He believed that "competent practitioners usually know more than they can say, and that their capacity for reflection upon their intuitive knowledge, in the midst of action, was central to their ability to cope with unique, uncertain, and conflicting situations in practice" (p. 9).

Mattingly (1991b) built upon Schon's concept, suggesting that therapists' words often fall short of practice because their knowledge was embodied in their daily habituation of repeated rituals and routines. Mattingly suggested that the result of this habitual tacit knowledge is a competent professional who "does not have to stop and think of what to do next" because this has become instinctive (p. 979).

This theory also is used in Schell's (1994; Schell & Cervero, 1993) research with occupational therapists, in which she describes the pragmatic knowledge of the therapists when they use clinical reasoning while working with patients. It is also a basis for Durbin's (1996) work when he advocated the use of therapist-driven protocols, and the recognition of clinical reasoning in what Schon termed "messes" or "swampy lowlands" of the intensive care units.

Reflection using metacognition

Metacognition, according to Merriam and Caffarella (1999) is considered the "highest level of mental activity and is especially needed for complex problem solving" (p. 206). Bruner, (1993) described it as "the ability to think about thinking, to be consciously aware of oneself as a problem solver and to monitor and control one's mental processing" (p. 67). Higgs and Jones (2000) suggested that it the ability of not only being

aware of ones cognitive skills, but also being able to exerting control over these processes.

According to Higgs and Jones (2000) research has found that not only do experts have a larger domain-specific knowledge base, they also monitor and regulate their own cognitive base during task performance using metacognition. They suggested that for an individual to perform well, they must be aware of the "knowledge and algorithms required for the task…their own motives and resources, the contextual constraints, and to plan strategically on that knowledge (p. 9).

Higgs and Jones (2000) also suggested that expert clinical reasoning could be interpreted as a process of integrating knowledge, cognition, and metacognition. The next portion of this paper looked at Benner's novice to expert continua and how this professional growth results in the progression of individuals from the clinical novice to expert when using clinical reasoning.

Novice to Expert Continua

Benner's works (1982; 1984; Benner et al., 1999; Benner & Tanner, 1987) concerning the clinical reasoning of nurses and their continua from novice to expert, has been used extensively in literature of allied healthcare as a theoretical foundation (Case et al., 2000; Greenwood et al., 2000; Jensen, Shepard, & Hack, 1990; King & Bithell, 1998; Robertson, 1996a, 1996b; Ryan, 1990).

According to Ward (1999) there has been much debate over the last century concerning the nature of expertise, "whether it is largely a question of extreme natural talent or the result of long years of intensive deliberate practice" (p. 6). He suggested that it was Ericsson (1994) who persuasively argued that expert performance is primarily a

function of "acquired complex skills and is the result of many years of intensive practice and/or competent teaching" (p. 6).

Proctor & Dutta (1995) believed expert performers have similar, common cognitive, perceptual and motor processes. Ward (1999) suggested that when compared to less experienced individuals, those who lack the intensive years of deliberate practice, the experts are able to "perceive meaningful complex patterns in a particular domain;" they have "enhanced short-term and long-term capabilities within their domains;" and have "rich knowledge structures making it easier for them to rapidly develop solutions and plans in order to solve a problem" (p. 6). He suggested that this is primarily due to the fact that knowledge is stored as scripts and "once activated, results in automatic, rapid information-processing and decision making" (p. 6).

Benner's works (1982; 1984; Benner et al., 1999; Benner & Tanner, 1987) are based on the Dreyfus model of skill acquisition, emphasized that the language practitioners among nurses used was "too simple and context-free to capture the essence and complexities of expert practice" (Ericsson & Charnes, 1994; McKay & Ryan, 1995). Instead, she believed theirs was a more interpretative approach, where an expert could work effectively going beyond the established rules, seeing information and patterns from previous patients, and rapidly reaching accurate decisions (Mattingly, 1991a; Ryan, 1990; Ward, 1999).

According to McKay and Ryan (1995) novices differ from experts in that the novices focus on the "immediacy of the situation and the rules governing that aspect of practice", they are "slower and more prone to inaccuracies" and may need to "break down the situation into its component parts to make sense of it" (p. 235). Benner (1982)

suggested that the main problem of the novices is the inability to judge selectively because in a clinical situation there are no rules to tell the novice which tasks are most relevant or when an exception to the rule is in order (McKay and Ryan, 1995).

Benner also believed that experience, as it was understood and used in the Dreyfus acquisition of expertise model, had a particular definition. According to Benner (1982), "Experience was not the mere passage of time or longevity; it is the refinement of preconceived notions and theory by encountering many actual practical situations that add nuance or shades of difference to theory" (p. 403).

Theories Supporting Novice-to-Expert Continua

Theories of the novice to expert continua are believed to be a way of explaining automatic or intuitive decision-making within a specific domain (Ward, 1999). The process of acquiring expertise has been documented in chess players (Dreyfus, 1972, 1991), radiologist (Proctor & Dutta, 1995), and musicians (Ericsson & Charnes, 1994), and is associated with a progression of expertise through several levels of proficiency.

Stages of Novice to Expert Behavior

Benner's work (Benner, 1982; Benner, 1984; Benner et al., 1999; Benner & Tanner, 1987), established five distinguishable levels of proficiency along the continua of novice to expert. These were separated into three stages; novice, competent, and expert practitioners. The novice includes the first two levels of proficiency, competence is the third level, and the last two levels are considered the experts.

Level I

Beginners, in this continuum have no experience with the situations in which they are expected to perform tasks (Benner, 1982). They have knowledge about clinical

situations, in the form of recognizable attributes, which has been taught to them in order for them to gain entry into a clinical area. They are also taught rules to guide action with respect to the different attributes. The difficulty for the novice lies in the inability to use discretionary judgment. Because they have no experience with clinical situations, they must follow the rules legislated to perform task. There are no rules to tell them which tasks are the most important in a situation or when there is an exception to the rule (Benner, 1982, p. 403).

Level II

Advanced beginners are capable of demonstrating, "marginally acceptable performances" (Benner, 1982, p. 403). They have been exposed to enough experience, in real situations, to be able to recognize recurring meaningful situations. They no longer rely on the measurable context free attributes of the inexperienced novice; instead they can now recognize characteristics, which are situational. While they are able to recognize certain clinical aspects, it makes a difference in how closely the new experience resembles the previous one. They treat all attributes and aspects of a clinical situation as equally important, lacking the ability to judge the relative importance of different aspects of the clinical situation.

Level III

Clinical competency is illustrated by an individual who has been on the job for two or three years, and has developed the ability to place their actions in long-range goals or plans (Benner, 1982, p. 404). They are fully aware of a plan or goal, and are capable of contemplating future situations that dictate which aspects of the current situation are to be considered most important and which can be ignored.

Competence is characterized by a feeling of mastery and the ability to cope with many different aspects of clinical practice. The competent level is supported and reinforced institutionally and many practitioners stay at this level because it is perceived as ideal by their supervisors. Benner (1982) suggests that standardization and routinization of procedures most often reflects this level of performance (p. 405). Most educational in-services are aimed at this level of achievement.

Level IV

The proficient practitioner is characterized as perceiving the situations as whole, rather than in terms of aspects (Benner, 1982). Their experiences have taught them what to expect in a given situation and how to modify their plans to avoid a particular situation. They also recognize when a situation does not present the expected picture. In other words, when the picture does not present itself in a normal way they know what to expect.

This holistic understanding of the situation makes practitioners better decision-makers because they now have an understanding of which aspects are the most important ones. The proficient practitioner now considers fewer options and is able to focus on those aspects, which they consider important.

Level V

The expert practitioner no longer relies on analytical principles to connect the understanding of the situation to the appropriate action. The expert has an enormous amount of background experience and now has an intuitive grasp of the situation and therefore can focus on the accurate region of the problem without wasting a considerable

amount of time and energy on "a long range of unfruitful possible problem solutions" (Benner, 1982, p. 405).

It is very difficult for the expert practitioner to articulate a description of his or her practice because the expert operates from a deep understanding of the situation (Benner, p. 405). They know much more than they can tell. A proficient practitioner has internalized the rules and guidelines. He no longer uses them to guide practice, instead he now uses past concrete experiences.

Thinking in Action

The practice of respiratory therapists, within the acute care settings, requires the ability to make quick judgments and responses in life-threatening situations where there is a narrow margin for error. Benner et al., (1999) described two modes of thinking: think-in-action or reasoning-in-transition, and clinical forethought, which guides judgment in expert practitioners. Together they demonstrate how "being situated in a particular clinical situation guides clinical judgment, thinking, and action" (p. 3).

Benner et al., (1999) suggested that the ability to do both of these, within specific domains of practice, is considered the hallmark of good clinical judgment. However, a loss of understanding or confusion in a clinical situation prompts practitioners to begin problem searching and reasoning-in-transaction, which Benner and her collegues said is characteristic of ethical and clinical reasoning in actual practice (1999). Thinking-in-action is the search for or anticipation of likely events when searching for a problem in a rapidly changing clinical situation. Because the situations in critical care can change very quickly, a therapist's practice involves many different modes of thinking and reasoning when faced with a critical clinical problem.

Benner et al., (1999) also suggested that the ability to actively reflect on practice captures the nature of clinical reasoning, and leads to expert clinical judgment. They, like Schon believed that practitioners "engage in productive thinking-in-action based on a narrative understanding of the situation, rather than on rule-governed thinking"(p. 8). Benner and her colleagues choose to use the term "thinking-in-action" rather than Schon's term "reflection-in-action" because "thinking conveys the innovative and productive nature of the clinician's active thinking 'in' ongoing situations" (p. 9). Although, both are important for the development of clinical knowledge necessary for clinical judgments, reflection suggests stepping back or being outside the situation. Benner and her colleagues suggested this stepping back and reflecting on a clinical situation is equally important because it facilitates experiential learning.

Experiential learning does not occur simply with the passage of time, nor without active participation. Benner et al. (1999) suggested that experiential learning always requires engagement in the situation and involves a 'turning around' of preconceptions; recognition of patterns, or sensing some thing disquieting or puzzling that generates a problem search (p. 9). This process generates a narrative memory of the clinical issues at the time, along with one's emotional senses, and it therefore remembered. Narrative memory allows for recognition and the ability to react skillfully in similar future situations.

The concept of engaging in a situation involves interaction within a practice. The acute care centers of hospitals have individuals from many different disciplines working within them. They may include, but are not limited to, physicians, nurses, physical and respiratory therapist, social workers, administrative personnel, and students. The social,

physical, and emotional interactions between these are what Wenger (1999) referred to as a community of practice.

Communities of Practice

The primary focus of this socialization theory is of learning is social participation where "participation refers not just to local events of engagement in certain activities and certain people but to a more encompassing process of being active participants in the practice of social communities and constructing identities in relation to these communities" (Wenger, 1999, p. 4). With its roots stemming from social learning theories, constructivist theories, and situated cognition theories, Wenger (1999) suggested that there are certain components such as meaning, practice, community, and identity necessary to characterize participation as a process of learning and knowing (p. 7).

Lave and Wenger (1991) described communities of practice as a "set of relations among persons, activities, and world over time and in relation with other tangential and overlapping communities of practice" (p. 98). Respiratory therapists who work in acute care centers are members of several different communities of practice; including those the respiratory care department, transport teams, and the acute care center where they work.

Schell (1994) suggested that this view of communities of practice provides a basis for understanding the contextual effects on the nature of clinical reasoning because it views "clinical reasoning as a social activity that occurs within the community of practice" (p. 54). Wenger's theory of social practice is concerned with everyday activities, with an emphasis on the social systems where groups of individuals "organize and coordinate their activities, mutual relationships, and interpretation of the world" (p.

13). These theories of identity are concerned with the individual as a person within the cultural and their understanding of relationships and associations between themselves and other individuals of the group.

The clinical reasoning of respiratory therapists, as performed within the acute care settings, does not occur within a void. There are many different members of the community of practice within the acute care setting, each coming from a variety of different disciplines or communities. They include, but are not limited to, the patients, family members, physicians, nurses, pharmacists, dietitians, respiratory, physical and occupational therapist, and all having different roles to play within this intense and highly emotional arena. These individuals and the interactions around and among them have a powerful effect on how respiratory therapists make decisions within this arena.

Summary

In summary, a review of clinical reasoning revealed its wide spread use in medical, nursing, occupational, and physical therapy clinical practice with patients. Its theoretical foundations are based on the works of Schon (1983, 1987) Benner (1982; 1984; Benner et al., 1999; Benner & Tanner, 1987) and Elstein (1976, 1992a, 1992b; Elstein et al., 1978a, 1978b), and have both psychological and sociological constructs. This literature review provided nine well-documented different methods of clinical reasoning, which were used in this study.

This study focused on the task and activities in which respiratory therapists used clinical reasoning, the methods of clinical reasoning used, whether or not there are differences in the methods of clinical reasoning used by novice, competent, and expert

respiratory therapists. It also sought gain an understand of contextual issues responsible for the development of expertise in clinical reasoning.

CHAPTER THREE

METHODOLOGY

This chapter describes the research methodology that was used in conducting this research study. The content of this chapter begins by presenting the initial research questions that guided this study, followed by a discussion of qualitative research, and the reasons a qualitative method was appropriate. It also provides a description of the sample selection, the method of data collection, and the procedures used for data analysis. Then the importance of validity and reliability in the qualitative study is discussed and the chapter concludes with a chapter summary.

Research Questions

Bogdan and Biklen (1998) wrote that research questions, in qualitative research, are not framed by Aoperational variables; rather, they are formulated to investigate topics in all their complexities" (p. 2). The research questions for this doctoral study were:

1. In which task or activities do respiratory therapists use clinical reasoning as a method of decision-making while working in an acute care unit?
2. Which methods of clinical reasoning do respiratory therapists use in their practice within the acute care unit?
3. What are the differences in the methods of clinical reasoning used by novice, competent, and expert respiratory therapists?
4. What contextual factors encourage or discourage the development of expert clinical reasoning among respiratory therapists?

Therefore, the purpose of this study was to examine the methods of clinical reasoning used by respiratory therapists, determine the task and/or activities in which they used clinical reasoning in their practice, the differences between the reasoning of novice, competent, and experts use of clinical reasoning, and determine which contextual factors encouraged or discouraged the development of clinical reasoning expertise among therapists.

Considerations of a Qualitative Method

If it is an intensive, naturalistic description of the phenomenon being studied, then qualitative is the most appropriate research method (Bogdan & Biklen, 1998). Qualitative research is a generic term, which encompasses many different applications; it refers to several different research strategies that share specific characteristics. It is descriptive, uses the natural setting as a source of data, is concerned with the process as well as the outcome, analyzes data inductively, and is interested in meaning from the participants' perspective (Bogdan & Biklen, 1998). Therefore, the purpose of this study and the nature of the research questions, which asked how and why, warranted an inductive method of inquiry because the focused on the process not the product.

Merriam (1998) suggested three necessary points to consider when choosing the most appropriate research method for a proposed study. First, the nature of the research should be considered. Both qualitative and quantitative research methods were suitable for answering how and why questions; however, a qualitative method was more suited for an in-depth naturalistic study. The second point was the consideration of how much control the researcher wanted to have over the research environment, and whether or not

they sought to control it. The final point was what results were desired at the end of the study; or what usefulness would it serve.

Qualitative analysis as a primary inductive method of inquiry, does not seek to test pre-existing theories instead it paved the way for the development of new theories based on the data collected (Bogdan & Biklen, 1998; Merriam, 1998). Research of this type is frequently called naturalistic because data tends to be gathered where it naturally occurs as opposed to laboratories or other researcher-controlled situations. It is indicated in circumstances where the researcher does not wish to manipulate the research setting in any way. The point of using qualitative methods is to Aunderstand naturally occurring phenomena in their natural occurring states" (Patton, 1990, p. 40). A naturalistic inquiry also assumes the setting is constantly changing. This type of inquiry is oriented toward exploration and discovery of individuals in a specific time and place. A naturalistic inquiry also assumes the setting is constantly changing.

This inquiry was oriented toward exploring and discovery of individuals in a specific time and place, without controlling the environment; therefore a qualitative method was determined to be the best method for this study.

According to Patton (1990) a naturalistic inquiry presupposes an ever-changing natural world. He suggested that this perspective is nicely captured by the observation in an ancient Chinese parable, which makes the point "no man ever steps into the same river twice" (p. 53). The researcher's affect on the reasoning of the respiratory therapists selected for this study was natural, was expected, and inevitably became part of the experience.

Patton (1990) also suggested a naturalistic perspective requires researcher to use a holistic paradigm, where they "strive to understand a phenomena as a whole" and assumes that, "a description and understanding of a person's social environment is essential for an overall understanding of what is observed" (p. 49). This type of study provides an in-depth and detailed evaluation of a selected topic and produces a wealth of information about a small, specific number of people. This increases the understanding of those particular individuals, but also reduces generalizability to other populations.

Another consideration for this study was a phenomenological inquiry, which focuses on answering qualitative questions concerning the real meaning of experiences of the phenomenon for individuals participating in the study. This type of study considers how people experience things through their own senses and their description of those experiences. Consequently it focuses on Ahow we put together the phenomena we experienced in such a way as to make sense of the world" (Patton, 1990, p. 69). This method provides richness and depth to the explanation of a phenomenon, in the words of the participants themselves.

Criteria for Qualitative Research Method

A basic or generic qualitative study simply seeks to discover or understand a phenomenon, a process, or the perspectives of the people involved" (Merriam, 1998, p. 11). Merriam (1998) suggested it typically draws from theories in educational & developmental psychology, cognitive psychology, and sociology. According to her, the data is typically collected through interviews or observations and the findings are a mixture of description and analysis that uses the theoretical framework of the study. In

this type of study there is “no bound system or functioning unit that circumscribes the investigation” (Merriam, 1998, p. 11).

The focus of this qualitative research was to identify, discover, understand, or gain insight into particular phenomena. Therefore the finished product of a qualitative study is richly descriptive (Merriam, 1998). This is because the qualitative data describes the people, places, and conversations. It results in data being collected through “sustained contacts with people in settings where subjects normally spend their time” (Bogdan & Biklen, 1998, p. 2). They suggested two of the most commonly used research techniques representative of qualitative research are those of participant observation and in-depth interviewing. Both are covered later in this chapter.

In this study, I conducted a basic or generic qualitative study because of my interest in an in-depth understanding of clinical reasoning among respiratory therapists in the acute care settings. The objective of research was to understand which task and/or activities therapists used clinical reasoning, the methods of clinical reasoning they used, differences between those considered novice, competent, and experts, and which contextual factors encouraged or discouraged the development of expert clinical reasoning, while they work in the intense and highly emotional arena of neonatal and pediatric acute care centers.

This arena was chosen because of the clinical complexities therapists encounter while dealing with patient care in these settings. Experimental research methods, with their precision and certainty, would not have been representative of a therapist’s reality within the clinical setting, and would not provided data that was richly descriptive.

Bogdan and Biklen (1998) wrote that qualitative research should be flexible and cannot be fully planned in advance of fieldwork when attempting to capture the interactions of individuals. Based on the dynamic natures of both the daily interactions of therapists and the flexibility of qualitative research, a qualitative method was best suited for the collection of both the anticipated and unanticipated data this study provided.

This method included in the design: being able to talk to the therapists about what they were thinking, considering what therapists thought about when making decisions in the acute care settings, what they perceived, and what they focused on and what they chose to ignore. It facilitated an understanding by allowing the researcher to observe the task and/or activities they did while they reason, ask them questions such as; (a) What did they hope to accomplish when they were reasoning? (b) How did they define what they are doing? (c) What was important to them when reasoning? (c) How did they learn to make decisions? (e) What helped them learn to make decisions?

According to Patton (1990), a phenomenological perspective suggested that even though the basic elements of common experiences, from a specific practice, can be identified, each person has a unique set of experiences which are treated as truth and which determine that individual's behavior" (p. 70). Because of the descriptive nature of qualitative analysis, this study sought to discover, understand, and gain an insight into the clinical reasoning of therapists in acute care settings, by understanding the clinical reasoning of the individual respiratory therapists who work there. Also, this methodology and perspective was appropriate for the theoretical framework of this study because of its consideration of the context within which therapists make their clinical decisions.

By its nature, clinical reasoning is largely invisible. It was expected that therapists became aware of their own reasoning because of the attention paid to it by this study. Observing it, even within the clinical settings of an acute care unit introduces an element of reflection and self-consciousness, which may not be present" (Barris, 1987, p. 149). Therefore, for this study, the phenomenon studied was clinical reasoning within the acute care setting, using therapists' own words it was described in a richly descriptive manner, and the participants became aware, reflective, and self-conscious as part of the experience.

Description and Justification of Sampling Procedure

According to Bogdan and Biklen, (1998), once the phenomena of the study had been determined, the researcher's approach of making the decision of with whom to talk, what time of day to observe participants, and the number individuals to observe is referred to as internal sampling. The literature (Bogdan & Biklen, 1998; Merriam, 1998; Patton, 1990) suggested that sampling for a study should be directed toward developing a deeper understanding of the phenomena being studied. Merriam (1998) also suggested nonprobability sampling as the method of choice in the selection of a sample for a qualitative case study, and according to Patton (1990) the most common form of nonprobability sampling is called purposeful sampling" where the researcher selects a sample from which the most can be learned.

The numbers of cases necessary for a qualitative study was not known at the beginning of the study. Merriam (1998) recommended specifying a minimum sample size, "based on expected reasonable coverage given the purpose of the study" (p. 64). Gall (1996) suggested that instead of instead of setting a specified number of cases at the

beginning of a qualitative study, the researcher should instead "concentrate on selecting an appropriate number of cases, provide replication of the findings and add certainty to the findings… or until no new information if forthcoming" (p. 237).

Therefore, at the beginning of this study, three therapists for each of Benner's novice to expert stages were nominated and later volunteered to participate. One therapist who had been nominated decided not to participate, and the respiratory supervisor nominated another as a replacement. This number was initially was flexible, and could have changed at some point later during the study. However, the data collection from nine therapists, three from each of the stages novice, competent, and expert provided sufficient data to reach a point of saturation.

Purposeful, Convenience, and Reputation-case Sampling

Purposeful sampling requires the selection of a specific criteria, particular subjects, or units to be included in the investigation because they are believed to facilitate the expansion of knowledge or the development of theory (Bogdon & Biklen, 1998). Gall, Borg, & Gall, (1996) suggested that qualitative researchers focus on the intensive data collected from one case, or one group, rather than the study being one aspect of a broader study. According to him, the goal is to select individuals that are likely to be "information-rich with respect to the project [where] the intent is to achieve an in-depth understanding of selected individuals, not to select a sample that will represent accurately a defined population" (p. 218).

Mishoe's (1995) dissertation research regarded critical thinking, and was also a qualitative investigation of respiratory therapists working in acute care units. She found that it is always desirable to get first-hand accounts when ever possible" (p. 78). When

interviewing educators or managers she found she was receiving second-hand accounts of other's use of critical thinking, and for that reason confined her study to observing and interviewing only those therapists working in the acute care units. Consequently, like Mishoe, the participants in this study all worked in the acute care units in which they are observed.

Convenience sampling is used as a sampling procedure when there are limits on the number of individuals to be sampled (Patton, 1990). The constraints of financial, logistical, and time had an influence in the sample selection for this study. The work done for qualitative study is very labor intensive. It would be preferable to have had the collaborative efforts from a group of investigators sampling the entire team of respiratory therapists working with pediatric and neonatal patients in this hospital. However, given the constraints of this study and the requirements for a qualitative dissertation, this was not possible.

According to Goetz, and LeCompte (1984) reputation-case selection is the process of selecting individuals, who are "chosen on the recommendation of experienced experts in an area" (p. 82). In addition to purposeful and convenience sampling, the sample selection for this study was accomplished through the nomination of individuals by the respiratory therapy supervisor using reputation-case selection. The supervisors position, credentials, length of time working in this unit, and the cumulative experiences working both as a staff therapists and as a supervisor qualified her as an expert in the area and qualified to select individuals for the following stages.

Individuals selected for this study were in line with Benner's (1982, 1984, 1999) and Mishoe's (1995) works, where length of time working in the unit and Benner's five

levels of proficiency determined the stages of novice, competent, or expert therapists. Clinical competency in clinical reasoning has been associated with the length of time an individual works within the setting (Benner, 1984; Greenwood, Sullivan, Kay, McDonald, 2000; Robertson, 1999). The supervisor was asked to use the following criteria to nominate individuals who fit into each of the three stages.

Novice Respiratory Therapists

Therapists selected in this category included those individuals who had worked in the acute care setting for less than two years. These therapists consisted of individuals who represented Benner's first two levels of proficiency in the novice to expert continua. Individuals in the first level of this continuum consisted of therapists who have no clinical experience, lack discretionary judgment skills, and have only the basic knowledge considered minimal for entry into the field (Benner, 1982, p. 403). This level was more representative of a respiratory therapy student's clinical experience, rather than an individual who had been hired and had already gone through hospital, departmental, and unit orientations and now works full time in the units.

Those therapists who had been exposed to enough real experiences to be able to recognize recurring meaningful situations were representative of Benner's (1982) second level. They no longer relied exclusively on measurable context free attributes to make decisions, but now were able to recognize characterizes which are situational (p. 403). While they were able to recognize certain clinical aspects, it made a difference in how closely the aspects of a new clinical situation match previous ones. They treated all attributes and aspects of a clinical situation as equally important, lacking the ability to judge the relative importance of different aspects of the clinical situations.

Competent Respiratory Therapists

Clinically competent respiratory therapists were demonstrated by those individuals who had been on the job for two or three years, and had developed the ability to place their actions in long-range goals or plans (Benner, 1982, p. 404). They were fully aware of a long term plan or goal, and were capable of contemplating future situations that dictated which aspects of the current situation were to be considered most important and which could be ignored. This level was characterized by a feeling of mastery and the ability to cope with many different aspects of clinical practice. These therapists were representative of Benner's third level of proficiency in the novice to expert continua.

Expert Respiratory Therapists

Benner's works (1982 & 1984) suggested that it takes nurses approximately five years of clinical experience before they are considered experts. According to Mishoe (1995), it was important that her sample, which looked only at expert therapists, consisted of therapists who had worked in the acute care setting for a minimum of five years full-time and had time to establish greater rapport with other health care workers and gained positions of greater responsibility within their respective departments" (p. 79).

This stage was divided into Benner's last two levels of proficiency; level four, the proficient therapists who could now perceive the clinical situation as a whole (Benner, 1982, p. 405). Their experiences had taught them what to expect in a given situation and how to modify their plans to avoid a particular situation. At this level they could also recognize when a situation does not present as the expected picture. This holistic understanding of a clinical situation lead to their considering fewer options and allowed them to focus on those aspects they consider most important.

The expert practitioner, level five, no longer relied on analytical principles to connect the understanding of the situations to the appropriate action. They had an enormous amount of background experience and had developed an intuitive grasp of the situation and therefore could now focus on the accurate region of the problem without wasting considerable amounts of time and energy on "a long range of unfruitful possible problems solutions" (Benner, 1982, p. 405).

The goal of this study was to use a combination of purposeful, convenience, and reputation-case selection as a method of sample selection; choosing respiratory therapist who were expected to be the most information-rich" in demonstrating clinical reasoning skills within the acute care settings. I believed that the therapists chosen for this study would provide the data necessary to evaluate and answer the research questions posed at the beginning of this study.

In an effort to learn the most about their clinical reasoning, it was important to include novice, competent, and expert therapists in the sample for this study. The therapists from this team had study had a wide range of differences in the length of time working in these units, skills learned, and individual experiences. This provided the opportunity to differentiate them into Benner's three stages of novice, competent, and experts.

Appropriate Population

The site for this study was the neonatal and pediatric acute care units of a hospital located in a medium sized metropolitan area in central Georgia. The therapists in this study were respiratory therapists who work in the acute care setting in this hospital. The sample consisted of respiratory therapists; who working as a team in neonatal and

pediatric intensive care units, went on transports, and responded to both high risk deliveries and cardiopulmonary arrest of children through-out the hospital. The autonomy of patient care granted to these therapists by medical and nursing personnel who also work in these units, their skills levels, and their quests for credentialing as Neonatal and Pediatric Specialist, was why I believed that these therapists would provide a first hand account of clinical reasoning.

Participants in this study graduated from accredited respiratory school; earned either as associate or baccalaureate degree; worked full time in the acute care setting, had earned the credential of Registered Respiratory Therapist (RRT) from the National Board of Respiratory Care.

They had commonalities, but they also had differences, which were important to this study. The commonalities they shared included all working in the same hospital, respiratory care department, and the same acute care units. Their practices were guided by the same hospital and departmental policies (including those of acute care centers and respiratory care departments), their job descriptions were the same, and they all worked under the same administrative and medical directors. Their educational similarities included completing the necessary requirements to graduate from an accredited respiratory therapy school, participated in departmental educational programs from both the acute care centers and the respiratory care department.

Their differences included years working in these units, personal experiences, educational training within the units, and quality of experiences. The shifts they work also provided differences in their scopes of practice and their opportunities for experiences.

Role of the Researcher in Data Collection

In a qualitative inquiry, the researcher as the primary instrument of data collection and analysis plays an integral part in the research itself. For this reason the researcher must be capable of providing the readers with a rich thick description" in sufficient detail to convince the readers that the author's conclusion makes sense (Bogdan & Biklen, 1998; Merriam, 1998). According to Merriam (1998), the investigator must be highly sensitive to the context, to the data, and to their own personal bias, must have an enormous tolerance for ambiguity, and must be a good communicator and listener" (p. 24).

The researcher should be keenly engaged in the situation and its context, and continuously search for an understanding without the development of a predetermined hypothesis. According to Bogdan and Biklen (1998), this requires that the researcher develop both an understanding and empathy for the situation researched by developing an intense involvement with the subjects, and the situation within the context that surrounds it.

When collecting data, the reflections of this author were noted in the field notes in an attempt to acknowledge and take into account my own biases. An effort was made to remain an objective observer and interviewer, by only asking questions that were relevant to this study, so that the relationship with the author and participants remained on a researcher- participant basis.

Documentation of Informant's Response

As mentioned earlier in this chapter, Bogdan and Biklen (1998) suggested that the two most commonly used research techniques representative of qualitative research are

those of participant observation and in-depth interviewing. According to Merriam, qualitative research from natural settings provides the opportunity for me to view the data firsthand rather than obtaining it secondhand, as in the case of an interview.

Prior to the start of data collection, a list of potential interview questions was composed. A copy of these is included in Appendix B. These were first tested in a pilot study, using the supervisor from the children's respiratory team. Necessary changes were made in the questions before the collection of data began. Then once collection of data began, and after subsequent analysis, these were reevaluated and revised as necessary to reflect descriptive data already collected.

Data collection consisted of the usual anthropological techniques of observation and in-depth interviewing; where the instrument for data collection was the researcher. Observation of respiratory therapists took place as they worked in the neonatal and pediatric acute care units and in the stabilization room adjoining a surgical delivery room. The therapists were asked to think out loud as they worked throughout their shifts. Their comments during observations were recorded in field notes and audio taping of in-depth interviews followed each observation. Subsequently, after each data collection session, the hand written field notes from the observation and the recorded interviews were typed immediately into notes for analysis in an effort to retain the data collected.

Observation of respiratory therapists within the acute care setting allowed the identification and description of situations requiring clinical reasoning, documentation of the interactions of respiratory therapists with other members of the acute care setting, the decisions they make in their daily practice, and an understanding of types of reasoning they utilize. Each observation last approximately six to eight hours, and provided

important data for this study and documentation of both the therapists' practice and clinical reasoning.

According to Patton (1990), the purpose of an observational analysis is to take the reader into the setting [with] data sufficiently descriptive that the readers can understand what occurred and how it occurred" (p.26). This is why a qualitative researcher chooses this method, they are not interested in finding out what is normally true of the masses; instead they want to understand a particular group in great depth.

The in-depth interviews for this study were done in conjunction with the participant observation, and were used to gather descriptive data from the subjects in their own words. After the observation in the subject's own environment, an interview lasting approximately one hour was conducted using open-ended, semi-structures questions. According to Bogdan and Biklen (1998), the nature of this open-ended approach is to allow subjects to answer from their own frame of reference rather than from one structured by prearranged questions" (p. 3).

The observation preceded the interviews for two reasons. First, this minimized research's effects on the behavior of the participant, which might be greater if interviews occur prior to observation. Secondly, conducting interviews after observations provided an opportunity to question respiratory therapists about specific incidents and aspects of their practice. This provided an opportunity for me to gain a deeper understanding of particular events documented during the observation. It also provided validity checks for clarification or discounting any interpretations of a specific circumstance the researcher had from observations.

According to the current literature (Bogdan & Biklen, 1998; Merriam, 1998; Patton, 1990), the types of questions and the way they are worded is critical to the collection of data. Patton suggested that to improve the amount of relevant data collected, the wording of a question should make sense to the interviewee [using words that] reflect the respondent's world views" (p. 312). In order to attain good responses (data) from interviewees, the researcher should use several different types of questions to stimulate responses (Patton, 1990). The interview for this study consisted of a combination of prepared, ideal, and interpretive question with the intention of extracting as much information as possible.

Confidential Response

It was important for the identities of the participants to be kept confidential; consequently, coded names were used in respect for their privacy, and all data connected with this study was kept confidential. Special care was used when writing the analysis and dissemination of the findings so that their confidentiality was not violated. In light of the fact that all of the individuals who participate in this study work at the same acute care settings, confidentiality was an important issue. According to Patton:

> Qualitative methods are highly personal and interpersonal, because naturalistic inquiry takes the researcher into the real worlds where people live and work, and because in-depth interviewing opens up what is inside of people ---qualitative inquiry are more intrusive and involve greater reactivity than surveys, test, and other quantitative approaches (1990, p. 36).

For this reason, the names of all therapists interviewed were not used in this research. Instead therapists were asked to assign themselves fictitious names, which were

used through all stages of the study. Copies of transcripts were kept in a secure environment away from sites of data collection.

Human Subjects Review Board

Before research began, the prospective research required the approval of the Institutional Review Board at the University of Georgia. A copy of this is included in Appendix D. Once organization and institutional approval was obtained, prospective volunteers for the sample were told the purpose of the study and what they might expect in both the interview and the observation. The interviewees were asked to sign the customary consent form. This is included as Appendix C. Immediately before the observation and interview, the researchers informed the volunteers that at any point during the observation or interview, they might withdraw their consents and discontinue their participation in this study.

Relation of Data Collection to Data Analysis

Data analysis began after the first observation and interview. Using a constant comparative method of analysis, data from the first observation and interview were compared and tentative categories were established. According to Merriam (1998) this is where the qualitative design is emergent" (p. 155). The simultaneous process of data collection and analysis allowed restructuring of subsequent data collection to be built on previous observations and fieldnotes by changing, deleting, and/or adding question to interviews after the initial interview.

In qualitative study the researcher is the primary instrument for gathering and analyzing data. This is seen as both a strength and weakness for all phases of qualitative research. The researcher (instrument) is fallible and capable of making mistakes because

biases are inherent to this type of research. Merriam (1998) suggested that since one of the philosophical assumptions of this type of research is that reality is not objective; rather, there are multiple interpretations of reality" the researchers bring with them their own construction and interpretations of the phenomenon being studied (p. 22). In order to minimize the effects of these constructions and interpretations, it was vitally important that both the researcher and the reader be aware of these biases.

Because this doctoral study is qualitative, I am concerned about the effects personal biases had on the collection, analysis, and dissemination of its findings. According to Bogdan and Biklen (1998), qualitative researchers have wrestled over the years with the charges that it is too easy for the prejudices and attitudes of the researcher to bias the data" (p. 33). They recommended that the researcher should be aware of their own biases by recording detailed field notes that included reflections on their own subjectivity. One of the classical strengths of a study of this nature is requiring that the researcher spend a considerable amount of time collecting and reviewing the data, while constantly confronting personal prejudices about the data.

I have been a respiratory therapist for eighteen years and have worked as a staff therapist, supervisor, assistant and interim director of a respiratory department, hospital educator and now as a college professor. In each of these positions I have observes therapists who are considered good decision makers by their peers and those whose skills sometimes have been less than desirable.

I am interested in gaining an understanding of how therapists make clinical decisions in the acute care setting, why some are better at reasoning or problem solving than others, and what facilitates or hinders their development of good reasoning skills. I

believe by obtaining this information I will be better prepared to teach the skills I want student to have. Also, as a consumer of health care, I would like to know that should the opportunity arise for myself or any member of my family to need the assessment skills and actions of a competent or expert respiratory therapists one will be available.

Bogdan and Biklen (1998) reported that the researcher's primary goal when doing a qualitative study is to add to the knowledge… [where]… the worth of the study is to generate theory, description, or understanding"; not to pass judgment on the subjects (p. 34). Before the collection of data began, the participants were informed that this study would not pass judgment on their methods of reasoning in the clinical situations. The intent of this study was to identify the types of reasoning used by respiratory therapists in the acute care setting, not to determine if it was appropriate or inappropriate. Therefore, for the purpose of this study, there were no right or wrong methods of clinical reasoning used by respiratory therapists, only the identification of types.

Description and Justification of Data Analysis

Bogdan and Biklen suggested at the point of data collection where the information you are getting becomes "redundant" was the place the researcher should consider discontinuing the data collection (Bogdan & Biklen, 1998, p. 62). Data analysis is the process of sifting through the data in an effort to determine themes or patterns.

Merriam (1998) proposed that data analysis is really a systematically searching and arranging of the interview transcripts, fieldnotes, and other materials that have been accumulated. This increases the researchers understanding of data, and enables them to better present what they learned to their readers. It involves the processes of breaking down data, organizing data into manageable units or categories, searching for patterns

and units in an attempt to discover what was important, and what to disclose in the dissemination of findings.

Patton (1990) suggested that qualitative analysis conclusions should seek to described "in-depth and detail, in context, and holistically" the phenomena under analysis (p. 54). In a qualitative design, analysis and collection of data should simultaneously allow the data to emerge during the process. According to Merriam (1998) this simultaneous process of data collection and analysis is one that distinguishes a qualitative design from other forms of research. Two different data analysis strategies of interest: phenomenological and constant comparative, both of which had a bearing on this research.

Determining when sufficient data has been collected was based on the saturation of established categories or when a point of over-extension is reached. Bogdan and Biklen (1998) suggested that this is, the point of data collection where the information you get is redundant" (p. 62). Merriam (1998) suggested the point of saturation occur when continued data collections produces only small amounts of new information in comparison to the effort to get them it. Lincoln and Guba (1985) also described a sense that any new information being discovered would not contribute to the emergence of additional categories once a point of saturation occurred.

The descriptive accounts of a study are the most basic presentation. According to Merriam (1998) at this stage the data are simply condensed into narrative categories that conveys the meaning the researcher derived from the study of a phenomenon. Bracketing defines these narratives in the fieldnotes and transcriptions.

The second step, using the constant comparative method, is the construction of categories that capture a recurring theme. Lincoln and Guba (1985) suggested that a units, categories, or subcategories must meet two criteria. The unit should be heuristic, it should reveal relevant information to the study, and it should be the smallest piece of information about something that can stand by itself. Both bracketing and constant comparative of categories were used in analysis of data for this proposed doctoral study.

Constant comparative method of data analysis consists of determining conceptual links between and among categories and is used as a means of developing grounded theories (Merriam, 1998). This method constantly compares data from interviews and observation field notes, leading to the formation of tentative categories. This comparison continues within and between categories until a theory can be formulated.

Phenomenological analysis focuses on understanding the essence of the phenomena of the study. According to Patton (1990) one dimension that differentiates a phenomenological approach [is] the assumption that there is an essence or essences to a shared experience" (p. 70). Using bracketing and constant comparative technique, analyzes the experiences of several different people by analyzing and comparing the essences of the phenomenon. This study evaluated clinical reasoning from a phenomenological perspective.

Validity in Qualitative Research

Because the instrument is the researcher in a qualitative study, the effort of ensuring validity and reliability provides a more complete and believable portrayal of the phenomenon being studied. According to Patton (1990) validity is dependent upon the

skill, competency, and rigor of the person doing fieldwork" (p. 14). Guba and Lincoln (1981) remarked:

> Since as often as not the naturalistic inquirer is himself [herself] the instrument, changes resulting from fatigue in knowledge, and cooptation, as well as variations resulting from differences in training, skill, and experience among different instruments easily occur. But this loss of rigor is more than offset by the flexibility, insight, and ability to build on tacit knowledge that is peculiar province of the human instrument (p. 113).

According to Merriam (1998) internal validity deals with the question of how closely the researcher's findings match reality. Ratcliffe (1983) suggested the author of a qualitative study must be consciously aware and address three following validity issues (a) data do not speak for themselves: there is always an interpreter or translator" (p. 149), (b) one cannot observe or measure a phenomenon/event without changing it," and (c) words are abstract representations of reality, but not reality itself" (p. 150). The literature (Bogdan & Biklen, 1998; Borg & Gall, 1989; Merriam, 1998; Patton, 1990) suggested several ways the researcher could enhance internal validity and limit the effect of these issues.

Triangulation is the practice of using multiple sources of data, or multiple methods of collecting data to confirm findings. It is a strategy used to increase both internal validity and add confidence to the research by aiding in the comprehension of differences and ambiguities that emerge from the data. Patton (1990) described data triangulation as using a variety of different data sources in the study. In this study the

combination of participants-observations, in-depth interviews, and member checks were used as methodological triangulation.

Two strategies for addressing validity issues are peer examinations and addressing researcher bias. Both of these strategies were used throughout the developmental, data collection, and analysis phase of this study.

Peer examination asking peers, colleagues, and experts to comment on the findings as they emerge. Colleagues from the respiratory care department where I currently teach, and a local hospital where our students do clinicals critiqued the findings from this study. This was done periodically throughout the project when they were asked to review the collected data analysis and any relevant questions or concerns were answered.

Researcher's bias refers to the researcher's own expectations about the possible outcomes of their research that are unintentionally transmitted to participants so that subsequent behavior is affected (Gall et al., 1996). The researcher is usually unaware of the phenomena or the effect it is having on their research. In an effort to reduce the effect and make the researcher aware of possible unintentional manipulations, Merriam suggested clarifying the researcher's assumptions, and theoretical orientations at the outset of the study" (1998, p. 2). The following is an attempt to do so.

According to Bogdan and Biklen (1998) the role of the researcher is as the primary instrument of data collection, data analysis, and disseminator of research finding may inadvertently bias the study. The following section shares with the readers my experience, assumptions, and perspectives**,** all of which have an effect on my biases.

I have had limited experience as a qualitative researcher at this stage of my career. However, to this study I brought almost twenty years experience as a registered respiratory therapist from which I drew inference. My career as a therapist began as a third-shift employee in a medium sized hospital, working primarily for seven years as a staff therapist in the adult acute care units. Later, I accepted a position as the assistant director of a respiratory therapy, and then acting director of a department in a comparable sized hospital and held that position until I accepted the position as an instructor of respiratory therapy …a position I currently hold.

I have participated in and witnessed the decision-making skills of a respiratory therapist from the perspective of staff therapists, administrator, and educator. Each perspective gave me a deeper appreciation for the need to know how we make clinical decisions in this intensely and emotional settings of acute care units, what differentiates the skills of the expert from the novice, or competent therapists, and what promotes the development of good clinical reasoning.

As a researcher and respiratory therapist, I had several assumptions, which influenced the selection of conceptual framework, the design of the study, and the sample selection. These assumptions were the result of my years of experience as a respiratory therapist, my review of current literature in preparation for this study, and my association with professionals who have previous research experience concerning clinical reasoning. My assumptions were as follows.

I assumed that all respiratory therapists engage in various degrees of reasoning while working in the acute care units. The assessment of patients and the ability to provide solutions to clinical problems is considered an important aspect of their

professional practice and everyday activities. Mishoe's (1995) research with respiratory therapists reveled that reasoning was one of several different forms of critical thinking used by therapists while working in the acute care settings.

A second assumption is that respiratory therapists were not aware of the types or depth of their own reasoning skills, and since these skills are not observable they are unaware of the reasoning skills of other therapists around them. They make better decision makers if they learn to become aware of and facilitate the development of their own clinical reasoning.

A third assumption is that the participants had something to contribute to the study; demonstrated expert respiratory practice in the acute care settings; could articulate what they currently knew about how they reasoned through clinical problems; and, were willing to share their practice. It was also assumed that the observations and in depth interviews were a true reflection of actual respiratory practice in the acute care settings.

My perspectives of the world are primarily from that of a dialectical constructivist view, believing that each person has his or her own interpretation of daily reality, and this reality is drawn from their own previous experiences. I believe that and individual's knowledge is the interactions between learners and their environment.

According to Bruning (1999), a dialectical constructivist perspective considers the interaction between internal and external factors into their view of knowledge acquisition, and that knowledge grows out of the contradictions and interaction that individuals experience. Another important aspect, is that dialectical constructivism is closely linked with the American psychology of "contextualism, which holds that thought and experience are intertwined with the context in which they occur" (Bruning, 1999, p. 217).

Merriam (1998) suggested that in qualitative research the participant's reality is filtered through the interpretations and subjectivity of the researcher. It was important to be aware and deal with my personal biases when reporting the finding from this study. Consequently, the triangulation of data was used in an effort to uncover and control the effects my personal biases had on the data and findings of this study. Triangulation of data is covered later in this chapter.

For this study the issue of personal biases and the establishment of personal creditability was addressed prior to the beginning of this study by keeping a journal or audit trail, which is a detailed account of all notes, records, and meeting in regard to all phases of this research. This was included as Appendix E. This enables both the researcher and the readers to reflect on the subjectivity of analysis. Lincoln and Guba (1985) claimed that the audit trail is the single most important technique for establishing creditability and trust in qualitative analysis. It is a deliberate organization of evidence so that someone external to the study can review both data and process in order to determine credibility. According to Merriam (1998) the researcher must describe in detail how data were collected, how categories were derived, and how decisions were made throughout the inquiry" (p. 207). It is then, up to the researcher to accurately document both the data and the process so that the readers can determine generalizability. For this study notes from all meeting, data collections, peer consultation, and member checks were kept in a journal.

Reliability in Qualitative Research

The reliability of research refers to the extent the findings can be replicated. In a qualitative study the researcher does not expect someone else to repeat the study and find

the same results. Instead, it refers to the ability of a researcher to describing and explaining the world, as other experience it.

The term reader or user generalizability for a study involves the extent to which the findings from a study can be applied to other situations. This is left up to the reader. Lincoln and Guba (1985) maintained that the researcher is less concerned with generalizing than the reader or user. To enhance the possibility of a qualitative study's generalization, Merriam (1998) suggested that the researcher should provide enough description so that the readers will be able to determine how closely their situations match the researcher's situation, and hence, whether findings can be transferred" (p. 211).

Summary

This study developed from an interest of the author's own reasoning as a respiratory therapist. It was conducted as a basic or generic study with a phenomenological perspective. The purpose of this study was to examine the clinical reasoning of respiratory therapists, the ways in which therapists used clinical reasoning in their practice, the differences between the reasoning of novice, competent, and experts use of clinical reasoning, and they ways clinical reasoning was encouraged or discouraged in the development of expertise among therapists.

Data collection consisted of observations and in-depth interviews of fellow respiratory therapists working in the acute care settings. Analysis used a constant comparative technique. The findings of this study were thick and rich using the words of the therapists themselves to describe their clinical reasoning. The following two chapters provide the results and a discussion and implications for this study.

CHAPTER FOUR

THE RESEARCH

This chapter presents a review of the purpose, a brief description of the nine participants, research setting, researcher's role, and the data collection process. A list of commonly used terms and definitions is presented as Table 1, Appendix A. These terms are later used in describing the research findings in Chapter Five, and implications for practice in Chapter Six.

Purpose of Study

The purpose of this study was to identify the nature of clinical reasoning in novice, competent, and expert respiratory therapists while making clinical decisions within the acute care settings. It also focused on determining the contextual factors that enhanced and/or hindered the therapists' development of good clinical reasoning skills.

The assessment of patients having difficulty breathing requires that respiratory therapists make decisions rapidly and accurately and, in most situations, that they also take action to quickly and precisely alleviate a patient's problem. Durbin (1996), suggested, "the most important skill a respiratory therapist has is that of clinical patient assessment" (p.108).

The development of good assessment skills is an important aspect of a therapist's practice. A better understanding of clinical reasoning and how and when it is used will hopefully facilitate the development of good assessment and reasoning skills in the transitional period from student to expert therapists. Likewise, an understanding of

contextual issues, which facilitated or hindered clinical reasoning, will enable therapists and managers alike to enhance therapists' ability to make good clinical decisions.

The research methodology for this study consisted of observations followed by interviews of nine registered respiratory therapists who worked in the neonatal and pediatric acute care settings. The observations allowed me the opportunity to observe, identify, and describe situations in which clinical reasoning was used. The interviews, which followed the observations, provided me the opportunity to ask in-depth questions and allowed therapists the opportunity to expound about particular circumstances of the observations. The data collection period took place over a period of ten weeks; observations were written as field notes interviews were taped and then transcribed verbatim for data analysis.

A constant-comparative analysis approach was used to continually analyze the data throughout this study. The first step was bracketing to define narratives in the field notes and transcripts. The second step, constant-comparative analysis, focused on the construction of categories that captured recurring themes. Validity checks were conducted with therapists from the Respiratory Care Department at the college where I work and a clinical affiliate, to discuss emerging categories and help validate the findings.

Participants' Biographies

Reputation-case sampling was used as a process of nominating therapists for this study. Nine therapists, who had been nominated by their supervisor, volunteered to participate in this study; seven were women and two were men. They all work full time, had earned either an associate or baccalaureate degree from an accredited respiratory

therapy school, and the credential of Registered Respiratory Therapists (RRT) from the National Board of Respiratory Care (NBRC).

Special care is used in writing this analysis and in the dissemination of findings so that the confidentiality of participating therapists is not violated. In light of the fact that all of the therapists who participated in this study work on the same Children's Hospital Team and in the same acute care settings, the issue of their confidentiality in this study requires special consideration. For that reason the pseudonyms of individual therapists used in data analysis are left out of the biographies, instead they are identified as novice, competent, or expert therapists #1, #2, and #3 and later when discussing the findings of this study the pseudonyms will be used so that no connections can be made between the findings of the study and the therapists who volunteered.

A description of the different categories, from Benner's novice to expert continua is presented in Table 2. Therapists were selected for this study based on the number of years they had worked within the neonatal and pediatric units, and their supervisor's evaluation of their reasoning skills based on the five stages from Benner's (1982) novice to expert continua. These are represented in the following as Table 2.

The section following Table 2 presents short biographies of nine therapists who participated in this study. It is important to mention that the novice therapists selected for this study had several years of experience as adult therapists before joining this neonatal and pediatric team. For that reason, much of their knowledge and experiences with ventilators was well beyond that of the novice in Benner's first two stages of proficiency. In fact, there were no true novices in this study; those individuals would more appropriately be represented by respiratory students in their first two semesters of school,

and graduates who are for the first time entering the field. The respiratory supervisor for this unit believed it doesn't matter how many years of experience an individual has outside of these units, they start as somewhat a novice when they join this team. These individuals were classified as novices for that reason.

TABLE 2 DEFINITIONS OF LEVELS OF EXPERTISE

Category	Description
Novice	This category include those individuals who have worked in the acute care setting for less than two years, and represent Benner's first two levels in the novice to expert continua. They have been exposed to enough real experiences to be able to recognize recurring, meaningful situations which is representative of Benner's (1982) second stage of novice. They no longer rely on only measurable context free attributes to make decisions, but are now able to recognize characteristics, which are situational.
Competent	These individuals have been on the job for two or three years, and have developed the ability to place their actions in long-range goals or plans (Benner, 1982). They are fully aware of plans or goals, and are capable of contemplating future situations that dictate which aspects of the current situation should be considered most important and which could be ignored. This level is characterized by a feeling of mastery and the ability to cope with many different aspects of clinical practice. These therapists are representative of Benner's level three in the novice to expert continua.
Expert	Benner's works (1982 & 1984) suggested that it takes nurses approximately five years of clinical experience before they are considered experts. This category includes Benner's last two levels of proficiency. • Level four, the proficient therapists who can now perceive the clinical situation as a whole (Benner, 1982) • Level five, the therapists who no longer relies on analytical principles to connect the understanding of the situations to the appropriate action. (Benner, 1982).

Because of their short length of time working with the neonatal and pediatric patients, the respiratory supervisor classified the following three therapists as novices. Several of these individuals at times were more appropriately representative of competent therapists, especially when performing task or activities that were familiar or when confronted with situations, which were similar to past experiences.

Novice Therapists # 1

This therapist has an Associate of Science degree in Respiratory Care, and has two years work experience on the Children's Hospital Team and three years of previous experience working in the adult units at the same hospital. Other responsibilities include serving on the transport team, serving as a clinical instructor with the respiratory students when they come into these units while in clinicals, and as an educator in the neonatal and pediatric units as a Pediatric Acute Life Support (PALS) and Neonatal Resuscitator Program (NRP) educator.

The supervisor for this team considered this therapist aggressive in a quest to become good at her job and cited a willingness to become an instructor in PALS and NRP as an example. The therapists on this team were all required to take and pass both examinations every two years as part of their departmental educational program. However they were not required to become instructors, and according to their supervisor when a therapist such as this one shows instructor potential, they are asked to participate in the programs. This therapist is considered a novice because of a limited number of years working in these units.

Novice Therapists # 2

This therapist received a Bachelor of Science degree in Respiratory Care. The other therapists working on this team considered this individual to be quiet most of the time. However when necessary, this therapist can be direct and assertive. This person had only worked on the Children's Hospital Team for six months, but had almost three years experience working in the adult acute care setting. Other responsibilities for this therapist include having served as a clinical instructor for students while they were in clinicals.

This individual is considered a novice on this team because of the short length of time working here. The supervisor for this team considered this person to be an aggressive learner because of an observed deliberate quest for knowledge to become an expert therapist. This person sill struggles with not having enough neonatal and pediatric experiences to understand all situations, and still frequently goes to other therapists when faced with new and unfamiliar problems.

Novice Therapists # 3

This therapist has a Bachelor of Science degree in Respiratory Care. The other therapists on this team considered this individual to be quiet by their standards. This person had served as a clinical instructor for students while they were in clinicals, had only worked on the Children's Hospital Team for less than two years and had an additional four years experience working in the adult acute care setting. At the time of this study this person had not become a member of the neonatal and pediatric transport team, but looked forward to the opportunity.

Competent Therapists # 1

This therapist received a Bachelor of Science degree in Respiratory Care. This individual is considered quiet, yet was self-confident, self-assured, and one who could

become assertive when necessary. This person has only worked on the Children's Hospital Team for three years, with an additional three years experience working in the adult acute care setting. As a therapist, this individual was very well read and strived to keep current on contemporary issues in respiratory care. This person is a member of the transport team, had worked with the students while they were in clinical, and had served as an in-service educator for the neonatal and pediatric units.

This therapist is considered competent because of the years of experience working in these units; the ability to feels comfortable with a mastery of most clinical situations, and an ability to cope with almost any problem. As a therapist this individual believed he/she knew what to expect in most situations, and was working to gain a holistic understanding of the patients' clinical problems.

Competent Therapists # 2

This person received an Associate of Science degree in Respiratory Therapy. Other members of this team consider this individual to be playful and teasing. This therapist had only worked on the Children's Hospital Team for two years, but had an additional five years experience working in the adult acute care setting. This person had also served as a clinical instructor for respiratory therapy students while they were in clinicals and was on the transport team.

This person was considered competent because of a limited number of years experience in these units. As a therapist this individual had an understanding of what to expect in most situations and had learned to recognize most clinical pictures as a whole. Nevertheless, this therapist had only two years and a limited number of personal experiences to help when making decisions with neonatal and pediatric patients.

Competent Therapists # 3

This therapist had Associate of Science degree in Respiratory Care. The other members of this team considered this individual to be playful and teasing. This person had worked on the Children's Hospital Team for a little over two years, but had another three years experience working in the adult acute care setting. Extra responsibilities for this therapist included the transport team and charge supervisor when necessary.

This individual was considered competent therapists because of the years experience on this team and the capability to understand which current situations to consider the most important and which could be ignored. This person was also characterized by a feeling of mastery and a keen ability to calmly cope with the many different aspects of clinical problems.

Expert Therapist # 1

This therapist received a Bachelor of Science in Respiratory Therapy. The other members of this team considered this individual to be self-confident, self-assured, and at times this therapist could be assertive if necessary. This person had sixteen years experience working on this team, with another two years experience working in the adult units in this same hospital. Other responsibilities for this individual included the transport team, charge supervisor, and clinical instructor with respiratory students when they came into these units. This therapist had taken and passed the National Board for Respiratory Care's Neonatal and Pediatric Specialty Exam.

Sixteen years of experience had given this person an intuitive grasp of almost any situation in these units. This individual found it difficult to explain her/his own

intuitiveness choosing to describe it as a "gut feeling" or "working within a comfort zone."

Expert Therapist # 2

This therapist received a Bachelor of Science in Respiratory Therapy. This individual is considered quiet, but capable of being assertive should a situation arise where it becomes necessary. This person had thirteen years work experience on the Children's Hospital Team, with another three years experience working in the adult units of this same hospital. This therapist was on the transport team, sometimes took extra responsibilities such as charge supervisor, and had served as a clinical instructor with the respiratory students while in clinicals.

This person was considered an expert therapist because sixteen years of experience had given this therapist an intuitive grasp of many different situations. According to this individual he/she had internalized the rules and guidelines of these units and now trusts them to make decisions. This individual longer relies on practice guidelines, but instead now uses past experiences when making decisions.

Expert Therapist # 3

This therapist received a Bachelor of Science degree. Twenty years work experience in the neonatal and pediatric intensive care units, has given this individual an intuitiveness about almost all clinical situation. This person had also passed the NBRC's Neonatal and Pediatric Specialist examination, served on the transport team, took extra responsibilities such as charge supervisor, served as clinical instructor for respiratory therapy students in the neonatal or pediatric unit, had been an NRP instructor, and had

taught the Stable Baby Program. This individual's supervisor considered him/her to be an extravert who was self-confident, and self-assured.

There were fourteen therapists who worked on the Children's Hospital respiratory team. Many of these therapists also serve on the hospitals neonatal and pediatric transport team that did an average of forty-five regional transports a month, and also worked in other areas of the hospital when there were staffing shortages. On nights or weekends when there is no respiratory supervisor in the hospital (such as days off or sickness) the senior therapist in the nursery sometimes had the additional responsibility of carrying the departmental charge beeper.

There were several reasons for this. Most of the therapists who work on this team had previously worked in the adult units, they usually have more years of experience that other therapist also working that shift, and there are usually two therapists assigned to the nursery.

The Research Setting

The settings for this study consisted of two acute care units in a 518 bed regional, non-profit, teaching, medical center. The Neonatal Intensive Care Unit (NNICU) consisted of thirty-six beds designated for premature or extremely ill newborns. This unit has an average of forty-seven admits a month, with an average length of stay of about fourteen days.

There were times when this unit was very quiet, people talk just above a whisper, the isolettes were covered, the lights were dimmed, and only the monitors and alarms indicated that there were tiny patients in the isolettes. Other times this unit was busy with the staff rushing around handling emergencies or new admits, and still other times when

the staff members were relaxed and carried on casual conversations or joked with each other. A tremendous amount of teamwork between nurses and therapists was observed in this unit.

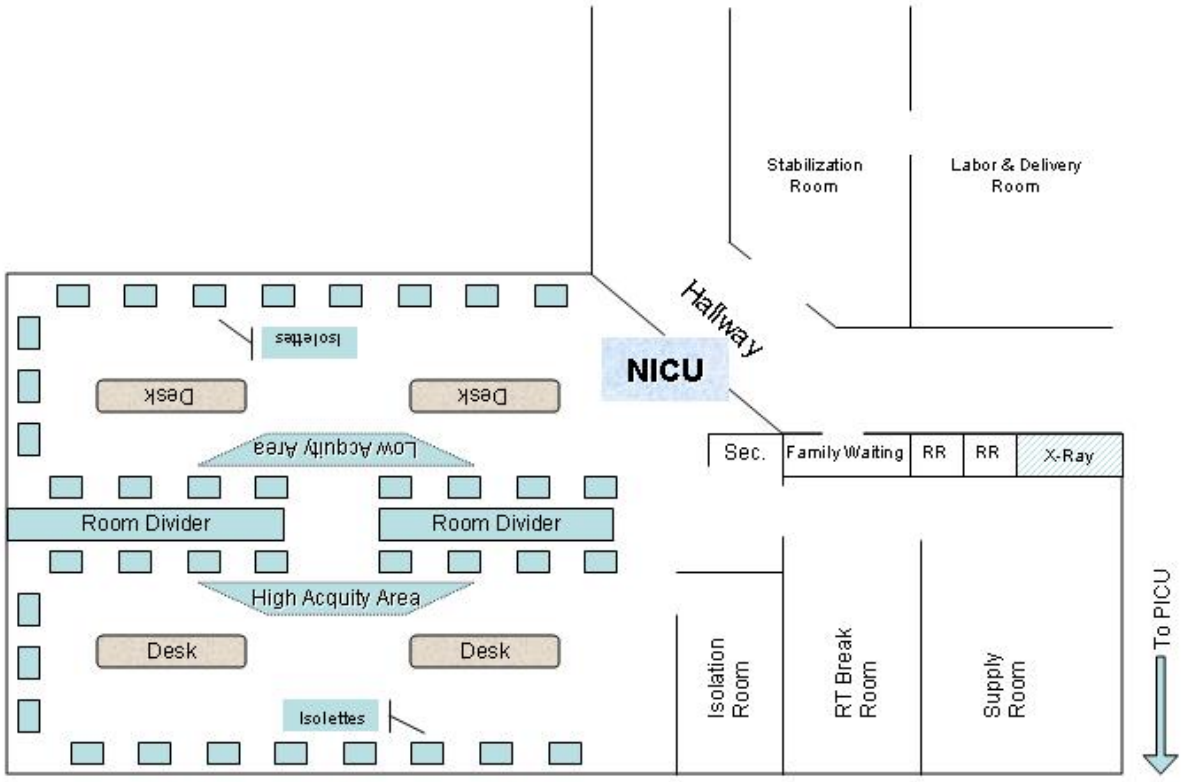

FIGURE 1 THE NEONATAL INTENSIVE CARE UNIT

At first glance, it was apparent that this was a nursery. The colors were soft pastels, large stuffed cabbage patch babies and animals sat high above on the divider between the two sides, soft quilts and blankets covered the isolettes, and Ann Gidden photos were used as covers for clipboards. Neonates were placed on either side of this unit depending on their acuity level, with the sicker babies being kept on one side, and those who have improved or required less acute care on the other side. The isolettes were

covered with colorful blankets and quilts, and wooden chests add to the feeling of a home. However, looking beyond that, there were monitors, oxygen and air hoses, blenders, ventilators, open-air warmers, phototherapy lights, and intravenous pumps with tiny tubes connected to very sick newborn babies.

On a bulletin board just inside a door to the staff's break-room was a wall covered with pictures of children, most of whom had been former patients in this unit. There were the survivors, and among those were other pictures of children belonging to therapists, nurses, and physicians who worked here. Located between the family waiting area and the entrance to NNICU was a picture stand, which held the senior portrait of a graduate from a local high school. She had been a preemie in this unit seventeen years ago.

Therapists and nurses were able to reflect back upon the successes they have had and to see the rewards of their works. When looking at these boards, it was evident that they had forgotten most of the names, but they remembered their faces and their stories. They talked about the difficulty of specific or unusual cases and the realizations that the job they do really does matter.

Located across the hall from the nursery, beside the labor and delivery room, is the stabilization room. It was a very sterile looking room, stocked with open-air warmers, monitors, transporters, and the equipment necessary to stabilize a neonate in their transitional period immediately after birth. This room was only a few steps from the NNICU.

The Pediatric Intensive Care Unit (PICU) consisted of twelve beds with an average admission of approximately fifty children a month. The average length of stay for a child in this unit is a little over six days. This number is somewhat skewed by

several children with chronic conditions who remained here for several months at a time. Some of those were babies that had been moved here from the NNICU after a long and difficult stay in that unit.

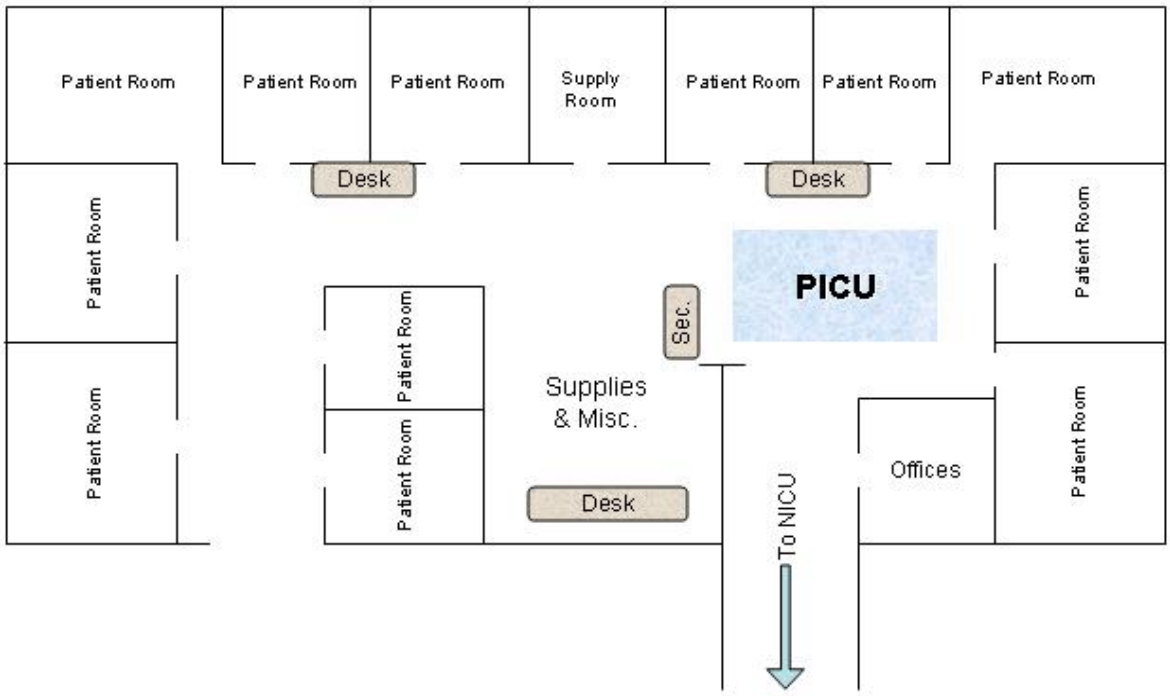

FIGURE 2 PEDITRIC INTENSIVE CARE UNIT

My first glance around the PICU, I could see that the comfort of these children and their parents had been a consideration in its design. The rooms were large enough for a crib or hospital bed, spaces for equipment to manage the patient, rocking chairs, and a small bed or cot for a family member who stayed in this room with the patient. In this unit, family members were encouraged to stay with children at all times. The individual rooms were separated from the center of the unit by walls of glass with large curtains, which could be pulled to give the patient and family privacy or quiet time. The walls

were decorated with large padded, pastel, fabric, sculptures, which also served to reduce the amount of sound between rooms.

The Role of the Researcher

In an effort to provide the readers with a better understanding of the clinical reasoning of these therapists, the following section of this chapter examines my role as the researcher. I have been a respiratory therapist for eighteen years and have worked in most areas of patient care, management, and education. I choose to do this study because of my interest in both the subject matter and the work respiratory therapists do in the neonatal and pediatric intensive care area.

I am a college professor in a respiratory care program, and am seeking a better understanding of how therapists make decisions. I am interested in enriching the learning environment for my students by finding ways to incorporate the learning of clinical reasoning into the respiratory therapy curriculum at the college where I am a faculty member. I consider myself a constructivist, and believe that knowledge is constructed from experiences, within the context where it occurs.

As a therapist myself, and having worked as a departmental manager, I am interested in understanding the issues which facilitate or hinder the development of good clinical reasoning skills among respiratory therapists. I have worked in institutions where I considered the clinical reasoning skills of therapists to be less than I believed capable. Also as a consumer of health care, I would hope that should I, or any member of my family, have the need for the assessment and good decision-making skills of therapists, they would be there.

Data Collection

During the ten weeks of data collection when I was present in the intensive care units, the participants, other therapists, nurses, and physicians inevitably became aware of the subject matter for this study. This came primarily from my introduction. Almost immediately they offered to help if possible, providing me with stories of situations where the therapists had been involved in the solving of difficult situations or cases, as a validation of the therapists' importance in these units.

At the beginning of data collection, I found it difficult to concentrate on the subject matter for this study. When reviewing my earliest observational field notes, I realized how much I would cognitively drift back into my therapist's mode of thinking and found myself recording information about the patient, the clinical situation, or the patient's circumstances rather than the manner in which the therapist was trying to solve the problems. It took a conscious effort on my part to break free of this mode of thinking.

This research procedure began by gaining permission to do this study from the medical institution, where the research occurred, and the Institutional Review Board at the University of Georgia. Then, using reputation-case sampling, the respiratory supervisor for the Children's Hospital Team selected and nominated therapists for each category. These therapists were then approached and consequently volunteered for this study. Three therapists were selected to represent each of Benner's novice, competent, and expert stages. Data collection consisted of observations followed by in-depth interviews of the nine therapists. Data analysis, which coincided with data collection, consisted of a constant-comparative analysis approach. Member checks were done following the collection of data and analysis.

Following the observation and interviews, I used a transcription machine and a word processor to transcribe the audio taped interviews. I had problems with the audio taping of two interviews and those interviews had to be redone. During analysis their ability to use multiple types of reasoning almost simultaneously emerged, and I went back to the first three study participants and asked them questions pertaining to this ability. Subsequent to each interview, I provided the therapists with an analysis of the types of clinical reasoning used in their observation and interview, and recorded any additional comments they made.

I concluded data collection after no new recurring themes were emerging, and no new data was coming forward as suggested by Lincoln & Guba (1985), and when the collection of data from three therapists from each grouping associated with Benner's novice to expert continua (1982, 1984) had been completed. The therapists in this study freely participated and seemed genuinely interested in providing me with the good examples of their clinical reasoning. When data collection was completed it took an additional month to formulate the categories into comprehensible data that could be presented in this document.

Initially, the data was divided into four categories, roughly corresponding with the four research questions from this study. At this point in the analysis process, I began dividing the bracketed data into subcategories with the use of charts. An example of these charts is included as Appendix F. Using these charts allowed me to see how the categories related to each other. They were very helpful in my final organization of how the results are presented in the following chapter.

The disadvantage of using these charts occurred in the repetitiveness of data between question's one and two. When formulating the chart for question one, the task and activities in which therapists used clinical reasoning, it became apparent the data appropriate for answering this question was question two, the types of reasoning used by respiratory therapists. However, there were multiple types of reasoning used in performing the task and activities from question one.

Summary

Reputation-case sampling was used to identify nine respiratory therapists who worked in the neonatal and pediatric respiratory team of the Children's Hospital. Three therapists from this team were classified as belonging in each of Benner's novice, competent, and expert categories. This team was chosen because it was believed they used clinical reasoning in their practice and would provide data relevant for this study.

Research, consisting of observations followed by interviews took place over a period of twelve weeks, with data analysis coinciding with data gathering. The results provided over 150 pages of typed transcript and observation for analysis.

This chapter provided the reader with an explanation of the research setting, the participants, the researcher's biases, the methods of data collection and analysis. The results of a qualitative study such as this are not generalized to other whole populations. Instead I am leaving it to the reader, on a case-by-case basis, to determine the usefulness and applicability of the research findings. The next chapter presents those findings.

CHAPTER FIVE

THE FINDINGS

This chapter presents a review of the findings from this study. The findings and discussions are organized and presented in the following sections: (1) the task and activities in which respiratory therapists used clinical reasoning, (2) the types of clinical reasoning used by respiratory therapists, (3) the differences in the types of clinical reasoning used by novice, competent, and expert respiratory therapists; and, (4) the contextual factors that encouraged or discouraged clinical reasoning among respiratory therapists.

A list of commonly used terms and definitions is presented as Table 1, Appendix A. The terms are later used in describing the research findings and implications for practice.

Results of the Study

There are four distinct areas in the discussion the findings of this study. Each area corresponds with one of the four research questions. These are:

1) The task and activities in which respiratory therapists used clinical reasoning,
2) The types of clinical reasoning used by respiratory therapists,
3) The differences in the types of clinical reasoning used by novice, competent, and expert respiratory therapists, and
4) Contextual factors that encouraged or discouraged clinical reasoning among respiratory therapists.

A description of the nine categories of clinical reasoning identified in the literature review is presented in Table 3. This is done to familiarize the readers with the different types of reasoning used in the discussion of results.

TABLE 3 METHODS OF CLINICAL REASONING IDENTIFIED IN THE LITERATURE REVIEW FOR THIS STUDY

Method of Reasoning	Description	References
Scientific or Theoretical Reasoning	This method of reasoning is much like the rational model of cognitive processing where the development of hypothesis is followed by data collection to either prove or disprove the hypothesis.	Fleming, 1991 Mattingly & Fleming, 1994
Backward or Deductive Reasoning	A method where the individual tries to solve problems by trying one solution at a time. They start with one step toward a solution, evaluate whether or not it works then either accept the solution or reject it and attempt a new step toward the goal.	Robertson, 1996a
Procedural Reasoning	This method of reasoning is the searching for techniques and procedures that can be brought to bear on the physical problems of a patient. In this form of reasoning the therapists think about the disease or disability and decide which activities (procedures) they might use to resolve the person's problem.	Fleming, 1991 Mattingly & Fleming, 1994
Inductive Reasoning or Forward Reasoning	This method of reasoning is considered pattern recognition and is associated with hypothetical deductive reasoning. It involves moving from one set of specific observations to a generalizations. It is also associated with the schema theory and connected to experiences, intuition and the use of advanced reasoning patterns or heuristics. It involves pattern recognition, which can also be thought of as pattern interpretation.	Elstein et al., 1978 Greenwood, et al., 2000 Higgs & Jones, 2000

Method of Reasoning	Description	References
Interactive	In this type of reasoning involves shared decision-making between the therapists and their clients. This method of reasoning occurs as a deliberate dialogue in the form of social exchange between therapists and patient.	Mattingly, 1993 Higgs & Jones, 2000
Predictive, or Conditional Reasoning	This method of reasoning brings together the whole picture by enabling the therapist to imagine past, present, and future revised conditions for their patients. In this type of reasoning the therapists estimate the patient response to treatments and likely outcomes of management, based on information obtained through assessments, examinations, and response to therapy.	Mattingly & Fleming, 1994 Higgs and Jones, 2000
Narrative Reasoning	This method of reasoning is ultimately tied to our ways of making sense of our experiences. It involves the use of stories concerning past or present patients to help therapists understand and manage clinical situations. This type of reasoning occurs two primary ways: though therapists sharing stories and through therapists creating therapeutic stories with current patients.	Fleming, 1991 Schell & Cervero, 1993
Pragmatic Reasoning	This method of reasoning concerns contextual factors that inhibit or facilitate therapy. This method of reasoning has two perspectives; the personal context and the practice context.	Schell, 1992
Practical or Logical Reasoning	This method of reasoning requires searching for a particular solution to a single problem, and is concerned with the most appropriate solution, at the proper time, and for the correct reason. It is the fine tuning of treatment to patients, it is know more than what will work; it is knowing what will work best, and when it is appropriate to do the best thing	Mattingly and Fleming, 1994 Meyers, 1986

Method of Reasoning	Description	References
Ethical Reasoning	This method of reasoning involves the less regard and less recognized moral dilemmas of health care. This method of reasoning involves good clinical judgments and good clinical judgments require an understanding of what is considered good clinical outcomes for the patient.	Rogers, 1983 Benner et al., 1991

Note. A more detailed description of each type of reasoning is presented in Chapter Two, the literature review for this study.

Multiple Modes of Reasoning

One of the first things I realized, in the early stages of collecting data for this study, was that respiratory therapists used several different methods of clinical reasoning to solve different aspects of the clinical problem. They would use procedural reasoning when they considered which task or activity could be used to improve the patient's ability to breathe. Then, they would use collaborative reasoning when they brought other individuals into their problem-solving process, and they used inductive reasoning when they compared their patient to similar past patients.

Fleming (1993) described this process in occupational therapists as "therapist with the three-track mind" (p. 120). She suggested that even though these problem-solving strategies were distinctly different, therapists could rapidly shift from one method of clinical reasoning to another. The therapists in this study, like those in Mattingly and Fleming's study, changed their reasoning methods as their attention was drawn from one aspect of the clinical problem to another.

Fleming (1991) suggested that therapists processed different aspects of the problem almost simultaneously without loosing track of their thoughts. They used different methods of reasoning, and effortlessly brought specific components of the clinical problem into the foreground when considering that aspect of the problem, or temporarily shifting them into the background when another aspect of the problem was in being considered.

Adding to the complexity of clinical reasoning, Fleming (1991) also suggested that clinical reasoning could not simply be reduced to a method or even methods of thinking because it involved ways of perceiving the problem. Robinson (1996a) suggested that how therapists construct the problem determines which type of clinical reasoning they choose to use.

McKay and Ryan (1995) believed that therapists initially break down the situations or problems into components or parts in an effort to make sense of it. Here lies the difficulty for a novice therapist because they lack the ability to judge selectively which aspects of a problem or task to consider the most relevant or when exceptions to the rule are in order.

The following example is from my observation of Joe. In this example several different methods of reasoning were used when working through the clinical problem of drawing an arterial blood gas.

> Joe was talking out loud though the assessment of a neonate. Much of what was said was based on knowledge of pathology and physiology of the human body. The alarms activated on another baby who was agitated. Pausing in the assessment, Joe looked at the other baby and the monitor, and then walked over to

the nurse and asked about getting sedation for that baby before drawing arterial gases later that evening. They agreed that the baby needed sedation. Then Joe returned to finish the assessment on the first baby. In a few minutes, Joe walked back to the other baby and watched the nurse give sedation. I asked what she/he was looking for in the second baby. Joe replied, "this baby is very active, that is what is causing the alarms to activate, and I want to see how she does with the sedation." Joe later told me that from previous experiences with babies on ventilators, she/he knew that if the baby was agitated and breathing rapidly when the blood gases were drawn they would reflect the baby's breathing in that state, rather than when she is breathing quietly. Gases drawn while the neonate was agitated might cause a less experienced, unobservant therapist to make unnecessary changes.

In the example above, Joe used a combination of inductive, scientific, procedural, conditional, and collaborative reasoning. Inductive reasoning was used when responding to the monitor's alarms; Joe knew monitor alarms indicated possible patient problems and that drawing blood on an agitated neonate would incorrectly reflect the neonate's physiological status. Scientific reasoning was used when making decisions based on the physiological status of the patient, such as heart rate and oxygen saturation. Procedural reasoning occurred when requesting sedation be given to calm the agitated neonate before drawing the blood. Collaborative reasoning was used when Joe and the nurse decided together the baby needed sedation. Conditional reasoning occurred because Joe knew from previous experiences what changes the sedation would make and how the arterial gases would then reflect the true condition of the baby.

In the following sections of this paper, when describing the methods of reasoning used by therapists to solve clinical problems, multiple methods may be described instead of attempting to isolate one component of the problem-solving process. The therapists in this study, from all levels of expertise, did not isolate one method of reasoning from another. They quickly and almost effortless move about the whole problem using multiple methods of reasoning.

The first section of this chapter provides the task and activities in which clinical reasoning was used by respiratory therapists while working in the acute care setting. These task and activities were accumulated from observations and transcripts of therapists in both the PICU and NNICU.

Section One: Task and Activities

In which tasks or activities do respiratory therapists use clinical reasoning as a method of decision-making while working in the intensive care units? This, my first research question, was answered by determining the tasks and activities therapists either performed during the time they were observed, or those they chose to use when describing how they solved problems during the interview.

There were many tasks or activities in which therapists used clinical reasoning. Since its inception in the 1950s, respiratory care has been a profession that dealt with mechanical and technical clinical problems. Their ability to locate and correct problems with equipment has consistently been a part of therapists' practice for fifty years. The profession has evolved from a labor intensive to a highly technical practice with new treatment procedures and physiological monitoring being added. Therefore I was not

surprised by the varied amount of equipment and procedures in the first section of results. According to my interview with Joe:

> It all begins in the delivery room. You have to make decisions whether or not you want to bag the baby or just go ahead and intubate. When it comes to drawing blood gases, whether or not to order a chest x-ray for a baby that has frequent desaturations. Like, whether or not to go and call a physician. Sometimes there are things you know you can't handle or you think that you need to call the physician and get an order for … that would be another thing, or just to notify them that this baby's oxygen has gone from … when I got here, from 40% to now he is at 80%. Just like the one I started, it starts in the delivery room, once the baby gets to the NNICU, and then even months while the baby stays in the NNICU, there are constant decisions that you have to make. Just about every thing we do.

The identified tasks and activities from this study have been divided into ten different categories. The following categories provide information about each task and activity performed, and the types of clinical reasoning associated with that task or activity. Similar procedures or types of equipment are compiled into one category for simplicity. A summary of the types of reasoning used is presented at the end of this section.

Arterial Blood, Inserting, and Troubleshooting Arterial Lines

Drawing arterial blood is an invasive and painful procedure for most patients. The procedure requires keen motor skills and practice in respiratory therapists. The analysis of arterial blood is used to monitor patients and evaluate the effectiveness of therapy,

oxygenation, and ventilation. Therapists in this study regularly drew arterial blood and inserted and troubleshot arterial lines. Shannon noted, in my interview, that therapists used arterial gases to monitor and make adjustments on neonate's ventilators.

> Yeah, real premature babies follow a pattern usually, there's a honeymoon period, the first twenty-four hours that you cannot get a blood gas that is not alkalotic, and you just wean' em, wean'em, and wean'em … and then the next twenty-four hours the honeymoon is over and you can't get a gas that's not acidic.

Shannon's inductive reasoning and schema about premature babies included ventilator management using arterial blood gases. The clinical decisions therapists made about drawing arterial gases included when, where, and how they should be drawn, whether or not to insert an arterial line when gases were drawn frequently, and what clinical actions could be made to make sure the arterial blood gases accurately reflected the patient's clinical status.

The insertion of an arterial line on a neonatal or pediatric patient was equally invasive and was considered a difficult task for some therapists because of patient's size. The following example from my observation of Joe indicated an ethical decision about the number of times a therapist would stick a neonate before asking someone else to attempt the task.

> Joe was unable to get the blood on the first stick, and after trying twice to obtain blood he/she asked another therapist to attempt the procedure. Joe told me, "I asked another therapist to stick. She is really good, and I'm not going to just stick and stick until I finally get the blood. This is a painful and invasive procedure and I don't like doing that to a patient."

These therapists also used pragmatic reasoning when using equipment such as arterial lines, monitors, and intravenous pumps. The therapists in this study calibrated equipment, determined problems associated with accuracy, and replaced arterial lines when necessary. I observed Joe using scientific or theoretical reasoning, as described by Fleming (1991), when trouble shooting a line. Joe developed hypotheses from previous experiences with troublesome arterial lines, tested the hypothesis by performing a task which might correct the problem, determined if the problem had been corrected, and when not, changed the hypothesis and moved on to the next possible cause and solution to the problem.

Therapists in the assessment of the patient's oxygenation and ventilation status used the results of arterial blood gases, based on scientific theories. They blood gases provided information about the patient's response to emergency care, two of which were the monitoring and management of patients prior to and after stabilization or resuscitation.

Stabilization and /or Resuscitation of Patients

Respiratory therapists routinely responded to the need for stabilization or resuscitation of neonatal and pediatric patients. The therapists in this study have all passed both the American Pediatric Association's Neonatal Resuscitation Program (NRP) and the American Heart Association's Pediatric Advanced Life Support (PALS), which provide guidelines for stabilization and resuscitation of neonatal and pediatric patients. In both programs the ability to maintain an airway, oxygenate, and ventilate, are of primary importance. As one therapist said, "We're the 'A' and 'B' of the ABC's (airway, breathing, and circulation). If we can't get the 'A' and 'B', there's no need for anyone

else to worry about the 'C'. Here is an example where Jordan described the stabilization of a baby with meconium and the decisions therapist have to make in doing this task.

> Nine times out of ten your main decision process is going to begin in the delivery room…whether it be in the stabilization room or in another room out on the floor. At the delivery, say meconium is present but we have to decide … Ok, is this baby crying or is he not crying, is the meconium thick or not thick at this point regardless of the meconium state … if they are crying you don't do anything, if they are not crying you resuscitate.

Jordan, a novice therapist, was describing the use of scientific or theoretical reasoning where she/he used algorithms in making "yes" and "no" decisions. I observed Shannon, an expert therapist, during the resuscitation of triplets. She described the same task, but at the same time listening to the resuscitation of two other babies. Shannon told me:

> I always focus on what I'm doing, but at the same time I'm aware of everything going on around me. There are two other less experienced therapists in here. If anything goes bad with one of their babies, I'll leave this kid and move to the one that has gone bad.

At the delivery and resuscitation of neonates, who were considered a higher risk for complications, the nurses, therapists, and physicians expected certain circumstances to occur and were prepared for them. Shannon's many years of working in this unit, her NRP training, and inductive reasoning allowed her/him to participate in the resuscitation of one neonate and "be aware" of the other two resuscitations. Shannon later described this "being aware" as having the ability to hear and "sense a problem" from sound, and

other people's voices. Shannon could envision where the other therapist and nurse were in the stabilization process from past experiences in the same circumstances.

The resuscitation of a child who, for whatever the reason, goes into a cardiopulmonary arrest is not always something that can be anticipated. The following excerpt from my interview of Stacy, another expert therapist, illustrated the need to reason through many different possibilities very quickly, in trying to determine the cause of the arrest.

> There was one little girl coding, or close to coding (cardiopulmonary arrest) a couple of months ago …that I had been trying to give chest physiotherapy with the vest. She was gagging and I had to take it off, and she continued gagging and she ended up coding. The whole time I was in there, I was trying to decide was it her airway, which you rule out first of all … you go ahead and make sure. So, I put an airway in anyway, but she continued to code, so I had to decide is it possible is this is a pneumothorax? [I'm thinking] do I need to tell somebody to maybe put a chest tube, or a line in? There were a lot of decisions to be made all at one time.

When the arrest occurred Stacy had been the only health care worker in the room. The initial responses were inductive reasoning because of previous experiences in similar situations. Stacy also used a scientific understanding of what could have caused a pneumothorax, which he/she used to develop her hypothesis. Stacy talked about using guidelines from PALS to consider what actions should be take to correct the situation.

In summary, when respiratory therapists responded to the stabilization and resuscitation of neonate and pediatric patients, they incorporate several different types of

clinical reasoning. The resuscitation of a neonatal or pediatric patient usually resulted in the therapist placing the patient on ventilatory support. The following section describes the reasoning associated with ventilators and oscillators.

Initiation, Adjustment, and Discontinuing of Ventilators or Oscillators

There were numerous examples of therapists using clinical reasoning while initiating, adjusting, or discontinuing ventilators or oscillators in this study. Maintaining systems such as these was a significant part of their practice. They constantly make conscious and unconscious decisions about both the patient and the equipment while maintaining patients on this type of equipment. If not properly used and monitored, this equipment had the potential to cause patient harm, such as pneumothorax, volutrauma, barotrauma, and fatalities.

A number of the decisions therapists made while using this type of equipment were pragmatic. Even though this department had technicians who were responsible for cleaning and calibrating equipment before it could be reused in patient care, therapists actually set it up in the units, monitored, and managed it. For example, during my observations Casey started the shift by setting up ventilators and resuscitator bags at two beds, because both new admit beds were in the back pod this particular night. Casey did this in preparation for an emergency situation, before getting busy with other tasks. Casey knew that it only took one emergency to through the nightly schedule off track.

Casey set generic parameters on both ventilators so that all someone would have to do was turn on the power, and connect it to the neonate's endotracheal tube. Casey said, "you never know what is going to happen in here, and you always have to be prepared".

Therapists used patient physical assessments, physiological monitoring, arterial blood gases, and guidelines to make decisions about adjustments they made on ventilators. The following is an example from my interview of Randy, a novice in the nursery, but with several years experience in the adult intensive care unit. Randy described a situation, which occurred when he/she first joined the neonatal and pediatric team, and how inductive reasoning and the schemata developed for adults had not worked with neonatal patients.

> I know when I first started and was trying to get use to what changes to make on a ventilator based on blood gases, especially when a baby's carbon dioxide was kind of high, or I thought it was high from my blood gas, lots of times my thoughts would be lets go up the volume, or lets go up on the rate (both normally done in the adult population). Then I would get back with the doctor and give them the results and tell them what I had done and they would correct me and say, well we want to try to protect that baby's lungs…basically they didn't want to go up on that volume, let's try going up on the rate to keep the peek pressures down. I would go ok…but I'm starting to realize now it's because those premature lungs are so tender and so they can be damaged so easily until that makes sense now.

Randy had since obtained enough real experience with neonatal and pediatric patients to begin the development of new schemata based on these type of patients. This enabled Randy to make more appropriate decisions, but he/she still used a scientific or theoretical method of reasoning to determine which schema the baby matched. This is illustrated in the next example:

Randy: How would I decide to use the conventional ventilator or the oscillator?

Basically I would ask myself is there much chance in this baby improving fairly quick? If I answer that question in my mind and I say, yea this baby looks like he will improve fairly quickly I would do just a regular ventilator using a volume mode. If I don't know, I must ask myself what condition is the baby in? What do we think is happening? And, If we give this baby surfactant will it turn around quickly? Or say they start this baby on medication for a patient ductus arteriosus that's open will it turn around quickly or does this baby have a lung condition that it looks like is going to be more long term, then I would say lets go on to the oscillator. Not even waste the time trying to maximize conventional therapy, just go on to the oscillator.

RB: What I'm hearing you say, is there are two tracts the baby may take, and you're trying to match the track you think it'll follow with the ventilator.

Randy: Right

Joe also described learning to use past experiences and inductive reasoning to make decisions when preparing for the delivery of a baby with a diaphragmatic hernia. The following example is from my interview with Joe.

You go ahead have everything ready, have the oscillator ready, and you know have the ventilator ready. You go though mental steps trying to get things prepared before that baby is born, once that baby is born, just from experience we know that we will have to go ahead and intubate that baby immediately use optimal vent support immediately, and if that fails go to the oscillator, and that just comes with my experience and a pattern in those babies that I've seen.

In summary, the care of patients on ventilators and oscillators required that the therapists use several different types of clinical reasoning in their practice. In this study they used inductive, pragmatic, procedural, collaborative, and conditional reasoning when dealing with ventilators and oscillators. The care for a patient on mechanical ventilation is a high concern for these therapists, but a patient who has lost the ability to maintain their airway and inability to breathe received an even higher precedence.

Maintaining Airways, Intubations, Extubations, and Suctioning

In the intensive care units, especially the pediatric and neonatal units, the ability to do assessments, and maintain an airway was an extremely important part of respiratory therapists' practice. If the airway could not be maintained, and the patient was unable to breathe, brain death could likely occur within a few minutes.

Intubation is invasive, requires steady motor skills, and is very crucial to the survival of some neonatal and pediatric patients. It was associated with procedural reasoning because it is a procedure done to alleviates problems such as respiratory failure or respiratory arrest and apnea. The following excerpt was from my interview of Jamie.

> The most difficult task in here is intubating this little bitty 26-28 week (gestational age) babies, whose airways are the size of a B-B. You have a little tiny tube…it's flexible, it moves around a lot, you have no room in the mouth. Their mouth is tiny, so you've got that big blade in there trying to get that tube in there, its awful. That's the hardest thing for me.

There were numerous examples of therapists maintaining patients' airways by intubating in this study. Shannon, a therapist with almost seventeen years of experience, explained the importance of rapid assessment skills and the decision-making that goes

along with changing endotracheal tubes in a baby with pulmonary hemorrhage. The following excerpt from Shannon's interview illustrated procedural reasoning, inductive reasoning, and how difficult maintaining the airway became.

> Yes, if you are changing an endotracheal tube and you have a baby that's actively bleeding; a pulmonary hemorrhage. You have to make a decision about how you are going to do it. Are you going to extubate with suction and reintubate, or are you going extubate under visualization and reintubate? You are going to have to look at that baby and see what you think they can tolerate. Because you know when you pull that tube out you may loose sight of your airway because of the bleeding…and then in PICU its the same thing, I have to make a decision am I going to extubate? or Am I going to change that tube out with a tube exchanger, or am I just going to visualize pull the old tube out, and put the new one in? Every patient's different so you have to look at those patients.

Another method of therapists protecting a patient's airway was suctioning. It was a procedure usually determined by assessment, and one of the first procedures done when a baby was born. The following excerpt, from my interview of Randy, described this procedure.

> When we go to a stork squad call, at a delivery, you get a baby and you are the first one to assess that baby and you've got to get it to breath. So you suction. I'm looking at its color, I'm looking at how it's responding to me…is it initiating its own respirations? And then, based on that I've got to decide how I'm going to intervene. Whether I'm just going to suction and give blow-by oxygen or do I need to bag and mask ventilate, or possibly intubate.

Randy was describing the use of several different types of reasoning in this example. Although the initial assessments were based on NRP guidelines, Randy recognized the baby's color from past experience with other babies in similar situations. Scientific or theoretical reasoning describes her/his "yes" and "no" answers to algorithms, inductive reasoning was used when comparing this baby's color with others, and procedural reasoning when determining which procedures could be use to alleviate the neonate's problem.

In summary, therapists maintain airways by assessing patients, intubating, extubating, and suctioning when necessary. They used procedural, scientific, inductive, pragmatic, and collaborative reasoning when performing tasks associated with these procedures. Other procedures therapists used to alleviate patients' respiratory problems included initiating, adjusting, and discontinuing aerosolized medications.

Aerosolized Medication and Surfactant Administration

Respiratory therapists routinely administered aerosolized medications to neonatal and pediatric patients as a part of their practice. The therapists in this study used clinical reasoning when initiating, adjusting scheduling or dosages, and discontinuing treatments. There were repeated examples of therapists giving treatments based on assessments. Perhaps one the best examples of practical and procedural reasoning use together, was Joe trying to get the resident to order treatment correctly. Joe found this very frustrating:

> Like whether or not…like when these Respiratory Syncytial Virus (RSV) kids come in, like these breathing treatments that they receive, that's a difficult thing going though the residents and convince them…they'll order them in a certain way, like every hour for 5 treatments, or every two hours for 4 treatments, and it's

difficult because they really don't understand this. It's what their pediatrician has told them, so they are just doing it, they are not thinking about it.

Other examples of procedural reasoning came from my observations of Stacie and Shannon. They gave aerosolized treatments to pediatric patients if the child had physician's orders for preventative aerosol therapy at home. They choose to maintain a continuity of therapy while the child was here in the hospital.

The delivery of surfactant to babies was usually done as soon as possible after stabilization. Experienced therapists were capable of recognizing familiar patterns during assessments, and could accurately predicting whether or not the baby would need surfactant. During my observation, Shannon used inductive and procedural reasoning when telling me, "This baby is going to need to be intubated, watch how the baby is retracting. It'll need to get ready for giving surfactant." Shannon recognized this pattern of breathing from past experiences with similar situations.

In summary therapists initiated, adjusted, and discontinued the administration of medications. They used their assessment skills in combination with procedural, inductive, and practical reasoning to make those decisions. Many of the situations they assessed were equipment related problems rather than clinical problem associated with the condition of a patient. These situations are discussed in the next section.

Securing, Adjusting, Troubleshooting, and Adapting Equipment

Respiratory therapists have dealt with technical and mechanical problems associated equipment, and the task and activities necessary to maintain that equipment, as part of their practice since the 1950s. In this study there were frequent examples of

therapists demonstrating their use of clinical reasoning to secure, adjust, troubleshoot, and adapting equipment.

Perhaps the best example of conditional reasoning I observed in this study was Stacy trying to secure an endotracheal tube on a neonate well enough that he couldn't pull it out again. The neonate had self-extubated himself three times in thirty-six hours. Stacy secured the tube again, made sure the neonate had a sedation order, and asked the nurse about giving him some medication. Stacy had retaped the tube more securely this time than before and told me, "If he does this many more times he's going to get a big boy's tape job."

According to Jordan, it was common for babies to move their oxygen cannulas or extubate themselves. Jordan said, "The child desaturates on the monitor, you go look at the child, and they've one nasal prong in their nose and one out. Or, the child has pulled it down and has the cannula in his hand." When securing an endotracheal tube on a neonate, he/she told me she would think of others who were able to remove the tube and how their tube was secured. This was procedural and inductive reasoning. Stacy told me he/she could recognize situations where a tube might come out by how active the baby was, and would try to prevent it from happening.

Therapists adjusted equipment on patients to prevent pressure sores or necrosis of the tissue. Almost every therapist I observed took the time to move pulse oximeter probes from one extremity to another on the neonates. Jordan indicated the use of inductive, procedural, and conditional reasoning when doing this task. Jordan told me, "You have to change these so their skin won't break down at the site, it can become necrotic from the

pressure." Having seen this before, Jordan told me she didn't want it to happen to this baby.

Randy demonstrated the use of narrative reasoning in deciding to move the pulse oximeter probe. Randy had never seen the necrosis a pulse oximeter probe could cause, but during orientation to this unit someone told him/her about an incident in this unit. Randy used their story, procedural, and conditional reasoning when deciding that the probe should be moved to another extremity.

In this next example Stacy told how she chooses to adapt the type of nebulizers to the child. Stacy explained the problems with more active children and using an older type of nebulizers.

> A choice between using two different types of continuous nebulizers which you would …just think one of them you can put a whole bunch in and it stays over here on a poll and can't get knocked over. Where the older ones we use to use, you just put a little bit in at a time and it's hanging off a mask, and the child can spill it, and you just think is this child going to be apt to do that and we just decide.

Stacy used pragmatic reasoning in deciding which type of equipment to use, procedural reasoning because he/she gave a treatment to alleviate a patient's problem, and inductive reasoning because he/she has established patterns of children who may or may not spill the medication in the nebulizers.

In problems or malfunctions with equipment, monitors, arterial lines, and ventilators, therapists used pragmatic reasoning and hypothetical-deductive reasoning, or "troubleshooting" to find the problem. An example of a therapists' troubleshooting

equipment came from my interview with Casey, where she/he discussed trying to find the problem with a monitor that had been alarming throughout the evening. Casey's step- by-step method of determining what caused the pulse oximeter to alarm was representative of scientific reasoning.

> Sure, an example would be troubleshooting a pulse oximetry…that maybe the extremities are cold and all of a sudden they are not picking up, or the kid is moving a lot, the probe is off, you kind of go look at it and go through all these steps of things that could be wrong to determine what is causing it to alarm

In summary the therapists in this study used several different modes of clinical reasoning when securing, adjusting, troubleshooting, and adapting equipment. These included pragmatic, scientific, inductive, narrative, conditional, and procedural reasoning. Another treatment procedure observed in this study was the initiating, adjusting, and discontinuing of Continuous Positive Airway Pressure (CPAP) or Bilevel Positive Airway Pressure (BiPAP).

Initiating, Adjusting and Discontinuing Continuous Positive Airway Pressure and Bilevel Positive Airway Pressure

Continuous Positive Airway Pressure and Bilevel Positive Airway Pressure are used to oxygenate patients without the need for invasive endotracheal tubes. The respiratory therapists in this study commonly used this mode of therapy when they wanted to increase the oxygenation of a patient but did not want to intubate, or place the patients on the ventilator. Some times CPAP was used as a transitional means of improving the oxygenation status for neonates who required less assistance than a ventilator and more than nasal oxygen.

In my observation of Casey, he/she explained that some babies tended to very easily become bradycardic. They (respiratory therapists, nurses, and physicians) planned to extubate one particular baby, and even though they had already started him on medication to increase his respiratory drive; Casey explained that babies like him usually go straight to nasal CPAP rather than a nasal cannula. The reasoning included the use of inductive, conditional, collaborative, and pragmatic reasoning in working with this procedure and baby.

At some point during my observation of Stacy, she received a patient who was having long and frequent periods of sleep apnea. Stacy used inductive, procedural, pragmatic and collaborative reasoning. Stacy associated this child with other similar cases, decided which procedures to use, and obtained the equipment and placing it his room in the solution for a patient problem. Later in the interview, she/he explained how the procedure was selected.

> Well, such as the little boy in there…getting him on the BiPAP before he goes back to sleep again. Kids like that go apnic when they go to sleep, and based on the fact that he has sleep apnea from sleep studies done by his doctor, and knowing that BIPAP will correct sleep apnea and hypoxemia.

When I asked what "kids like that" meant and Stacy said it was from previously seeing other kids with sleep apnea. I then asked what the assessment was based on when trying to decide which method of oxygenation to use. The following shows how Stacy, an expert therapist, used patient assessment and inductive reasoning rather than physiological monitoring to make decisions. Experts sometimes confirmed their decision

rather than made their decisions by using physiological monitoring in the form pulse oximetry, heart rate, and blood gases.

> I normally originally based it, if the child's not on a ventilator, on just his level of consciousness and whether he's acting confused or anything else…and then I would, if I was in doubt at all, I would probably then get a spot check [pulse oximeter] and see if his level was low enough to require oxygen.

In summary, therapists used assessments and collective, pragmatic, inductive, practical, and procedural reasoning when managing patients on CPAP or BiPAP. They initiated, adjusted, and discontinued these procedures. When this method of oxygen delivery was more than was needed by the patient, therapists used oxygen delivery by nasal cannula or oxyhoods.

Initiation, Administration, and Discontinuing Oxygen Delivery

Perhaps the best example of practical reasoning I observed was the management of oxygen delivery in the nursery. It seemed that almost everyone was continually adjusting the flow or concentration of oxygen on neonates based on their current oxygenation status. Sometimes it would be for only a breath or two, and other times it would be for a considerable length of time. Therapists used comments like these: "this will be stressful for this baby" and "last night when we messed with her, she got a little bradycardic", or "the baby has dropped down a little bit, it's obvious that they are just a little agitated, so you give them a couple of oxygen breaths" to explain why they made minute to minute decisions about the oxygen they administer. Here is an example from my interview where Lee talked about how the use of oxygen was frequently adjusted to meet the need of the patient.

> That's the way it going to be for a while, you are going to be going up and down on the oxygen, you'll turn it up, then you have to wean it back down. Then he'll desaturate again, and you have to turn it back up. He's going to need oxygen when he gets off the ventilator, and he'll probably go home on oxygen.

During one of my observations Randy spoke of the continual adjusting of oxygen. The nurses and therapists constantly changed the oxygen, trying to protect the neonate's eyes. The baby would go bradycardic or its heart rate would drop and someone would increase the oxygen. Then when the baby's heart rate had recovered and stabilized and the baby settled back down, the oxygen could be turned back down. This went on constantly in this unit.

Jamie explained an attempted to wean a baby off of oxygen. Jamie wanted to see what the neonate did without the level of flow it was on, and told me, "When he was stimulated last night he would desaturate, become bradycardic, and his respiratory rate increased". Jamie might take the neonate off the oxygen, if he doesn't develop bradycardia, and suggested past experiences with other similar babies led him/her to believe this baby would do fine. For Jamie, decisions about how much oxygen or the flow a neonate needed was a relatively easy one. The following example from my interview of Jamie, suggested that decisions were made using procedural, conditional, and inductive reasoning, based on previous similar cases.

> Whether or not I think the baby needs to stay on oxygen, or whether or not they need the flow through the oxygen? It's was very easy to stop or turn it down and watch them over a short period of time and see how they are going to do. It's a very instantaneous thing; if they really needed the oxygen they automatically

dropped their saturations. If they really needed the flow they started retracting almost immediately it doesn't take much time to see which direction they will go.

The therapists in this unit were aware that high levels of oxygen could be potentially dangerous to neonates. Randy suggested that they try to minimize lung injury, and prevent damage to the babies' eyes by weaning the oxygen as soon as possible. During my observation of Jordan told me:

> I'm checking to see if he is tolerating the dose. I see he is resting quietly, not agitated, or his hands aren't constantly messing with the cannula. I then check to see if he can be weaned. I look at his color, I look at the pulse oximetry, I look to see how hard he's breathing. Then I determine whether or not to increase or decrease the oxygen by looking at the saturation, determine whether or not he can tolerate a higher or lower saturation.

Jordan, who is relatively new to these units, still uses scientific reasoning and systematically goes through a checklist trying to determine how to best manage the baby. Jordan used procedural reasoning in determining which procedure would alleviate the neonate's oxygenation problem. The scientific or hypothetical deductive reasoning used was in the form of hypothetical questions, which were answered by yes or no.

In summary, therapists made decisions about the management of oxygen primarily using practical reasoning, because they managed oxygen on almost a minute-to-minute basis, depending on the condition of the baby. Three other types of reasoning collaborative, inductive, and scientific were also identified.

Stacy's viewpoint, in the following excerpt from my interview of her, sounds very

much like that of Randy's at the beginning of this section. She considered that most of the activities or tasks that she performed were guided by some form of clinical reasoning.

> Everything we do back here requires a decision to be made; I make decisions every time I check the ventilators. Decisions that they are on the right settings, that they don't have to be changed, that I don't need to go talk to the doctor about their settings, or a plan or their level of sedation. It's an everyday thing that we do. When a child comes in new and distressed, there's even bigger decisions then, because you have to analyze exactly what it going on with the child, and what he needs from you at that moment, and then create a plan for him.

Summary for First Research Question

In summary, the therapists in this study used several forms of clinical reasoning in many of the tasks and activities they performed. They drew arterial blood, inserted and troubleshoot arterial lines, stabilized and /or resuscitated patients, initiated, monitored and adjusted ventilators and oscillator, maintained airways by intubation, extubation, and suctioning, administered aerosolized medication and surfactant, and secured, adjusted, troubleshoot, and adapted several different types of equipment. Many times multiple types of reasoning were used to solve different aspects of a clinical problem. The next section of this paper provides examples of how respiratory therapists used different types of clinical reasoning described in the literature review of this study from the fields of nursing, medicine, occupational, and physical therapy.

Section Two: Types of Clinical Reasoning Used

My second research question considers the types of clinical reasoning that respiratory therapists used in their daily practice within the intensive care units. This was

answered by determining which types of clinical reasoning the therapists used in this study. The following section presents the nine methods of reasoning described in the literature and the ways respiratory therapists used those types of clinical reasoning in their practice.

Scientific or Theoretical Reasoning

Fleming (1991) described scientific reasoning, sometimes referred to as theoretical or hypothetical deductive reasoning, as being much like the rational model of cognitive processing where the development of a hypothesis is followed by data collection to either prove or disprove their hypothesis. According to Benner (1999) this type of reasoning yields either a ““yes” or “no” answer. The therapists in this study indicated that they used scientific or hypothetical deductive reasoning, particularly when searching for the cause of a problem, as part of process in finding its solution.

Therapists demonstrated how they used a mental list and “trouble shooting” as a method of problem solving. Perhaps one of the best examples of scientific or theoretical reasoning I observed was from my interview of Casey:

> Casey: Maybe let’s say the baby starts to desaturate and you’ve got take into account whether or not it could be something to do with the babies heart…the baby could be having a shunt problem so you might want to watch and see if it comes back up if it doesn’t come back up you might want to listen make sure the endotracheal tube is still in place, if the baby has an endotracheal tub, if not, go over, make sure that he is taking adequate breaths, find out if you have bilateral breath sounds, and make sure that your ventilator circuits are [connected], take the baby off of the

ventilator and bag them and see if it's a problem with the ventilator… that it's not ventilating them and manually ventilate them… maybe consider that you could have a problem with your tube, it could be plugged buy secretion. If you are manually ventilating them and the saturation is still not coming up you should consider that there is a problem with your endotracheal tube. It's not uncommon up here to extubate and reintubate a baby because there is a plug in the tube, even if you can pass a suction catheter that doesn't mean that there's not a plug on the end of the tube that's flopping back and forth.

RB: This sounds like you have a mental checklist that you are going over?

Casey: I go though…Yeah, like a mental…from the most obvious to the least obvious...trying to solve the problem, I mean you need to go though…also in your mind you are going through what's least invasive to the patients when you are trying to solve a problem.

RB: Sounds like there are lots of opportunities for you to solve a problems like that?

Casey: All the time, almost everything we do.

In some cases, respiratory therapists used this method of reasoning differently than occupational and physical therapists. Fleming (1991) suggested that occupational therapists already knew the clinical condition or disease problem when they saw patients or clients. Their specialty was in knowing about the disease, clinical condition, or specific details of performance rather than diagnostics.

Respiratory therapists are often faced with solving clinical problems when they don't know the condition or situation causing the problem. They commonly referred to this as "trouble shooting." This involves scientific or hypothetical deductive reasoning, as in the previous example, where they generate and test hypothetical solutions by doing a procedure, as a method of determining the cause of a problem.

Therapists in this study commonly used guidelines, which were provided by policies, procedures, and physicians, and protocols, along with their own personal unwritten guidelines in their practice. The unwritten intuitive protocols seemed to be the most commonly used guidelines. Here is an example of how Jordan described the guidelines used:

> We have guidelines for our work, you have guidelines that the doctors set obviously, and then you have guidelines that you kind of go by yourself. The guidelines that the doctor may set may be such as for instance, we've got a patient that's got certain oxygen levels, they want his saturation 88 to 90%, that would be guidelines that the doctor set. The guidelines I might set might be up above his or 92%. So you've got different guidelines for your blood work than their limits and there are different guidelines for different patients. He may say these are the normal limits I want for this patient, but you may have set slightly different ones.

Other therapists also talked about using both the written and the unwritten guidelines in their practice. Benner (1999) suggested that formal guidelines, or technical rationality, as a form of scientific reasoning, required an absolute "yes" or "no" answer. Most of the therapists in this study found it difficult to work with written guidelines in the form of policies and procedures due to the complications and exceptions they found in

actual practice, so they developed their own more flexible and inductive guidelines. The following quotation is from my interview of Randy:

Yeah, What we do is based on guidelines. We have guidelines for different therapies, there are written down protocols and then the majority of the guidelines that I use are unwritten guidelines. They're just what I've been taught, what I have seen to work, you know, we just kind of…like I said, mostly what we do is more like an unwritten ... it more like that because we've learned what to do and you've seen what works, so you just kind of understand what you need to do. All of it's not written down concretely, do this for this situation, do that for that for that situation [because] every situation is a little different.

The participants of this study used an underlying basic understanding of scientific theories as a method of comprehending their practice. The task, activities, and procedures they performed, as part of their practice were based on well-established scientific research and theory. Joe told me all therapists in this study used science in their practice, although, "sometimes it may not be intentional." My interview of Randy provided the following example:

RB: How does science fit into all of this?

Randy: You've got to have basic knowledge of science and physiology of the human body, and the way mechanical ventilators work, the knowledge of the equipment, and how it works just to even be able to function. So, I mean you've got to have that scientific knowledge base to even start you can't come in here and not know what oxygen as a molecule is, or how oxygen interacts with the body, and come in here and expect to do good

therapy. I mean you've to have that. The knowledge you get in school is like your first building block, and then when you get here you start building on top of it, and it's mostly like your subconsciously knowledge that you have in your mind.

RB: Do those who have more or less scientific knowledge find it affects their ability to build experience?

Randy: Yeah, I think there are some [therapists] that didn't retain it, and it affects their performance ultimately.

RB: It is like a foundation? Where if it's correct, when you start to build on it, everything is stable and fits. Or where, if you have something wrong in your foundation, all of the experiences you associated with that foundation are wrong. That has an effect on the decision they make based on those facts, and somewhere it will cause them to make a mistake?

Randy: Yeah, you've go to know the basics, if you are going to get it right.

In summary, therapists in this study used scientific reasoning in the forms of hypothetical deductive reasoning and reasoning based on science to solve clinical problems. They would "trouble shoot" problems using hypothetical deductive reasoning, and a mental list of possibilities from which they created a hypothesis. They also used scientific reasoning as theoretical reasoning, based heavily on scientific research and theory as a base of knowledge for their practice.

Procedural Reasoning

As expected, there were numerous examples of procedural reasoning in this study, ranging from the administration of oxygen to determining what should be done in the

stabilization or resuscitation of a neonate. Procedural reasoning as described by Mattingly (1983) was the decision-making process used when therapists searched for techniques or procedures that could be used to help alleviate patient's physical problems.

Higgs (1991) described this type of reasoning as also being similar to the hypothetical deductive reasoning described in the medical literature. In this form of reasoning, the therapists considered the disease process or disability, formed a hypothesis about what caused the problem, investigated the evidence of the hypothesis, and then searches for the solution to a physical problem based on the evidence they found and then proceeded with actions to alleviate or remedy the problem.

Perhaps one of the best examples of procedural reasoning, as described by Higgs (1991) was in my observation of Shannon as she participated in the resuscitation of a neonate. The following examples are excerpts from my field notes of that observation.

> We had just brought our lunch back to the therapists' break room located just outside of the NNICU. We had just begun to eat when we overhear some commotion about a pneumothorax on the baby girl just born. Shannon dropped the fork and ran to the bedside. It took less than a minute and she/he was in the middle of the neonate's resuscitation. I stood back and watched as they did compressions and bagged the baby. Shannon, the nurse practitioner, and another therapists were talking about what might have happened. They thought it might be a pneumothorax, and several other people in the nursery were trying to find a transilluminater or flashlight to look for a pneumothorax. When an illuminator was found, they didn't see a pneumothorax, so they began searching for another cause. One of the nurses called for the results of an echocardiogram, that had just

been done, because someone though the report showed a pericardial effusion. Quickly everyone started scrambling for another type of equipment to relieve the pericardial effusion. Within a minute or less, it was learned that the effusion wasn't large enough to have caused the problem or require a special procedure to alleviate it. The babies heart rate had by now come back up to an acceptable rate (epinephrine had been given), the baby had been placed back on the ventilator, and everyone settled into a calmer mode. When Shannon moved away from the baby, I asked what had happened. Shannon told me, "I knew that was going to happen, she (the neonate) just looked mottled, like other children just before coded." I asked what was wrong with the baby and he/she told me the baby was septic, had gone into shock, and the nurses were going to start antibiotics.

The previous example showed how therapists actively searched for the problem, in their attempt to understand which procedure would alleviate the problem causing the neonate to require resuscitation. They hypothesized a problem, eliminated that possibility, and then formed their next hypotheses about another possibility until they determined what had caused the problem, then started the appropriate solution to correct the situation.

In the next selection, Jamie described how she/he reasoned through a problem when called to do an assessment of an unfamiliar patient. The following was a quotation from that interview.

Often times, yeah, you can see a patient that…maybe someone that is going into early pulmonary edema…you can see it when you get to the floor and get called for these patient assessments. Two-thirds of the time it's a pulmonary edema

assessment, where you go and listen to them and they are crackling like crazy. A lot of times they are already coughing up the frothy stuff and the nurse is saying they are in respiratory distress, give them a treatment and a lot of times they are wheezing because they've got all that fluid and generally when I hear them like that, I say what is their output? Do you know what their input and outputs are? Well, if they don't know that, I say, well do you know how much fluid they've gotten today. You know this looks like --- and then getting a doctors order either a diuretic or even putting them on CPAP a lot of the times. Sometimes you can put them on CPAP for an hour or two and they'll be perfectly fine after that. Getting the CPAP and a diuretic, they come into the emergency room like that lots of times.

The therapists in this study used procedural reasoning almost every element of their practice. They use procedural reasoning in the stabilization or resuscitation of neonate or pediatric patients, when initiating, monitoring, making changes, or discontinuing a ventilator, treatments, or oxygen, and in determining when the patients need suctioning.

Inductive Reasoning

Inductive reasoning is considered pattern recognition or schema development (Greenwood, Sullivan, Sperce, and McDonald, 2000) where therapists develop the ability to recognize and interpret patterns based on previous experiences. Higgs (2000) suggested this method of reasoning allows for "direct automatic retrieval of information from a well-structured knowledge base" (p. 6). In this study there were several examples of therapists using inductive reasoning or schema to make decisions.

My interview of Lee provided an example of a schema for a specific disease. The following excerpt is from that interview.

> Yes, Like babies with Bronchopulmonary Dysplasia, I know these babies are going to desaturate frequently, but you get use to it. That's the way it going to be for a while, you are going to be going up and down on the oxygen, you'll turn it up, then you have to wean it back down. Then he'll desaturate again, and you have to turn it back up. He's going to need oxygen when he gets off the ventilator, and he'll probably go home on oxygen.

Higgs and Jones (2000) suggested that inductive reasoning is also intuitive knowledge linked to specific past experiences. Therapists in this study demonstrated how they used inductive reasoning to make patient related decisions. This type of reasoning allowed them to mentally compare the patient's responses with expected responses and therefore anticipate problems and even prevent them from occurring.

The more experiences a therapist had with a specific case, the more likely they were to recognize deviations from these patterns or schemas. The following is an excerpt from my interview of Shannon describing the schema for a premature neonate and then exceptions to the pattern.

> Yeah, real premature babies follow a pattern, usually there's a honeymoon period, the first twenty four hours that you cannot get a gas that is not alkalotic, and you just wean' em, wean'em, wean'em…and then the next twenty four hours the honeymoon is over and you can't get a gas that's not acidic. Then every once in a while you get a baby, that's a real premature baby that's been on steroids or that's

had enough stress going on in utero, that it's lungs are a little bit better. Then after the first twenty-four hours and they don't have that change. They're different.

Often expert therapists were unable to explain their inductive reasoning and how they determined the solution to a problem. They referred to it as "know it from my experiences" or "having seen this before." The following is from and interview with Jackie, another expert therapist, trying to describe how she/he made a decision based on a "gut feeling."

> You've just got to take everything that you've seen, encompass everything you see now, and put it together in you thoughts like how the baby looks, what the monitors are saying, and what's your gut feeling…you've got to be on top of it too, you know if you make a change you've got to come back not two to three hours later to check what you've done…if it works, you've got to come back in thirty minutes to see what you've done.

This was consistent with Benner's (1999) suggestion that expertise does not simply occur with the passage of time. She suggested that instead, the learner must actively involve himself or herself in the situation, question their own preconceptions, recognize patterns, and purposefully engage in the problem-solving process. The respiratory therapy supervisor suggested that there was a big difference in the therapists who has had seven years of experience, and one who has one year of experience, seven times.

The use of inductive reasoning and development of schemata allowed therapists to recognize patterns when they occurred, anticipate problems before they happened, and recognize exceptions to those patterns. They were able to minimize unwanted outcomes

by closely monitoring physical and physiological parameters. The development of these schemas was enhanced as the therapists actively participated in the process of finding solutions to problems.

Interactive, Predictive, & Conditional Reasoning

According to Mattingly (1993), interactive reasoning implies a shared decision-making that occurs between the therapists and their clients. Higgs and Jones (2000) suggested that interactive reasoning occurs as a deliberate dialogue between the patient and the therapist. As I expected, there were no examples of interactive reasoning between therapists and neonatal patients or their families. However there was an example of interactive reasoning between the physician, therapists, a pediatric patent and his family.

During my observation of Stacy, when she worked in the pediatric intensive care unit, she and the physician deliberately developed a plan for introducing a new type of respiratory equipment to a ten-year-old patient in an attempt to gain trust and facilitate his acceptance of the treatment. They talked about "making friends with the child" and "introducing the CPAP to him before attempting to get him to wear it". They did this in hopes that he would tolerate the treatment when they actually started using the procedure. Stacy assembled the equipment, prepared, and placed it in the patient's room close to his bed without saying much to him. Later, she and the physician talked with the child and persuaded him to try the new procedure. This interactive reasoning facilitated therapy because they used dialogue to enhance his acceptance of therapy.

Had this study taken place where therapists worked in the adult intensive care units or in pulmonary rehabilitation, perhaps this type of reasoning would have been identified more frequently and it would have more closely resembled that of occupational

and physical therapists. In those areas therapists would have been more likely to communicate directly with patients.

Mattingly and Fleming (1994) also suggested that conditional reasoning brings together the whole picture of the patients because it allows the therapists to use nonlogical methods of reasoning such as imagination in considering the patient in both current and future circumstances. Therapists demonstrated that they used conditional reasoning in this study, although differently from that of occupational and physical therapists. Throughout this study when therapists managed patients they considered the harmful effects oxygen and ventilators on tiny premature lungs.

This reasoning frequently occurred as therapists thought about multiple future possible outcomes of treatment, and tried to adjust therapy to minimize the negative consequences on the patients' futures. This was especially important when considering the harmful effects of ventilators, which included pneumothorax, volutrauma, barotrauma, and intraventricular hemorrhage. These therapists tried to minimize the unwanted responses to ventilation, while at the same time providing sufficient support. The following example is from my interview of Jamie:

> I think that a lot of what we do to these babies has an effect on their outcome in the end. Like I told you before, almost anything can cause a bleed in these little babies, their vessels are very immature and high pressures cause them to bleed, and all it takes is a little bit of rubbing like when you're doing your stabilization, putting them on the ventilator with the positive pressure of the ventilation, or lots of oxygen. There is a fine line in there, I'm doing this to save this baby, but am I hurting him more than I'm saving him. Yeah, that stuff comes up quite a bit.

Another similar example of reasoning associated with trying and preventing injury came from my interview of Jackie when we talked about the hazards of ventilation.

> Oh yeah, like barotraumas. With every good thing there is a bad thing. I try to minimize the bad. Especially like a kilo baby, you set them on a tidal volume of 16 ml, and they've got good compliant lungs and I immediately try to wean them down off of the volume because of the volutrauma. You know in 28 days when Bronchopulmonary Dysplasia shows up, that could be the cause of it.

Both of these examples were situations where therapists considered possible future problems for the neonate and tried to avoid the consequences. There were times when this type of reasoning must be ignored because of difficulty in present management of the patient. The following example was from my interview of Lee, when discussing the difficulty in getting a good seal with a CPAP mask.

> Sometimes you just have to get it tight, and then deal with the consequences later. We did have this one baby and it was debatable whether or not he still had the bridge of his nose when he left. I know he had a plastic surgery consult before he left here, but he was alive. I think about what the child's life will be like, and how this will have an effect on him for the rest of his life.

Therapists also used conditional reasoning in their daily practice when they "washed hands, gowned, and gloved up" in preventing contamination of babies, or when they replaced blood when drawing from an arterial line to "prevent the need for a blood transfusion" or marking a suction catheter to "prevent trauma when suctioning" and checked the pressures set pop-off valves "to prevent trauma when bagging the baby with a resuscitation bag."

According to Mattingly and Fleming (1994) occupational therapists used interactive reasoning when they were convincing their patients to "buy into" the

therapeutic regiment. Respiratory therapists' patients, especially pediatric and neonatal patients, have no say so about their regiment of care, it was dictated by the physical and physiological status of the patient.

Respiratory therapists thought about the consequences of their practice by considering future problems caused by their work, and tried to prevent them at the present time and in the future. In doing so, they assessed the patient and situation, detected small subtle changes they could make, and adjust therapy accordingly. Predictive and conditional reasoning were used with neonatal patients, and additionally interactive reasoning was used to facilitate treatment with pediatric patients.

Narrative Reasoning

Narrative reasoning according to Mattingly (1991a & 1991b) and Schell (1993) occurs two primary ways, through story telling and through therapists creating therapeutic stories with current patients. Respiratory therapists use of story telling was documented in many of the interviews and transcripts from this study.

Shift report among respiratory therapists was an exchange of information between individuals at the beginning of each shift. It usually consisted of settings and parameters for equipment, history, medications, patient's progress through the last shift, diagnostics and lab results, and any specific physician's guidelines for individual patients. An inadequate shift report limited the therapists' holistic picture of the patient, and eventually limited their practice. It was common practice to include the patient's story as part of shift report. This provided additional information, added a personal touch, and provided the oncoming therapist with a broader perspective of the whole picture.

The therapists in this study also told patients' stories as a form of narrative reasoning through conversations with other therapists, nurses, and physicians. Initially I would get lost in the stories myself, switching back into my therapist's mode of thinking, and even taking the time to write these stories in my field notes. Some were elaborate and

very descriptive providing detailed information about critical or unusual cases, and others were simplistic providing only basic information about the patients.

Possibly one of the best example of narrative reasoning I observed occurred during my observation of Shannon in PICU, when talking with the mother and grandmother of a small baby who earlier that day had received a tracheostomy. Shannon told them a story about another baby who recently had the same procedure, and how important it would be for the mother to develop a network of individuals who would feel comfortable helping with this baby. Using narrative reasoning, Shannon tried to prepare the family for the enormous and time consuming responsibility they faced.

Therapists also used story telling as a way of sharing information and learning from each other. In the next example, Randy explained how the narratives of more experienced therapists increased his/her knowledge during orientation to these units.

Randy: When I was being oriented in here…you know, because you can' t…you're not going to have everything that can happen…it's not going to occur through that four week orientation. So, you get stories about what could happen. So, that just kind of prepares you, at least in part mentally, as to what may happen later on when you get down the road. This may end up happening to a patient you're taking care of. So that was big part of my orientation just a more experienced therapist sitting there telling me what's happened to them the baby has a…you know…diaphragmatic hernia, this is what you might see. I mean I never saw that during orientation but they just kind of went through it.

RB: So you think you would recognize it, if you see it, from hearing their stories about it?

Randy: Right.

According to Merriam (1993), this type of story telling enlarges the practical knowledge of the whole group. These therapists told sometimes told stories during lunch about what had happened to them earlier in the day, or when they were trying to help each other with a specific problems, and when they just had a story to tell that they thought everyone should hear. The following is an example from my interview of Lee:

> Oh yes! I tell them alright, like a story about a situation with a patient, like when I was on a transport and we got into trouble, and there was not a resuscitator bag on the transporter. I thought there was always a resuscitator bag on the transporter. But this one time, there was not one, so I learned from that experience that I should always check, regardless of whether or not there should be a resuscitator bag on the transporter and I've shared this with everybody.

I also found that narratives, in the form of story telling, was used by the physician in teaching rounds when he was trying to present examples of situations he wanted the entire group to understand. There was a lot "let me give you this scenario" intermingled with scientific-based examples, questions and answers.

The therapists in this study used narrative reasoning in the form of story telling to share information with each other, patients' families, nurses, and physicians. The physicians used teaching rounds and storytelling as a method of increasing the knowledge of the whole group.

Pragmatic Reasoning

Pragmatic reasoning involves practice decisions that go beyond the relationship of therapist with their patients (Schell & Cervero, 1992). It concerned contextual factors that either inhibit or facilitate therapy based on two perspectives, practice and personal. They found that certain pragmatic issues had a "tendency to be more influential in a therapist's clinical reasoning that their own beliefs and attitudes" (p. 608).

Schell and Cervero's (1993) work with occupational therapists identified practice pragmatic issues including, environmental issues, hospital and departmental issues, personnel and budgetary issues. The personal pragmatic issues they identified included motivation, issues of power, preferences, clinical competences, commitment to the profession and life outside of work (p. 94). The therapists in this study also demonstrated their use of pragmatic reasoning in departmental equipment and supplies issues, and time or staffing issues.

Physicians and nurses depended on respiratory therapists' technical expertise in responding to alarms of the equipment usually maintained by respiratory care, including mechanical ventilators, pulse oximeters, capnographs, and oxygen analyzers. They relied on the therapists to make accurate technical decisions, validate the reading of equipment, and if necessary, when possible remedy problems associated with the alarms. Respiratory therapists dealt with many different types of equipment on a daily basis, so it was not surprising that the majority of their pragmatic reasoning concerned problems associated with departmental equipment and supplies.

The workloads for therapists quickly and drastically fluctuated in the nursery, and since there were generally two therapists assigned to this unit they divided their workload between themselves. Their responsibilities included keeping track of multiple patients simultaneously throughout the day. They constantly, consciously and unconsciously monitored patients in a manner similar to what Fleming (1993) described as using multiple tracks, where "components of one situation were temporarily shifted to the background while others [components of another situation] were brought into the

foreground" (p. 121). The following example was from my fieldnotes when I observed Randy.

> While taking care of one baby, he heard another alarm, on a ventilator in the next pod, the responsibility of another therapist. Randy looked over at her and realized that she was busy retaping another baby's endotracheal tube, so he/she responded to the alarm. The ventilator's monitor showed no exhaled volume, which usually indicated that the circuit had come loose from the ventilator or endotracheal tube, or that the endotracheal tube itself was out of place. Randy checked all the possibilities he/she could think of with no results, then called for the senior therapists to come help. She stepped in to asses the situation, but she also couldn't find the problem. Randy moved back away from the baby and ventilator, giving her more room, and recognized that someone had left the inline suction on. Randy turned it off and the ventilator alarming stopped. Both therapists, satisfied they had found the problem and corrected it, returned to their subsequent work with other babies.

Jackie, considered the development of these skills an important part of practice. The following quote is from that interview.

> I guess that's one thing about respiratory, you are pretty lucky to be able to develop, because you've got multiple patients rather than like a nurse that only has one or two and that's all they have to worry about…You know, if you have twelve ventilators then you have to have twelve tracks. Yeah, that's why God keeps our ears going while we are thinking about another patient. That way we use all of our senses, that way they are always activated.

Equipment alarms had different sounds or pitches. These sounds were distinctly recognizable to the therapists, and they responded differently to them. Sometimes their response to an alarm was almost subconscious. When either the pattern of alarms or the tone of the alarm did not indicate a problem, sometimes the therapist chose not to respond. However, alarms with different sounds, those that lasted longer, or even certain combinations of alarms brought very different responses. These responses ranged from simply looking to see if someone was causing the alarm, responding to the alarm in a casual manner, or dashing across the unit to an alarm that was out of sight.

Their quick responses were a combination of inductive, scientific, and pragmatic reasoning. Lee suggested it was like a sensation of knowing what was going on around her just by the sounds she heard. The following example is from my interview of Stacy, when I had asked her if he/she hears all of the alarms in the unit.

> Yeah, it's selective amnesia. It's because you know if you're hearing the slowing down of a pulse oximeter you don't think about that…but at the same time as a high pressure alarm… that's certain ones that come together at the same time in your mind make an alert go off and you know that this is trouble.
>
> Staffing and time were also important pragmatic practice issues for these therapists.

Their pragmatic reasoning about staffing and time involved issues both inside and outside of these units. On two occasions during this study, these therapists started their shift trying to correct staffing problems. The following excerpt is from my observation of Jackie:

"The schedule [was] wrong this morning. I had to forget about the babies and take care of that. Some days, it's really bad. There are days when the schedule isn't right, there is a transport, and they call you for the stork squad. I've had all three happen at once". I asked Jackie which would get done first and last? She told me the resuscitation of a baby would come first and the schedule would be last.

Jackie's answer suggested that in a situation like the above example she/he would triage work, taking care of the most critical issues first. The personal pragmatic issues identified in this study were attitudes and amount of experience. These therapists worked long hours in one of the most emotionally stressful area of the hospital, and their development of personal attitudes, good or bad, was considered a pragmatic issue.

Therapists talked about issues such as receiving lower pay than nurses, not having the same scheduling opportunities, and not being publicly recognized by administration as an important part of this team. They also talked about personal fatigue from mandatory overtime when it become necessary, and times when there had been more work than they were physically able to do. But, on the other hand, they also talked about liking the people they worked with, loving their jobs, being proud of the work they perform, and that they choose to work at this hospital rather than go to others.

These therapists were aware that their personal attitudes affected their own personal interaction with each other, but did not believe it interfered with patient care. The following example is from my interview of Jackie:

I used to be a nice person, but this place changes you. I use to just hold everything in... anger, frustration, to much to do, and it's people's lives we are dealing with here. We use to have to many chiefs and not enough Indians, and the chiefs

wouldn't do anything to help. Things are a little better now, and I stand my ground on the really important things.

While observing Shannon I noticed how personal pragmatic issues were subordinated by a critical situation with a neonate. The following example from my field notes, illustrated this point:

> Shannon received a page from his/her son. When the call came Shannon was in the middle of the resuscitation of a neonate. It seemed the grandmother hadn't picked him up after school. Shannon told me, "I've got children problems and I've got to go to PICU first." We very quickly went down the hall to the other unit. Shannon went into the room, checked the ventilator, and when satisfied that everything was all right, after assuring the nurses, went to a phone located at the nurses' station to make another call. "I've got to find my child, I can't get my anyone and someone needs to go pick him up." After several attempts, Shannon was finally able to reach a sister who went to get her child. It was then, that I realized the information about the child came in the middle of the resuscitation of a neonate. Shannon told me, "I would have continued taking care of that baby, but the whole time I'm thinking where's my kid, where's my kid, and I'm getting sick at my stomach."

The issue of personal experience, its affect on clinical reasoning, and the decisions therapists made were evident in my interview with Joe. Joe suggested that a lack of experience using a specific piece of equipment would cause a therapist to push the limits on other equipment, ones they were more comfortable with, or they would try to get the orders changed to more familiar equipment.

> If you have been shown a way to do it, even if you are still uncomfortable, you're still not going to want to do it, because if something goes wrong and you can't trouble shoot it…it's in the back of your mind that your going to try to optimize what you have, and if that fails you're going to have no choice…yeah…you know. I would try to optimize the ventilator settings and at the point that we just couldn't oxygenate or ventilate that baby…we just have no choice, we're going to the nitrous oxide…another thing is the high frequency jet because we hardly ever use that here…so that's like real intimidating too,.. trying to set it up. I would talk to the physicians and say…hey look, can we just go to the oscillator instead of the jet.

Therapists in this study used pragmatic reasoning when dealing with practice issues of equipment and supplies, staffing, and time. Those identified as personal pragmatic issues included attitudes, personal problems, and experience. However, there were times when their reasoning required more than just knowing which procedure or piece of equipment was appropriate for the situation. In these situations they used practical or logical reasoning adapting the procedure or equipment to specific patient situations.

Practical or Logical Reasoning

Practical or logical reasoning according to Mattingly and Fleming (1994) is the "searching for a particular solution to a single problem" and is concerned with the most appropriate solution for a patient, at that time (p. 10). It is more than clinical competency, which is knowing what to do in a specific condition; this type of reasoning is knowing when, why, and also how to intervene in the same clinical circumstance. It is the fine

tuning of treatments, knowing more than just what will work, it is concerned with what will work best, and when it is the most appropriate to do what is considered best for a particular patient.

Therapists are traditionally "tweakers." Their profession, having evolved from taking care large and heavy pieces of equipment, has remained somewhat technical and mechanical. However, the equipment of today's respiratory therapists includes highly technical physiological monitors and ventilators. These therapists monitored and manipulated pressures, volumes, rates, flows, oxygen concentrations, and medications as part of their daily practice.

During an interview, Joe suggested that a therapist's ability to make patient assessments and understand "why" rather then "how" changes were made, separated the good therapists from the less astute ones. This difference according to Durbin (1996) is based on a respiratory therapist's accurate assessment of a situation and the ability to make subtle changes in patient care, based on their assessments. Durbin suggested that this is one of the most valuable aspects of respiratory therapists' practice.

Without realizing how the decision was made, Shannon an expert therapist with sixteen years of experiences, walked into a room where I was standing and adjusted the ventilator. Shannon then said, "There, now most of the breaths are the ventilator. Watch the baby's sternum and you will see". Without thinking about how or why, Shannon had synchronized the ventilator with the needs of a tiny patient. When I pressured her to tell me how he/she knew to adjust the ventilator Shannon said, "I just know, I looked at the baby and I knew what I needed to do."

The patient, in the previous example, was already on the ventilator and successfully being ventilated and oxygenated. Shannon's assessment of the situation, knowledge and previous experiences allowed him/her to make slight adjustment so that the ventilator more accurately met the needs of the tiny patient.

In another incident from my observations, Joe helped a resident successfully intubated a baby then decided to change the endotracheal tube to a larger size to eliminate a small leak. The resident had stepped up and asked Joe if he could intubate. Joe helped select the appropriate size tube, and determine the correct placement. The resident intubated, he and Joe listened for breath sounds, and they both determined that the tube was in the correct place. The resident moved away to prepare for another task. Joe listened again, and decided the baby's airway was large enough to require a larger tube. So, after removing the endotracheal tube, Joe reintubated the baby with a larger tube.

The following excerpt from my interview of Randy, illustrated how the nurses and therapists used practical or logical reasoning in this study and constantly changed the oxygen delivery for neonates.

> We are constantly making changes trying to protect the neonate's eyes. The baby will go bradycardic or their heart rates will drop and someone will turn up the oxygen, they will settle back down and we can turn the oxygen back down. It goes on constantly.

Although this seemed very casual, it was very important for the neonates to have Their oxygen administration synchronized with their needs on a minute-to-minute basis. Without enough oxygen the neonate could spiral down into disastrous situation or even

fatality, and with to high a concentration of oxygen their eyes and lungs can become damaged.

Therapists in this study demonstrated how they use practical reasoning as a method of decision making similar to that described by Mattingly and Fleming (1994). All therapists in this study constantly adjusted the neonate's oxygen concentrations and flows based on both physical and physiological assessments. Their assessments and past experiences helped them determine which therapeutic procedures they should use in a particular case, when changes should be made, and what patient improvements they should expect from the therapy. This type of reasoning involved knowing what worked best in a specific, how to best accomplish it, and when changes should be made.

Ethical Reasoning

During collection of data for this study, it was evident that respiratory therapists were often faced with ethical dilemmas, which causes them great emotional conflicts. However, I found they did not make ethical decisions concerning the removal of patients from life support, based on their personal feelings. They did however reason ethically about their own practice during times of reflection.

Respiratory therapy is a profession which deals with the pain, suffering, and dying of others on a daily bases. In this study, therapists' practice included the stabilization and resuscitation of premature neonatal and pediatric patients, and maintaining and monitoring the life support technology of ventilators and oscillators. Not only did they deal with death on a daily bases, they tried to "cheat it" by preventing it from occurring in some of the most likely patients in the hospital. They understood the importance of their expertise in dealing with life and death issues, and that they played an important part in

the saving of lives. However, they also had to cope with the fact that not every thing they did resulted in the saving of a life. Many times they considered what they did as inflicting pain and suffering upon others, and there were times when nothing they could do would change the inevitable.

They were compassionate, sympathetic, and empathic about their patients, but they didn't allow those feelings to interfere with practice. I noticed that short bouts of humor were sometimes used to help therapists and nurses alike lighten the atmosphere and ease the tension when dealing with these life and death situations, which at times became almost unbearable. The following example from my interview of Jamie was typical of the ethical dilemmas these therapists often dealt with.

RB: Do you ever look at some of the babies and it bothers you?

Jamie: I do it everyday. I look at them a think, that poor baby needs to go to heaven. You know. He's suffering, he's miserable, he's blown up, he all edematous and he has no quality of life there whatsoever, and the parents don't even come see him, because they can't stand to look at him, but they won't make the decision that he looks too bad to keep going … remain on life support. Its like why do we keep doing this to this poor baby. We stick them for more IVs so we give more blood, we reintubate, all kinds of stuff.

RB Why can't we just stop?

Jamie: No. There's no way you can just stop. It seems so cruel, but sometimes we laugh at it all, that's the way we get over the trauma of not being able to do something about it…sometime it's really hard. Sometimes you think, Ok if

> this baby codes I'm just not doing anything, I going to bag real slow or I'm going to do bad CPR, and when it comes down to it…. there's no way you can do that.

Randy's comments about the same situation provided insight into the reasoning about why they didn't allow emotional feelings to interfere with the work they did.

> I'm here to do my job, and under my job description, I do what the doctor writes orders for me to do. So, inside my mind I might be thinking about these things, but I'm going to be doing what I can to help that baby at this moment, right now. I'll be thinking about what I'm doing. How is this going to affect this baby long term, but I've got to do what I have to do right now. In the medical field that's the way we have to be. You're here to do a job and sitting there getting all bogged down emotionally and thinking about the ethical issues, which you know they are important, but if it's hindering you doing your job to benefit that patient at that time. It's a hindrance.

There was, however, an ethical component to the therapists' practice and they wanted the best care possible for their patients, not only from themselves but also from other therapists. There were times occasionally when they had to spent the majority of their shift working with a single critical patient, and in those incidents they prioritized their time, making choices on which patients they would see first and which they would see later. They regretted having to do this, and even when other therapists assisted them by seeing patients they did not have time to see, they disliked this part of their practice.

They also felt strongly about the type of care other therapists provided, especially when they felt the care was less than what the staff member was capable of providing. The following is an excerpt from my interview of Jamie:

Jamie: I think they [therapists who are not concerned with the quality of care they provide] if they have the knowledge they don't take the time to use it. This particular person, I'm thinking about just doesn't really care. I'm not real sure why they're in the profession, but I just get the feeling that you know, I don't want be bothered with that. They ignore things, and you can say, well why didn't you do so and so, and they'll go "Well, I don't know." Are they just not thinking period or do they just not care? I always get the distinctive impression that they just don't care.

RB: Did this have an effect your decision-making?

Jamie: I think so, because it really ticks me off, that people don't care and they don't want to learn enough to know what to do...or that they don't want to ask questions and find out what they should do. A lot of times I'll say what did I do wrong tell me what I did wrong in that situation, that I should have done differently, and there are people who don't... I just don't think they care. They don't want to hear it if you say so and so. I've always tried to act very diplomatic even though some time it doesn't come out that way.

It was common to see the therapists talking to the babies, trying to calm or comfort them in stressful situations, wrapping them securely in blankets, rubbing their backs, and even immediately after birth offering a gloved finger for them to suckle for

reassurance. They cared deeply, passionately, and were very protective of these tiny patients.

The therapists in this study did not use ethical reasoning as a method of making management decisions about whether or not their patients should receive therapy or remain on life support. They left those decisions up to the parents, physicians, and hospital's ethical review board. However, there was an ethical component to their practice. They expected the best care for their patients from both themselves and the other members of the team. When they, or another member, provided less than adequate care for these patients it bothered them.

Collaborative Reasoning

Collaborative reasoning, according to Higgs and Jones (2000), in the field of physical therapy, refers to the shared decision making between the practitioner and the patients. The therapists from this study also used collaborative reasoning, but in a different manner from the physical therapists described by Higgs and Jones. Collaborative reasoning is the shared thinking to solve problems associated with the management of patient care. The respiratory therapists in this study used collaborative reasoning by involving the combined decision making of a therapist with that of a physician, nurse, or another therapist.

In this study collaborative reasoning was used in two different ways. First, therapists used collaborative reasoning when they participated in teaching rounds with other members of the health care team. The second way they used collaborative reasoning was unstructured, frequently taking place at the patient's bedside, in break rooms, or at desk for charting, with concern for the day-to-day issues of patent care.

Teaching rounds were important to these therapists, and although their participation focused on the respiratory component of patient care, they provided and received input about a variety of patient related issues. The individuals who participated in these rounds followed a more structured format for addressing patient management decisions with physicians or residents leading the discussion. The following excerpt is from my interview of Stacey:

> Sure, I make the decision, but I don't necessarily act on them totally on my on. But I make the decision that it is time to go and talk with the doctor or bring this up, or bring that up in rounds. I like to bring up everything that I feel is relevant to the situation, which is one reason that I like to be there. It's what makes me able to do what I do – to be as sure of myself as I am, because I know that the other people depend on me and I depend on them and I don't want to let them or the patients down. They learn from me and I learn from them.

During my interview of Casey, she discussed how four therapists got together, and collaboratively tried to solve a problem in a difficult case in PICU. They, along with the resident and physician on call could not come up with a solution to the unusually difficult problem. The on-call physician told them that he also was confused about the case and instructed them to make whatever choices they needed.

These therapists worked closely with most of the physicians in these units. They were comfortable calling or talking to the nurse practitioner or physicians about problems they were having with patient care. The following is from my interview of Jackie:

> Like when we first got the oscillators, it was a lot of times a hard decision. Oh my God which do I do to fix this, and it would be like us and the nurse and the doctor,

> and we would say, OK, if we increase the power that will help with the ventilation and the mean will help with the oxygenation ... yeah, we discussed like chest x-rays … should we right mainstem a baby who's collapsed on the right side and hyperventilate it on the left? I know when I started here I was scared to go up to the doctors and ask them anything because they might think, "That was a stupid question." But, now I don't have that fear any more.

It was evident that these therapists valued the input of others in their decision-making process, and they were willing to share their own knowledge with others. They were eager to learn and preferred a collaborative approach to solving difficult problems.

Collaborative reasoning was the shared thinking to solve clinical problems. The therapists in this study used collaborative reasoning with physicians, nurses and other therapists in the daily management of patient care. There were two different ways therapists used this type of reasoning. They followed a more structured method of reasoning in teaching rounds and more informally in discussions with physicians, nurses and other therapists at the patients' bedside.

In summary, this section provided examples of therapists from this study using each type of clinical reasoning described by the literature, in chapter two. Therapists in this study used all types of clinical reasoning similarly with the exceptions of inductive and scientific reasoning. The difference in amounts of experience a therapist had determined whether they primarily used scientific or inductive reasoning to solve clinical problems.

The next section of this chapter describes the difference that experience made for these therapists. It provides an understanding about different types and ways novice, competent, and expert therapists used clinical reasoning.

Section Three: The Novice-to-Expert Continuum

What are the differences in the types of clinical reasoning used by novice, competent, and expert respiratory therapists? My third question was answered by considering the differences in categories and ways therapists use clinical reasoning during my observations and interviews.

The therapists in this study demonstrated how their reasoning changed as they gained experience working in the neonatal and pediatric intensive care setting. These therapists were all aware of the differences personal experience made in their ability to solve clinical problems. However, none were familiar with the theories of clinical reasoning or novice to expert continua as described in the literature. Each group of therapists (novice, competent, and expert) used clinical reasoning in a similar manner with the exceptions being the experts used more inductive reasoning and the novice used more scientific or hypothetical-deductive reasoning.

According to Benner's levels of proficiency (Benner, 1982; Benner, 1984; Benner et al., 1999, & Benner & Tanner, 1987) there were no novice therapists who met the criteria for classification as beginner novices in this study. Student respiratory therapists, who have never been to clinicals, would more appropriately be classified in this category. The novice therapists in this study would be classified as "advanced beginners", Benner's second stage of beginners, because of their ability to recognize characteristic patterns. However, in some aspects of practice they exceeded even this classification and more

closely resembled the competent therapists because they understood the importance of different aspects of clinical problems and treated them accordingly.

There were situations where a novice therapist actually had more exposure to a newer or specific type of equipment procedures than those individuals classified as competent or expert therapists because of newer procedures taught in schools and conferences they had attended. In another situation with two similarly classified therapists, one use more advanced reasoning skills than another in a task because one therapist found the particular or unusual task more interesting. Subsequently the more interested therapists had purposefully read and studied more about that particular task.

There were other instances where therapists had more previous experiences working with a particularly difficult case because they were more aggressive in their quest to learn as much as possible and believed that being responsible for difficult cases made them learn. This individual used opportunities to ask questions of the physicians and nurse practitioners when they were in the units. One therapist felt she had reached her "limitation" and when faced with what was perceived as a difficult task, even before trying the procedure had decided that it would not be successful and she would eventually have to call on another therapist to perform the procedure for her.

The analysis of data became difficult when there were inconsistencies in the reasoning skills and problem-solving abilities associated with the classification of novice, competent, and expert therapists and the actuality that therapists didn't easily fit snuggly into these categories. This indicated that both practice and personal contextual issues influenced the novice to expert continua in ways that affected the types of reasoning therapists chose to solve problems with.

The Novice Therapists

The novice therapists in this study, Randy, Casey, and Jordan, had an average of 1.5 years experience working in the neonatal and pediatric intensive care units. However, each therapist had several years' previous experiences working in the adult intensive care units and this experience changed their reasoning skills. Some of the task and procedures they performed in the adult units were similar to those in the neonatal and pediatric units, and for that reason there were several procedure or task in which some individuals classified as novices, were actually competent or even experts. Several types of equipment such as monitors and ventilators, and some supplies were used similarly between the two different patient populations.

The novice therapists understood that it was the competent and expert therapists greater collection of diverse experiences that distinguished them from themselves and their own ability to solve problems. The novices also knew that competent and expert therapists were capable of determining the solutions to clinical problems faster and accomplished task and activities quicker than themselves because of their advanced capabilities.

The novice therapists in this study used more scientific reasoning or hypothetical-deductive reasoning, in the form of backward reasoning, to solve the clinical problems they encountered than did the other therapists in this study. The following excerpt is from my interview of Randy:

> Something that's happening…that I'm less familiar with. Of course my decision-making is going to slower. I'm going to be trying to think ... I'm going to be trying to figure out what I'm trying to do. So, I'm going to be probably going

through several steps in my mind. What if I do this, and what if that next and then, if that doesn't work I'll try step four or five. Whereas someone who has been here a long time or has seen a lot of things happen and they just kind of … in the back of their minds know what's going to work and they'll skip from point one to point ten all just at one time. While, I'm kind of having to work though each step, trying to figure out, ok this didn't work, so lets go on to the next thing. So I'm still going step by step right now.

Scientific or theoretical reasoning in the form of backward reasoning, according to Case, et al., (2000), was typical of the novice who developed a hypothesis and then returned to the clinical data for supporting facts, before searching for a solution. Although the information bases for all therapists in this study was similar, their process for finding the solution to problems was different.

Novice therapists tended to use the physiological monitors in their reasoning more frequently and for different reasons than the competent or expert therapists. When trying to make decisions about the physiological status of the patient, the expert therapists preferred to look at the baby, and found it very frustrating that the novice, and sometimes competent therapists, looked at the monitors instead of the babies. The expert therapists from this study frequently told the novice or competent therapists to "look at the baby, don't look at the monitors."

One reason for the novice therapists' frequent use of monitors to make decisions involved their considerably smaller amount of experience observing neonatal and pediatric patients. This resulted in subsequently often-smaller schema with which they could compare the present baby physical appearance. They understood the monitors, the

meaning of numeric displays, the science behind the technology, and used guidelines for the parameters from these monitors when making decision. Initially, when they came to work in these units, they were already comfortable making decisions based on information associated with monitors, because each had several years experience working with the similar monitors in the adult populations. The following quotation is from my interview of Randy explaining how he/she was trying to change from looking at the monitors to the baby when making decisions.

> Like, if you had a baby that has come in and you know, you are a new person, and you're looking up there and the saturation is reading 77% and you go, oh, my baby is hypoxic, then look down and look at the baby and go yea, he is looking kind of gray or blue. An experienced therapist is going to look at the baby and say well he's looking kind of gray and modeled looking. I bet his saturations are kind of low maybe in the 70's or 80's whatever and then they look at the monitors. So is kind of the opposite.

The Competent Therapist

The competent therapists in this study, Lee, Joe, and Jamie, had an average of over two and one-half years experience working on this team. They also had several years' previous experience working in the adult intensive care units. These therapist used less scientific or theoretical reasoning than the novice, and had begun to use inductive reasoning to make a decision based on their own past experiences. They still relied heavily on physiological monitoring to make clinical decisions.

However, because of their experiences in these units simultaneously looking at both babies and monitors, and the expert's insistence that they make decisions based on

observations and physical assessments of the baby, they had begun to develop their own schemata based on observations. These newly formed schemas were used when making decisions, by comparing current clinical conditions or situations with previous similar experiences. Nevertheless, the majority of the time, the competent therapists still used both the monitor and their assessment of the baby's physical appearance when making decisions.

They were aware of how their reasoning had changed from the time they first joined this group, felt comfortable in their own abilities, and considered themselves competent. The following comment is from my interview of Lee:

> When I first came to work in here I was terrified. I had an upset stomach every day, I was not comfortable making decision, not comfortable with my own ability to make decisions, looking at x-rays, drawing blood, none of those things. But now, I have some experience, and I can see how I've grown and how my skills have improved.

Lee brought up another point when telling me that at first her decision making was all about the rules and later it became all about the baby. Lee said, "When you get out of school, you think you know what you are doing, but you are just starting to learn." Lee admitted forgetting the formulas, theories, and laws taught in respiratory school, and suggested now managing most babies without "all those formulas." This feeling of mastery and ability to cope is describes by Benner (1982) as being one of the characterizations of the competent stage.

The competent therapists reflected back on previous experiences, used

physiological monitoring, and hypothetical-deductive reasoning less frequently than the novice. However, they still realized that the experts had considerably more experience and were still quicker at making decisions. The following excerpt is from my interview of Jamie.

> They have tons and tons of more experience than I do. They've seen everything under the sun, and I've come to know the more you see and the more you do, the more you remember. You might not even be able to think of it like today coming up with something, but when a situation happens again it's like it automatically comes to you. I've been here before, I've seen this before, and I'm goanna do it this and they (experts) are way better at it.

The Expert Therapists

The expert therapists, Shannon, Stacy, and Jackie, had an average of almost 13 years of experience working with neonatal and pediatric patients. They considered themselves confident, assured, and felt they could become assertive when they believed it was necessary. The experts in this group used inductive reasoning more frequently with their elaborately developed schemata to make decisions than did the novice or competent therapists.

According to Benner (1982), therapists with this amount of experience would have an intuitive grasp of most situations and could focus on accurate regions of the clinical problem without wasting considerable amounts of time and energy on "unfruitful possible solutions" (p. 405). A technical problem with a specific or unusual situation or a difficult case, which was easy for these therapists, may be difficult for the competent or novice therapists to solve because of their lack of previous experiences.

Physiological monitoring for this group was used primarily as confirmation of what they already sensed. Shannon told me after drawing blood gases from a baby; the gases were not necessary to tell if the baby should be intubated. Shannon had already made that decision and the gases were used as proof to others of what an expert therapist already knew.

Therapists in this group had difficulty explaining their own reasoning. They expressed their problem-solving ability as sensing problems with their "gut feelings", or "that they just knew how to do something." Jackie suggested that she/he didn't need to look at waveforms on a monitor to tell if the baby's chest was being over expanded; a strong gut feeling told that from just looking at the baby. The physiological monitors only provided confirmation of what years of experience and an expert therapist's senses already knew from an assessment of the baby.

The more critical the situation the more the therapists used their intuitive reasoning. The following is an example from my interview of Stacy:

> At the moment that it was going on (resuscitation) I can't tell you how I did it. I did it almost totally without thinking, because you have to act so fast and when you are all through you might start shaking a little bit and wonder how you did all of that. But while I'm doing it, it comes automatically pretty much most of the time. If it's not critical a situation, I may take more time to consider different options, to think about everything I've learned and been taught, and whether or not there might be something else available that would work better.

Benner said that experts were capable making decisions intuitively, because they

had “internalized the rules and guidelines” in the development of their schemata used in inductive reasoning (Benner, 1982, p. 405). This was typical of the therapists in this group. During one of my interviews, Stacy described intuitive reasoning when telling me about the guidelines they used.

> I’m sure I have the guidelines stuck somewhere in the back of my head. I don’t pull them (written guidelines) out and read them for everything. But I’ve worked by certain guidelines so long being here that they are automatic. I have built my own set of guidelines from my past experiences with these patients.

All three of the expert therapists suggested their method of reasoning was comfortable, felt natural, and was almost effortless. However, there were situations when they had to revert back to reading guidelines and using scientific reasoning to making decisions, the same way as a novice.

All of the therapists in this study were in the process of learning a new procedure and had just begun using it at the time of this study. When talking with the children’s team respiratory supervisor about difficulty she faced convincing them to use the new procedures and the required training necessary for establishing a sufficient knowledge base for nurses, physicians, and therapists, she suggested that the expert therapists had more difficulty accepting new procedures and equipment than did the novice. During the observations and interviews from this study, I observed the same thing. I asked them questions, but it was later in the analysis phase of this study that I understood why they felt reluctant to use new procedures and equipment.

The competent and especially novice therapists, from this study, made decisions entirely different than did the experts. While, the expert’s reasoning to solve problems

was primarily inductive, they "knew" and "felt" things, and made decisions within what one expert therapist described as "their comfort zones". On the other hand, the novice and competent therapists, solved problems using reasoning that was not intuitive, because they had not developed their abilities to reason inductively. They solved the problems associated with the new procedure the same ways they solved problems with any other procedures, which was usually scientific or hypothetical deductive and backward reasoning.

The expert's reasoning with the new procedures was similar to the novice or competent therapists, using the same hypothetical deductive reasoning. This type of reasoning took longer, and required that they develop hypotheses to solve problems rather than using their "comfortable" inductive reasoning. Their reluctance in using this new procedure, may have been misunderstood by others as resistance to new technology, instead it was difficulty in the type of reasoning they had to use to make clinical decisions about new equipment and procedure. This is consistent Benner's novice to expert theory, where the expert had difficulty reverting back to analytical reasoning or technical rationality.

I end this section, concerning the novice to expert continua, with an excerpt from my interview of Randy when explaining how a novice's reasoning had changed in the short time since she/he first came to work in these units.

> When I first got in here, I was basically scared of what I had I gotten myself into, just real uncomfortable with neonates period, and then basically I would make my decisions. I would make what I considered to be a non-risk decision on my own. But if there was something that I had a question about, or was unsure about I

would go ask another one of the therapists to get their opinion and get their input and make my decision based on what they would say. I was dependant on other people and what they said a lot. I've built a little of my own experiences in a lot of situations. I haven't seen every situation that can come in, but I've seen a lot. So I've built up my own way of doing things. When I first came in I would look at the heart rate and saturation monitor, and say, ok, what's happening and what's going on here, why is my baby's heart rate dropping and trying to figure out. I just trying to think through what causes bradycardia, you know it could be the endotracheal tube down on the carina or what. But now it's like I can look at the baby and, the first thing you know, you are going to do is look at the baby and see what's happening. Is the ET tube out of place? Is the baby in some distress? I still use both the monitor and looking at the patient, but now I'm a little bit more comfortable with everything, so now I look at the baby more. I'm looking to see if the baby is telling the truth. If the baby is presenting one picture and the monitor is doing something else then I've got to say well something's not right here, and usually you will go with what the baby is presenting. The monitor, the lead may be off or a bad connection or something. Most of the time the monitor has to match the baby.

In summary, the novice therapist had fewer experiences, and subsequently smaller schema to use when reasoning through clinical problems. This required that they use slower methods of reasoning, such as hypothetical deductive reasoning to solve problems and relied on heavily on physiological monitors in making decisions.

The competent therapists used more inductive reasoning and less scientific

reasoning than the novice. They also depended less on physiological monitoring when making their decisions. They felt confident in the decisions they made, and had a feeling of mastery over the task and skills they could accomplish. They used a combination of both the monitors and physical assessments to make decisions.

The expert therapists primarily used inductive reasoning to make decisions about clinical problems with patients. They seldom used hypothetical deductive reasoning. When they did, they were able to focus in on important and familiar aspects of the problem, and therefore generated fewer hypotheses than the novice before finding a solution. They used physiological monitors as confirmation tools of their physical assessments, relying on their own intuitiveness to make decisions rather than the monitors.

Shannon, an expert therapist, was careful when working as the preceptor for novice therapists, not to always provide answers to clinical problems to quickly. Because of previous experiences, there were times when Shannon could have solved problems much quicker than the novice or competent therapists. Nevertheless, whenever possible Shannon chose to provide "clues" instead of solutions when helping them solve the problems.

It would take the novice considerably more time to solve the problems, but Shannon believed the novice better understood why problems occurred if they found the solutions themselves. Shannon's understood that the development of expert reasoning skills required time and individual experiences.

The next section of this chapter considers the contextual issues that facilitate and hinder the development of good reasoning skills. The therapists acknowledged both

practical & personal issues which had an effect on their development of good clinical reasoning.

Section Four: Contextual Factors

Which contextual factors either encouraged or discouraged the development of expert clinical reasoning among respiratory therapists? This, my fourth question, was answered by determining the contextual issues therapists considered important enough to include in their discussions during their interviews.

Contextual Factors That Encourage Good Clinical Reasoning

The therapists in this study believed there were several factors that encouraged their development of good clinical reasoning. They included: previous similar experiences, a good scientific base of knowledge, well-written guidelines from which a strong system of unwritten protocols could be developed, collaborative reasoning, and the expectations and support of physicians. These are discussed individually in the following section of this chapter.

Previous Similar Experiences

There were numerous examples of therapists using previous similar experiences as a basis of clinical reasoning, and when they had no personal experiences of their own, they borrowed experiences, in the form of story telling, from more experienced therapists. Higgs and Jones (2000) suggested that one of the more important issues of an experience was the capability of the therapists to link or connect previous similar cases to current ones. Those who had not experienced a particular case or specific situation could use the experiences and stories from others when they were faced with similar cases or situations.

According to Higgs and Jones (2000) as an individual experiences additional similar experience, they develop abstract associations, which convey meanings of the situations. These meanings could be linked to future similar situations. They believed this association becomes important to the therapists when interpreting data, and recognizing signs, symptoms, or patterns because they matched the newly recognized clinical information against previously learned abstracts rather than a specific case or problem.

The expert therapist in this study had difficulty describing specific individual patterns, from an enormous amount of similar abstracts. The novice, on the other hand, because of their limited numbers of similar cases, could not only provide examples of specific disease patterns, sometimes, they could provide the names of individuals with a specific disease.

During my interview Lee, a competent therapist, suggested that an expert's ability to reason was different from his/hers, because of the numbers of times experts had seen similar patients. During one of my interviews, Lee said:

> It's based on their experiences with that patient, and another patient like him, and then others that were like both of them. Their experience in this unit, doing this for years, over and over, and all the information of what they know. It's what makes them different.

Shannon, an expert therapist, suggested that reasoning was based on past experience of "seeing other babies that were very similar to this baby." Titchen and Higgs (2000) believed that "learning from experiences of professional practice was a means of generating knowledge, particularly personal and professional craft (tacit) knowledge" (p. 223). Benner, Hooper-Kyriakidis, and Stannard (1999) used the term

"clinical forethought" when writing about the inductive and forward reasoning skills of nurses, and their ability to know what to expect of a particular patient within specific contexts (p. 67). The therapists in this study suggested they knew what to expect from pervious cases and were aware of the deviations or exceptions when they occurred.

Fleming and Mattingly (1994) referred to this development of professional judgment as tacit knowledge. Benner earlier work (1982) suggested that tacit knowledge is an important aspect of expert reasoning.

A Good Scientific Base of Knowledge

The therapists in this study believed the ability to make good clinical decisions required a good solid scientific base of knowledge. The fields of science heavily influenced the respiratory schools these therapists graduated from. The following was an excerpt from my interview of Randy when we were discussing therapists' need for a scientific base of knowledge.

> You've got to have a basic knowledge of science and physiology of the human body, and the way a mechanical ventilator works, the knowledge of the equipment and how it works just to even be able to function. So, I mean you've got to have that scientific knowledge base to even start. You can't come in here and not know what oxygen as a molecule is or how oxygen interacts with the body, and come in here and expect to do good therapy. I mean you've to have that. The knowledge you get in school is like your first building block, and then when you get here you start building on top of that and it's most like you subconsciously have that knowledge in your mind.

The majority of these therapists, especially those who work on day shift, regularly

attended teaching rounds, where they had the opportunity to learn from physician, nurses, and other health care workers. These discussions were interactive, involving scientific theories, basic human physiology and pathology, and pharmacology. The therapists in this study indicated that they read professional journals, attend departmental in-services, and conferences, and renew their certification in NRP and PALS every two years as means of acquiring knowledge relevant to their practice.

Well Written Guidelines and A Strong System of Unwritten Protocols

The therapists in this study primarily used unwritten guidelines, in the forms of narrative and inductive reasoning, as methods of making decisions. That is not to say that well-written guidelines didn't serve an important purpose. In fact, these therapists used well written guidelines along with personal experience to develop their on personal guidelines. Every therapist I asked told me they either had or were developing their own sets of guidelines. The following passage was from my interview of Randy:

> What we do is based on guidelines. We have guidelines for different therapies, there are written down protocols, and then the majority of the guidelines that I use are unwritten guidelines. They're just what I've been taught, what I have seen to work, you know, we just kind of ...There are lots of unwritten protocols. Like I said, mostly what we do is more like an unwritten … it's more like because we've learned what to do and you've seen what works, so you just kind of understand what you need to do. All of it's not written down concretely, do this for this situation, or do that for that for that situation… Every situation is a little different.

Therapists found the use of their own unwritten guidelines much easier and faster

than trying to use written guidelines when making clinical decisions. The development of unwritten guidelines is described (Jones, & Higgs, 2000; Benner, 1984; Benner, et. al., 1999) as forward reasoning. Their decision making with unwritten guidelines is inductive reasoning, and as developed becomes parts the schema from which they work, or an intuitiveness they develop.

Several therapists told me they didn't like strict guidelines; they were to confining and hindered them from making decisions. When these therapists used physician's guidelines or written policies to make decisions they used scientific reasoning, and according to Benner et al., (1999) this types of decision-making requires a "yes" or "no". In other words, the patient is either within the set guidelines, or they are outside the guidelines.

The intuitiveness of an expert takes years of experience to develop, and becomes their ability to make decisions without guidelines. This is where good, well-written guidelines are utilized. The novice uses these guidelines, guidance from other therapists and physicians, a well-developed base of scientific knowledge, and personal experience to develop their own schemata. They then use their schemata to reason inductively.

Collaborative Reasoning

There was a great deal of mutual professional respect between the members of this team, the physicians, and nurses in these units. The therapists in this study shared their decision-making about problems they encounter during rounds on a regular basis, in complicated or difficult clinical cases, emergencies, and in situations where they felt it was appropriate. They also involved other individuals in their daily management of

patients by casually providing, or requesting information. The following citation is from my interview of Joe:

> It's still a learning process for me, so we just all set down all together and using the instructions went from step one and went down the list, making sure it was calibrated and purged and all the systems were connected. So, we all still did it together. I didn't go up there and say do this or do that … it was as a team … so we all learned together.

Jones, Jensen, and Edwards, (2000) suggested that collaborative reasoning Incorporates the therapists own ideas about the nature of the problem, their own personal experiences, and advice from other personnel into the reasoning process.

The Expectations and Support of Physicians

Perhaps the strongest issue that facilitated good clinical reasoning among these therapists was the expectation and support of the physicians. These therapists were excited about the respect the physicians gave them, their level of autonomy, and the work they did in these units. In fact many of them stated this was the reason they choose to work at this hospital. The following quote is from my interview of Casey.

> Dr. C. is probably the biggest advocate we have. Dr. C. will tell you that when you get orientated in PICU that if he has good therapists he can go home and rest. If he's not confident enough in you to go home and rest then he doesn't want you down there. He trusts our opinion a lot, he asks for our opinion, and as far as learning he keeps up with stuff and keeps us on our toes. Because he knows stuff that we aren't keeping up with and you can learn a lot in just a conversation with Dr. C. He's one of these doctors though ... that ... some doctors will come in and

> they are doing a million different things. They come and in shouting orders and Dr C. takes everything slow and easy, and tells everybody calm down, lets get this together, very deliberateand it helps. I think it's the right way to go. Sometimes you get so caught up in adrenalin, with what's going on, that you are not really paying attention to what is really going on.

When I interviewed Jamie, the comments were very similar to Casey's. Both reflected the enthusiasm they felt about the job, responsibility, and the respect they felt from physicians. The following is from my interview of Jamie.

> Yea, we really do, we can make those decision and make the actual change and then call the physician and say the patient was doing so and so, I changed this or that, they are doing much better now, is that ok with you? They like to be called if you are going to have to make a lot of changes, but if it's little things they don't expect to hear about it. They expect us to do it in this hospital, they expect you to be able to make that decision and make a call and not have to call them for every little thing, which is great.

Contextual Factors That Discouraged Good Clinical Reasoning

Therapists identified several issues they felt hindered them from making good clinical decisions. The issues they identified included: limited or lack of experiences, lack of time and staffing, limited expectations and nonsupport of physicians. These are discussed individually in the next section of this chapter.

Limited or Lack of Experiences

The therapists in this study suggested they might actually devalue certain options

for treatment because they felt they lacked the necessary experience or they lacked the ability to identify problems associated with certain types of equipment necessary for treatment. They indicated that if they lacked experience with certain pieces of equipment, they would try to maximize more familiar equipment or request different equipment before using ones where they felt uncomfortable.

Joe suggested the reason they were reluctant to use such equipment was because they couldn't trouble shoot or find problems associated with the equipment if they got into a difficult or confusing situation. Because they lacked experience in using some types of equipment, if something were to go wrong, they mentally had nothing with which they to compare the situation.

Lack of Time and Staffing

The workloads in hospitals, especially the intensive care units, continually changed with new babies arriving and others being moved to less acute areas, transferred to other hospitals, or the unpreventable dying. The therapists in this unit were never sure what their workload would be from day to day, or from the beginning to the end of their shift. In addition to their work in the intensive care units, this group of therapists were part of a regional transport team that did 440 transports last year, and because most of them had previous experience in the adult units, when there were shortages in those areas they could be moved to other units to work.

During the interviews, I asked them to identify situations that had caused them to make poor judgment decisions and what they considered mistakes in patient care. Several therapists identified lack of time as their most common cause of problems associated with poor clinical decisions. The following was from my interview of Jordan.

> Time and amount of patient … as in the volume of work … I've got eight ventilators, so that volume is…you know, I've got all these ventilators to worry about checking, to intubate or extubate if necessary, go to stork squad if they call. I've got to get the treatments done by a certain times. I have blood gases that need to be drawn by certain times, all of that factored into what I do, is what causes a short-out in your reasoning ability.

Taking care of multiple patients was not uncommon for these therapists. However, there were situations, where they felt they had more patients, task, and activities than they could cognitively and physically manage, so they made lists, wrote notes to themselves, developed personal methods of reminders, and used these as methods of keeping organized and as a way of remembering what they needed to accomplish. They believed that because there were two therapists in the NNICU and the one in PICU, just down the hall, that several times their team work had saved them from situations where patient care would had gone lacking. Most times, in unusually busy situations, the majority of their work had been accomplished, but not in the manner they would have liked.

Limited Expectations and Nonsupport of Physicians

Therapist's participation in collaborative reasoning about patients with respiratory problems, on ventilators, or with difficulty breathing is not always expected or excepted by other member of the health care team. Some therapists in this study worked full-time in this hospital and occasionally part-time at other institutions. They described how fulfilling it was to work in an institution where their skills are respected, appreciated, and expected, and how difficult they found it to restrain their abilities and input in those

hospitals where they are not expected to make clinical decisions. Jamie's following comments were typical of this view.

> I hate that, I've worked in hospital where that is exactly what happens, and they don't want you to touch anything, they don't want you to do anything, and I hate it. Because what does that do for your ability to reason? I mean if you are stuck in that all of the time, you are going to quit reasoning, you are going to quit using those skills and eventually you are going to not care. Why should you care, if you're not going to get to do anything about the situation anyway. You know, they don't want your input, they don't expect you to do anything, and you kind of just loose that. That is one of the things I enjoy about this job, that is why I'm working here … it's because I get to do all of those things.

This inability to make decisions based on assessment and clinical reasoning is what Schell (1994) described as an issue of power. In her work with occupational therapists, she concluded that the lack of perceived authority to act on the basis of clinical reasoning, as well as the tendency to devaluate more tacit forms of clinical reasoning (such as intuition) and the repetition of this cycle would, "eventually short circuit even the consideration of some actions" (p. 43).

According Higgs and Tichen (2000) individuals seek validity of both personal and professional knowledge, where they saw knowledge as being a dynamic phenomenon undergoing constant change. To devalue therapists' knowledge interrupts the dynamic growth in their personal and professional quest for useable knowledge and their development of reasoning skills.

The therapists in this study identified factors they perceived as encouraging or hindering their clinical reasoning. Factors which encourage clinical reasoning included; previous similar experiences, a good scientific base of knowledge, well written guidelines from which a strong system of unwritten protocols could be developed, collaborative reasoning, and the expectations and support of physicians. Those contextual issues which hinder their reasoning included; limited or lack of experiences, lack of time and staffing, limited expectations and nonsupport of physicians.

Summary

The following are the salient points from this chapter. These results will be used to developed implications for practice in the last chapter. The results of this study were at times similar to what was expected, and at other times this study provided unexpected, or results dissimilar to the literature. There was documentation of therapists using each of the types of clinical reasoning from the review of literature. There was a difference between the novice, competent, and expert therapists' reasoning skills. The amount of documentation, the therapists' use of multiple modes of reasoning almost simultaneously, and the ability to document almost every task or activity performed by the therapists in their work within these units was not expected.

The results showed that respiratory therapists used clinical reasoning in their practice in the acute care setting. They used procedural, interactive, narrative, pragmatic, practical or logical, scientific, and ethical reasoning in much the same ways as described by the literature review for this study. However they used conditional, and collaborative reasoning differently than occupational and physical therapists. This was expected since

it is very unlikely that neonatal and pediatric patients, especially those who are intubated and sedated, are unable to talk.

The therapists from this study showed differences in the types of reasoning used to solve clinical problems; depending on the length of time they had worked in this unit. Novice therapists were more likely to use scientific reasoning than the competent or novice therapists, and the expert therapists used inductive reasoning more often than the competent or novice therapists. There was evidence of contextual factors causing individual therapists to be classified differently in those task or activities or with special cases in which they had more experiences or were more interested.

The results of the study also indicated that respiratory therapists used clinical reasoning in much the same manner as the occupational therapists, first described by Fleming (1991) as reasoning with a three-tracked mind. Therapists from this study could rapidly shift from one method of reasoning to another, depending on which aspect of the clinical problem attracted their attention. They also managed to keep track of multiple patients simultaneously; shifting their reasoning among the patients as effortless as they shifted the methods of reasoning they used to solve problems with individual patients.

These therapists revealed the presence of contextual factors that either facilitated or hindered their development of good clinical reasoning skills. The issues they identified as hindering the development of clinical reasoning included: limited or lack of experiences, lack of time and staffing, limited expectations, and non-support of physicians. Those which facilitated good clinical reasoning skills included previous similar experiences, a good scientific base of knowledge, well-written guidelines from

which a strong system of unwritten protocols could be developed, collaborative reasoning, and the expectation and support of physicians.

These salient points are used in the next chapter as implication for practice. The points along with the conceptual foundations for this study will be used to make recommendations for practice and education and for further studies.

CHAPTER SIX

IMPLICATIONS FOR PRACTICE

This chapter is organized into five sections including; a review of the problem and purpose for conducting this study, the conceptual frameworks on which the study was based; the implications for practice and theory, the recommendations for further studies, and a conclusion. The first section reviews the problem of decision making by respiratory therapists in the medically complex area of neonatal and pediatric intensive care. Also, the purpose of the study is stated. The conceptual framework, the second section, provides a discussion of the findings related to the conceptual frameworks and the sociological and psychological constraints on which this study was based. The third section, implications for practice and theory, provides the implications that have emerged from this study. These implications for practice are based on a discussion of the findings and theoretical framework developed at the beginning of this study. Recommendations for further studies, the fourth section, is developed from a discussion of the finding and implications for practice, provides suggestions for other studies. The last section provides the summary for this chapter.

Problem and Purpose of the Study

This first section reviews the problem of decision making by respiratory therapists together with purpose of the study. Therapists-driven protocols are well-referenced treatment algorithms that are widely used by respiratory therapists outside of the intensive care units. Their use has facilitated more appropriate and effective patient care

and possibly caused a reduction in hospital stay, resulting in less costly health care (Durbin, 1996). These protocols are well-written documents based on scientific theories and research, which are taught as algorithms and serve as strong clinical guidelines. However, clinical problems in the intensive care units involve complicated and complex medical issues and as a result, no single therapist-driven protocol can be written that matches each intensive care situation.

This study focused on when and how respiratory therapists made clinical decisions, not only in critical situations, but rather on a continuous basis. Other issues for this study included the differences their years and quality of experience made, and the contextual factors that either facilitated or hindered their development of ability to make good clinical decisions. Therefore, the purpose of this study was to (a) examine the clinical reasoning of respiratory therapists, (b) determine the task and/or activities in which they used clinical reasoning in their practice, (c) identify the types of clinical reasoning used, (d) examine the difference experience had made in the development of reasoning skills, and (e) develop an understanding of contextual factors which encouraged or discouraged their development of clinical reasoning expertise.

Conceptual Framework

This section provides a discussion of the findings related to the conceptual framework for this study, including the sociological and psychological constraints on which this study was based. The operational definition of clinical reasoning used for this study was:

> The process of using thinking, interpersonal and clinical skills, and knowledge in order to acquire, evaluate, and make sense of the masses of clinical information

> available to the health care practitioners during interactions with clients, and thereby making, implementing, and evaluating, in association with [others], clinical decisions which are relevant to the situation and the clinical problem (Higgs, 1990, p. 13).

Higgs and Jones (2000) suggested that the use of assessment skills and decision-making processes associated with clinical practice is critically important to all health professions and an essential part of their professional practice (p. 3). They suggested this ability, or reasoning process, enables therapists to consider and take the best action for an individual patient, within the specific context where clinical problems occurs. This view of clinical reasoning incorporates elements of cognition, knowledge, metacognition, and the contextual issues which either facilitate or hinder therapists' clinical reasoning abilities.

The theoretical framework for this study included clinical reasoning, the reflective practitioner, and the novice-to-expert continua. Because at the present time no one theory has been developed which incorporates all types of clinical reasoning, the following section of this chapter provides an understanding of relevant traditions and theories from which clinical reasoning has risen.

Clinical Reasoning

Clinical reasoning is considered to be an important component of clinical practice, and is a term used interchangeably with an assortment of synonyms such as clinical decision-making, clinical problem-solving, clinical judgment, and clinical rationale (Case, Harrison, and Roskell, 2000). Mattingly and Fleming (1994) suggested that clinical reasoning is more than just the application of theory to a clinical problem,

because it resulted in a deliberate action. They considered good clinical reasoning to be more like wisdom than competences because it involved the "figuring out" of how to act, or what course of action to take in specific circumstances. They believed clinical reasoning involves, "deliberation about a particular patient related problem, what the appropriate action was in a particular case, and at a particular time" (p. 10).

Clinical reasoning involves different methods of reasoning. This study incorporated nine methods of clinical reasoning, described in the literature of occupational and physical therapy, nursing, and medicine, in determining the types of clinical reasoning used by respiratory therapists. These included; scientific/theoretical, procedural, inductive, interactive/predictive/conditional, narrative, pragmatic, practical/logical, ethical, and collaborative.

The findings of this study indicated that respiratory therapists used each of the nine different methods of clinical reasoning described in the literature, as components of their work in the neonatal and pediatric intensive care units. In some situations their use of clinical reasoning skills was similar to that of occupational and physical therapists, while in other situations it more closely replicated that of nursing or the medical professions. In the course of patient care, all nine documented methods of clinical reasoning were represented in the findings of this research.

These therapists used multiple types of clinical reasoning almost simultaneously. The results of this study indicated that respiratory therapists used many different combinations of reasoning, in much the same manner as occupational therapists. Fleming (1991) first described this as "reasoning with a three-tracked mind" where therapists could rapidly shift from one method of reasoning to another, depending on which aspect

of the clinical problem attracted their attention. Fleming based this on her observations of therapists using three types of reasoning; procedural, interactive, and conditional. In this study the therapists used many different combinations of all methods of reasoning, not just the three initially described by Fleming almost ten years earlier. Since Fleming's earliest studies other types of reasoning have been identified.

Fleming (1991) believed that therapists used a variety of different "reasoning strategies" for different proposes or in response to particular features of the clinical problems they encountered (p. 1007). In other words, this method of reasoning involved the use of several different types of reasoning to solve particular aspects of complex clinical problems. In understanding clinical reasoning, she also suggested that clinical reasoning could not be reduced to a simple method (or even methods) of thinking, because it is also a therapist's way of perceiving the problem (p. 1008).

Reflective Practitioner

Some of the earliest considerations of clinical reasoning (Rogers, 1983; Mattingly and Fleming, 1991; Mattingly, 1993) and novice to expert continua (Benner, 1991, 1999) were based on the work of Donald Schon (1983, 1987), who studied the way practitioners think about their practice. He suggested that much of what professionals do is guided by knowledge, which has been gained from previous experiences. His work proposed that practical knowledge is used in situations where individuals must make sense of and manage complex problems.

Schon (1987) considered practical knowledge, also known as tacit knowledge, to be the cornerstone of reflective practice. Schon's key concepts were reflection-in-action

and reflection-on-action. In this study, there were examples of therapists both reflecting while in action and reflecting on their actions after they had occurred

Reflection-in-action is thinking about what you are doing, while you are doing it. Schon (1987) suggested commonly used phrases such as "thinking on you feet" and "keeping your wits about you" expressed reflection-in-action" (p. 54). The findings of this study indicated, in those situations which therapists considered less critical, that they reflected about other possible solutions to problems, previous experiences in similar situations, and how to acquire specific desired outcomes. In these situations, their use of procedural reasoning combined with other types of reasoning provided an awareness of possible changes in therapeutic regimes, and opportunities to reflection about their choice. However, there were situations where their reasoning occurred so rapidly, and in expert therapists so intuitively, that reflection became a process that occurred mostly after a procedure had been completed.

Reflection-on-action is the process of thinking through a situation after it has happened. According to Schon (1987) reflection-on-action results in possible changes of behavior and commitments to another form of action. Subsequent reflection on a situation allows an individual to reevaluate what should have been done differently, and then consider which aspects of the solution they would change when faced with a similar situation (p. 28). The findings of this study indicated there were incidents in which expert therapists reflected on situation only after they had managed to handle emergency or critical life-threatening problems.

Benner's works (1991, 1999) with novice and expert nurses also considered reflection-on-action. She and her colleagues suggested that the ability to step back or be

outside of the situation was important for the development of clinical knowledge (Benner, Hooper-Kyriakids, & Stannard, 1999, p.19). This provides the opportunity for individuals to gain an understanding of what had just occurred, and to reflect on what could have been done differently and learned from their experience.

There were also examples of therapist reflecting-on-actions, after the occurrence of a particular situation in which they believed they had made incorrect decisions. They also reflected on previous situations when they were uncomfortable with their own decisions and wanted to revisit the circumstances in looking for what may have been a more appropriate solution. Several therapists suggested they deliberately would find a more experienced therapists, nurse practitioner, or physician and ask them questions about their earlier decisions. They saw their reflection-on-actions as an opportunity to learn from both their accurate and inaccurate decisions.

However, as previously mentioned, therapists indicated in special emergency situation, such as those they considered critical to a patient's well being, they acted instinctively and reflected on their own actions only after they had managed to gain control of the immediate situation. When pushed to explain the how they knew which actions they should take in critical situations, the novice and competent therapists suggested their use of appropriate guidelines such as PALS and NRP. However, the expert therapists sometimes had difficulty explaining the reasoning behind their actions. They suggested they just "knew what needed to be done" or an ability to "sense the cause of a problem" indicating their use of inductive reasoning.

Novice-to-Expert Continua

Benner's work (1982) with neonatal nurses, using the Dreyfus Model of Skill Acquisition, proposed that during the acquisition and development of skills, individuals passed through five levels of proficiency. Each level of proficiency reflected changes in two general aspects of skilled performance. First, was a movement from "reliance on abstract principles to the use of past, concrete experiences as paradigms" (p. 402). The second aspect involved changes in the individual's perception and their understanding of a situation so that it was "seen less as a compilation of equally relevant bits and more clearly as a complete whole in which only certain parts were relevant" (p. 402).

The results of this study indicated a difference in the types of reasoning used by novice, competent, and expert therapists. Novice therapists were more likely to have used the slower scientific or theoretical reasoning, and the experts more frequently used inductive reasoning as their method of solving clinical problems.

The novice therapists in this study, because they had limited amounts of experience in the neonatal and pediatric intensive care units, were forced to use the slower scientific or hypothetical-deductive reasoning as their method of problem solving. Their lack of experience and well-developed schemata resulted in the necessity of relying on the generation of hypothesis and testing as a method of finding solutions to clinical problems.

The competent therapists in this study used both scientific and inductive reasoning in their problem solving. Their method of reasoning differed, depending on the amount of experiences with a specific situation or clinical problem, the quality of those experiences, and how closely the current situation matched previous similar situations. If

they lacked sufficient experiences in a particular situation, they used scientific reasoning as their method of clinical problem solving. However, if they had been exposed to sufficient real situations to begin the development of schema, and again depending on how closely the current situation resembled past experiences, they may use inductive reasoning with limited capabilities.

Benner (1999) considered the expert as one having extensive knowledge, an enormous background of experiences, an intuitive grasp of the situation, and skills, which were elusive and difficult to measure. Their vast amounts of domain specific knowledge allowed them to "zero in on the accurate region of the problem without wasting consideration of a large range of unfruitful possible problem solutions" (p. 405).

Jones and Higgs (2000) also suggested the depth of clinical judgment or intuition demonstrated by an expert clinician was due to their enormous wealth of "personal experience of clinical practice in combination with their processing of prior learning" (p. 28). Benner chose to use the term "professional craft knowledge" when discussing problem solving and making clinical judgments because it provided the sense of knowing how and when, as well as how to solve a clinical problem. However, according to Schell and Cervero (1993), a therapist's ability to develop these skills is affected by contextual and personal issues, which can either facilitate or hinder their decision-making abilities.

In the findings of this study, therapists revealed the presence of contextual factors associated with their professional practice which they believed affected their development of expert clinical reasoning skills. The issues they identified as hindering their development of good clinical reasoning skills included; limited or lack of experiences, lack of time and staffing, limited expectations and nonsupport of physicians.

Those issues which facilitated good clinical reasoning included previous similar experiences, a good scientific base of knowledge, well written guidelines from which a strong system of unwritten protocols could be developed, collaborative reasoning, and the expectations and support of physicians.

In this study, the theories of clinical reasoning, reflective practitioner, and novice-to-expert continua were used as guides for evaluating respiratory therapists' clinical reasoning skills. They provided the necessary conceptual frameworks for understanding the different methods of clinical reasoning used by respiratory therapists, an understanding of their professional growth as they moved along the novice to expert continua, and in determining those factors that either facilitated or hindered their ability to develop good clinical reasoning skills. The next section of this chapter examines the implications for practice from this study.

Implications for Practice

An implication for practice, the third section, is based on the discussion of findings, the conceptual framework, and the sociological and psychological constraints that formed the theoretical foundation for this study. There are two implications for practice.

First, the therapists in this study described factors that encouraged and hindered their development of good clinical reasoning skills. Understanding these factors and their significance to practice provided the therapists, their educators, and their managers the opportunity to minimize or eliminate those factors that hinder the development of good clinical reasoning skills, and more fully utilize those which facilitate good clinical reasoning skills.

Secondly, educators have the opportunity to improve students' clinical reasoning by finding ways to help students generate effective knowledge through knowledge construction in forms that can be used to enhance the development of good clinical reasoning skills. These implications are presented in the next sections of this chapter.

Management of Contextual Factors

The results of this study strongly supported the situated nature of respiratory therapists' clinical reasoning. In this study, therapists believed one of the major factors, which hindered their ability to reason appropriately, was the lack of time and staffing. When asked to discuss a situation in which each believed they had made an inappropriate decision and the factors which hindered their decision making process, therapists suggested the lack of time or staffing was the most likely contextual practice issue to affect their reasoning process.

Schell and Cervero's work (1993) indicated that contextual issues such as these were perhaps more influential in determining the solutions to clinical problems than other types of reasoning. They termed this type of reasoning pragmatic, suggesting it encompassed both contextual practice and personal issues that affected clinical reasoning.

The results from this study, provided practice issues which both hindered and facilitated therapists abilities to develop good clinical reasoning skills. In determining how to best present these issues, I decided to look back to the theoretical foundations from which this study developed. The implications for practice are presented from the perspective of sociological and psychological constructs introduced in literature review for this study.

Domain Specific Cognition Theory

This study indicated that previous similar experiences enhanced therapist's development of clinical reasoning skills regarding specific situations. It also suggested that when therapists were faced with their own limited or lack of experience with certain procedures or equipment, they would modify recommendations, maximize familiar options, and possibly disregard potential options in favor of more familiar equipment or procedures.

I consider myself a constructivist and believe that knowledge is constructed from experiences within the context of where they occurred. This view proposes that an individual's learning occurs from being immersed in the experience, the context surrounding it, and the therapist's own perceptions of the event. However, a therapist simply being present in a situation does not constitute gaining experience, or the development of expertise about a particular case or situation.

The length of time working in these units, and the quality and variety of their experiences were important factors in the types of reasoning therapists used when solving clinical problems. Benner (1999) suggested that expertise does not simply occur with the passage of time; instead the learners must actively involve themselves in the situation, question their own preconceptions, recognize patterns, and purposefully engage in the problem-solving process. As one therapist suggested, there is a big difference in the therapist who has had seven years of experience, and therapist who has the same one year of experience, seven times.

Domain specific cognition theory proposed that an expert's broad knowledge base is developed through extensive experience, facilitates their recognition of patterns or themes, and is context specific (Allen, 1998). The findings of this study indicated, that

the more experiences a therapist had with a specific cases or situations, the more likely they were to recognize both the reoccurrence and the deviations from these patterns or schemas.

The novice therapists in this study each had several years' previous experience working in the adult intensive care units. However, they suggested that when they first came to work with neonatal and pediatric patients, they felt as if they were new graduates lacking both experience and confidence.

The scope of practice for respiratory therapists is continually changing, and according to Ryan (2000), educators and managers alike cannot assume that students or therapists' reasoning skills learned in one clinical setting would automatically be transferred to another setting. Expertise in one specialty area of practice is developed from repeated occurrences of similar situations, and the therapist's perception of similarities between current and future situations with past comparable occurrences.

In respiratory therapists' profession there are differences in areas of practice and a wide variety of task, activities, cases, and problems associated with each. This creates situations where the development of expertise becomes difficult for therapists working in many different areas of practice. As the profession continues to grow and diversify there will be additional needs for development of new specialty areas of practice and the continued education associated with each.

Situated cognition theories

Lave's (1988) situated cognition theories proposed that learning and cognition are processes of a person interacting within their environment. She believed that an individual's everyday activity was evidence of cognition that "stretched across mind,

body, activity, and settings" (p. 18). This approach goes beyond the cognitivists, who looked only at the person, or the phenomonalists who looked at the interactions, by looking at the effects of environment or contextual issues as well.

Anthropologists Lave and Wenger (1991) studied apprenticeships and coined the term "legitimate peripheral participation" to characterize learning whereby an individual's participation and identity transformation occurs as the result of their participation. These therapists identified their inclusion in the collaborative reasoning associated with the treatment of patients, an important factor in their desire to develop good clinical reasoning skills.

In this study, collaborative reasoning occurred when therapists participated in teaching rounds with other members of the health care team, and at the patient's bedside, in break rooms, or at charting desk, as they discussed the day-to-day management of patients. Teaching rounds were also important to these therapists. They were proud of their contribution in the decision-making processes concerning patient care and consciously made an effort to learn as much as possible about specific situations or unusual cases before their participation in teaching rounds. They found it difficult to come back to work after several days, and find a completely new group of patients, which they knew very little about.

These rounds, other than in shift report, were where they gained detailed information about the patients in their care. One therapist told me, "It's what makes me able to do, what I do…and to be as sure of myself as I am." Lave and Wenger believed that learning took place through modification, in the forms of participation designed to open the practice to members.

Cognition and Social Language Theory

Cognition and social language theory is the concept of familiar commonalities within a group which shapes what an individual voice can say (Wertsch, 1991). Schell (1994) suggested this concept is important in understanding how clinical reasoning is socially determined (p. 52). The therapists in this study identified the respect, appreciation, and expectations of physicians as the one most important contextual issue that fostered their development of good clinical reasoning skills. Consequently, they also identified the lack of this expectation and support from physicians as being one of the primary hindrances in their development of those skills.

Communities of Practice

According to Wenger (1999), in order for an outsider or newcomer to become a member of an established community of practice, they must be in what she termed "an inbound trajectory" and must be granted enough legitimacy to be treated as a potential member of the group (p. 100). This legitimacy involves sponsorships or apprenticeships where a master in good standing is required to facilitate the movement of the newcomers into the community's practice.

The acceptance and expectation of respiratory therapists clinical reasoning by physicians, earlier strong expectations and training by other therapists, and the acceptance of their involvement by nurses provided the legitimacy which facilitated the movement of respiratory therapists into these communities of practice. Therapists indicated the presence of this sponsorship or apprenticeship, their scope of practice, and the responsibilities they have as therapists as important considerations when choosing the institutions where they will work.

Consequently, they also suggested the possible lack of this support and participation in clinical decision-making was also instrumental in choosing facilities they wouldn't work. Hospital medical and administrative directors may want to examine the actual or perceived support from the medical and nursing staff, and the therapists perceptions of that support, in an effort to identify potential hindrances to therapists ability to develop good clinical reasoning skills.

Hypothetical-deductive reasoning model

According to Higgs and Jones 2000, the hypothetical-deductive reasoning model involves both inductive reasoning (moving from a set of specific observations to a generalization) and deductive reasoning (moving from a generalization to a conclusion in relation to a specific case) in finding a solution to a clinical problem. According to Benner (1982) this type of reasoning is more commonly found in novice and competent therapists because of their lack of experiences.

Most institutions support and reinforce the competent stage of practitioners, and many therapists choose to remain at this level because "this stage of development is recognized by management as appropriate and predictable"(Benner, 1982, p. 405). Benner also suggested the standardization and routinization of procedures often reflect a competent stage of performance and most educational in-services are aimed at this level of achievement.

The novice in this study used hypothetical-deductive reasoning as one of the methods in determining solutions to difficult cases or clinical problems. Their reasoning consisted of the development of hypotheses, testing that hypothesis or reevaluating clinical data, followed by determining whether or not a solution had been reached. If the

solution had not been reached they changed their hypothesis and began the procedure again. Guidelines, algorithms, protocol, and instructions from physicians or more experienced therapists or preceptors guided their reasoning.

One of the contextual issues identified by this study as facilitating the development of good clinical reasoning skills was the use of well-written guidelines, which were not restricting and which allowed therapists the opportunity to evaluate and negotiate their own solutions to clinical problems. Hence, one of the contextual issues which restricted clinical reasoning in this study were guidelines which therapists considered to strict or ridged.

Well-written guidelines provide the scientific and theoretical frames from which the novice therapist combined with their own personal concrete experiences, when beginning their development of illness scripts or an intuitiveness of certain situations. The development of this intuitiveness allows the novice & competent therapist the opportunity to move away from using hypothetical-deductive reasoning to inductive reasoning.

There were examples of competent and expert therapists in this study suggesting their reasoning was determined by unwritten guidelines and protocols which had been taught to them by more experienced therapists or physicians, and from their own years of personal experiences. However, these unwritten guidelines and protocols actually represented both individual and shared illness scripts and schemas.

Intuition Theory

Intuition theory, primarily from the nursing literature, is rooted deep in the concepts of experience and recognition. Benner (1999) suggested it involves the

recognition and understanding of patterns and similarities known as schema or illness scripts within a clinical situation. She described intuition as the, "direct understanding of particulars in situations without deliberation, awareness, or articulation" (p. 568). Schell (1994) suggested that this "commonsense understanding" allows for flexibility in understanding many situations.

The expert therapists in this study indicated that written guidelines, procedures, or protocols which were to ridged or strict hindered their ability to reason when faced with complex problems. They found their ability to work with these required that they revert back to the hypothetical-deductive reasoning strategies commonly used by novice and competent therapists, taking them out of what one therapist described as her "comfort zone." They were more comfortable working from their intuitive grasp or subconscious awareness of situations and their abilities to recognize similar or dissimilar background experiences.

Inductive reasoning, and the development of "unwritten protocols" or schemata, and according to Higgs and Jones (2000) is pattern recognition, which can also be thought of as pattern interpretation. Furthermore, they believed unwritten guidelines such as these represented "pattern recognition or direct automatic retrieval of information from a well-structured knowledge base" (p. 6). They suggested that this type of reasoning is characterized by speed and efficiency, and more commonly occurs when experienced practitioners are dealing with familiar cases.

It was not only the expert therapists who used unwritten protocols, the competent and even novice therapists also indicated they made decisions based on what expert therapist, preceptors, and physicians had explained, what they believed was expected of

them, and what they had seen work when finding solutions to previous problems. However, the unwritten protocols which were passed from one therapists to another were based on guidelines, policies and procedures, previous experiences, and were similar to what Benner (1982) described as changing from "reliance on abstract principles to the use of past, concrete experiences as paradigms" (p. 402).

The development of polices, procedures, and clinical practice guidelines are written for the novice and competent therapists. According to Benner (1982), the experts are capable of making decisions intuitively because they have internalized the rules and guidelines of the practice in their development of schemata and are comfortable using inductive reasoning in finding solutions to problems (p. 405). Individuals responsible for writing policies and procedures should be aware of which therapists will need and use departmental policies, procedures, and guidelines as they are written, and not be too surprised when expert therapists use their own internalized guidelines in making clinical decisions.

It takes a considerable amount of time and experience before a respiratory therapist can function as an expert. There is no way to force feed information to the novice and competent therapists and expect the results to produce an expert. However, there is ample literature from the fields of nursing, occupational and physical therapy, and medicine to indicate that this process can be facilitated by educational curriculums designed to enhance the acquisition of good clinical reasoning skills. The following section of this chapter looks at how this might be achieved.

Education Designed to Enhance Clinical Reasoning

According to Schon (1987), there is an increasing gap between what is taught in

schools and the "actual competencies required of practitioners in the fields" (p. 10). He suggested that educators and managers alike should realize the expert practitioner does not have an enormous amount of more professional knowledge, instead they have more wisdom or tact knowledge which has been gained from their experiences. Benner and Tanner (1987) choose to use the term "professional craft knowledge" when writing about clinical wisdom, which according to them incorporated both procedural and clinical intuitive knowledge.

The therapists in this study used clinical reasoning in the neonatal and pediatric intensive care units when solving clinical problems associated with their professional practice. An understanding of therapists' use of clinical reasoning is relevant for educators who want to improve students' clinical reasoning. This can be accomplished by finding ways to help students generate knowledge bases, through knowledge construction, in forms that can be used to enhance their clinical reasoning skills.

The general focus of this study was not in finding ways to help students or therapists generate knowledge bases, or how knowledge constructed in certain forms could be used to enhance the development of clinical reasoning skills. However, when determining the practical applications for this study, it became apparent that helping students generate knowledge bases through knowledge construction was an important factor. Therefore, creating an awareness of the different forms of knowledge and how these can be used in conjunction with clinical reasoning should be one of the implications for practice. The following section of this chapter looks at this implications both from the perspective of constraints, which formed the foundation for this study and current literature, which addresses the issue of teaching clinical reasoning.

Thinking-In-Action

The findings of this study indicated that a sufficient base of scientific domain specific knowledge is required for the development of good clinical reasoning skills. These therapists suggested that a strong base of applicable knowledge was essential for the development of good clinical reasoning skills, and the absence of such knowledge would eventually result in therapists making serious mistakes.

The practice of respiratory therapists is heavily influenced by and dependent upon scientific research and theories. As one therapist in this study suggested, "You've got to have a basic knowledge of science, and physiology of the human body, and the way a mechanical ventilator works, or knowledge of how an oxygen molecule interacts with the body, just to be able to function here."

These therapists were in no way reluctant to tell me they no longer used the scientific theories and formulas taught by instructors such as myself in respiratory schools. They believed they no longer used them in making clinical decisions. However, there was a considerable amount of science used, journals read and discussed, and educational in-services and teaching rounds attended by the therapists in this department.

The competent and expert therapists suggested that their reasoning occurred as a result of thinking about situations as they occurred, recognizing problems from similar past experiences, in combination with current observation, evaluations, and assessment of the patients and situations. Nevertheless, their comprehension and application of this knowledge, and the development of their everyday skills was dependent upon and strengthened by their continued and repeated use of abstract scientific knowledge. They intertwined science into their development of schema and illness scripts.

The practice for respiratory therapists requires their ability to make quick judgments and responses in life threatening situations where there is a narrow margin for error. Benner et al. (1999) described this on-the-spot mode of thinking as reasoning-in-transition or thinking-in-action. The respiratory student's development of clinical knowledge requires an astute understanding of the sciences of human physiology and pathology, the physical nature of hemodynamics, and aerodynamics when problems are associated with mechanical ventilators.

In situations where there is little time to consider the possibilities of different options or ponder scientific explanations, therapists must quickly evaluate the situation, develop a solution, and perform a task to alleviate the problem. However, in these situations they are aware of scientific abstractions in combination with their own past concrete experiences.

Benner et al., (1999) suggested that experiential learning requires the use of a broad base of appropriate domain specific knowledge, engagement in a specific situation, recognition of patterns, the ability to sense something that is disquieting or puzzling, along with one's emotional senses. They believed this process generates a narrative memory of the situation, allowing the student to recognize and react to the situation in the future (p. 9). The therapists in this study may have indicated that they had forgotten the formulas, when in reality they had combined them with specific situations and patterns that they now recognized as concrete experiences, the result of experiential learning.

The therapists in this study benefited from previous education, teaching rounds, departmental in-services and case studies, which kept the principles of science present in their practice. However, students who are just beginning their process of learning can

have their learning and future reasoning abilities enhanced as educators find ways to facilitate the development of clinical reasoning into their curriculum.

According to Ryan (2000), more attention should be given to exploring and understanding ways to creatively enhance clinical reasoning skills both in therapists and students. She suggested the importance of making the best use possible of clinical settings, because they provide experiences that are context dependent. According to her, clinical reasoning is a reflective process involving thinking, reasoning, and reflecting and the "teaching of clinical reasoning needs to be placed with a reflective framework" (p. 242).

Boshuizen and Schmidt (2000) suggested the traditional approach to facilitating the reasoning skills of students were based on the assumptions that clinical reasoning or problems solving skills were separate from professional content knowledge, and clinical reasoning was the thinking process that occurred while dealing with clinical problems. However, they believed that while these two cannot be separated in practice they need to be considered separately. They suggested in the reasoning associated with experts these two components are both required and intertwined in a well-developed reasoning process.

Boshuizen and Schmidt (2000) believed an expert's extensive base of domain specific knowledge along with the process or method the expert uses to apply that knowledge to the clinical problem was important. They suggested that in order to improve clinical reasoning, educators should not only focus a domain specific knowledge bases, but also on the development of adequate knowledge structures. In other words, teaching should include training, coaching, modeling, and supervising as suggested in the

situated cognition literature in the actual development of knowledge organization for students.

Tichen and Higgs (2000) suggested that a student's concept of his or her own knowledge or acquiring knowledge about his or her own knowledge, and metacognition or reflecting on his or her own thoughts would effectively contribute to effective learning. According to them, "the relevance and depth of knowledge content, the structure of individuals' knowledge bases, and the learner's ability to organize knowledge in meaningful ways were of major importance to clinical reasoning abilities" (p. 222). They provided the following information as a list of ways to facilitate clinical reasoning in the curriculum for students.

- Make the relevance of knowledge explicit in the classroom or clinical setting, so that knowledge can be described, reflected upon, and analyzed in relation to a specific experience or case.
- Explicitly valuing different types of knowledge through analysis of experiences, feeling and thinking.
- Helping students articulate the structure of their knowledge bases to develop an understanding of their own knowledge and knowledge of their field. Integrating the different types of knowledge used in clinical cases, leading to meaningful organization of knowledge.
- Demonstrating the depth and complexity of knowledge to learners.
- Facilitating understanding of the content and structure of knowledge so that learners can more easily judge its validity.

Higgs & Tichen (2000) believed the constructivist philosophy is concerned with how

individuals “make sense of their worlds and how they create personal systems of meanings that guides them throughout their personal lives” (p. 26). Their work focused on understanding various forms of knowledge used in clinical practice, and suggested that restricting ourselves to only a single method of knowing or questioning would result in a limited range of knowledge or depth of understanding, which could be applied to a clinical problem.

The implications for practice developed from this study are that therapist themselves, their leaders, educators, and mangers must assume responsibility for learning, teaching, and facilitating the process of good clinical reasoning in the workplace. Mangers, including medical and administrative directors, have the responsibility of making possible the establishment of organizational communities of practice, which facilitate clinical reasoning. Educators, including those who develop continued education and in-services, should strive to find ways to increase therapists acquisition of knowledge in such ways that it facilitates their development of skills useful for clinical reasoning.

Further research concerning respiratory therapists’ use of clinical reasoning, the personal contextual issues which facilitate or hinder their reasoning, and an understanding of the organizational communities of practice in which their clinical reasoning develops are needed. The following section of this chapter provides recommendations for further research concerning these issues.

Recommendations for Further Studies

The recommendations for further studies, the fourth section of this chapter, are developed from the discussion of findings and the implications for practice. This study has succeeded in determining that respiratory therapists used clinical reasoning in their

daily activities in the neonatal and pediatric intensive care units and that they used multiple types of clinical reasoning almost simultaneously by easily switching between different types of reasoning as certain aspects of the clinical problem attracted their attention.

It was also determined that therapist utilized different types of reasoning depending on their level of expertise, and the presence of situational and contextual factors which facilitated or hindered their development of their clinical reasoning abilities The results of this study have implications for respiratory therapists, their educators and managers, and these finding may prove to be important if they are validated in other studies. This study contributes to the knowledge about how respiratory therapists make daily decisions when solving clinical problems in the neonatal and pediatric intensive care areas, however several questions still remain. The recommendations for additional studies are as follows.

First, this study does not provide an understanding about the personal contextual issues which facilitate or hinder reasoning. This study addressed only a small number of contextual practice issues, and did not address the personal contextual issues. Therefore the issues identified in the study represented only a small aspect of therapists' practice, and further research is needed to understand additional factors, which have the potential to facilitate or hinder their clinical reasoning.

Schell's works (Schell & Cervero, 1993; Schell, 1994) examined the contextual issues and situational pressures that affected clinical reasoning among occupational therapists, suggesting that clinical reasoning was a situated activity, and that therapists paid attention to the situational factors through pragmatic reasoning. She believed that

actual professional practice would predictably vary as a function of the contextual issues and situational pressures.

Secondly, a better understanding of the organizational practice context in which good clinical reasoning skills develop or are hindered is needed. Other theories, such as Lave and Wenger's (1991) communities of practice, may more fully explain the influence certain contextual factors have on respiratory therapists desire and ability to develop good clinical reasoning skills.

One aspect of the contextual issues that facilitated or hindered therapist's desire to develop good clinical reasoning skills was the expectation and acceptance of their abilities by the medical and nursing staff. In these units, the full participation of therapists was granted and expected. Yet, one therapist described her personal experiences working in another institution where therapists desired to achieve the same acceptance and respect, and they were never fully granted by the physicians and nurses who work in that hospital. Lave and Wenger (1991) described this acceptance as legitimate peripheral participation (p. 29). Schell (1994) suggested that Lave and Wenger view of communities of practice provides the basis for understanding the contextual effects on the nature of clinical reasoning because it views "clinical reasoning as a social activity that occurs within a community of practice" (p. 54).

Third, an understanding of how therapists make clinical decisions in other areas of health care, specifically those of pulmonary rehabilitation are needed. The clinical reasoning of respiratory therapists in these two units at times closely resembled the clinical reasoning described in occupational and physical therapists literature, and at other times it more likely resembled that of their nursing and medical colleagues.

Studies concerning the clinical reasoning skills of respiratory therapists who work in the areas of pulmonary rehabilitation, may find their practices more closely resemble that of the occupational or physical therapists. Such findings may have the potential to strengthen their reasoning abilities when working with pulmonary rehabilitation patients, their obstacles and goals, and provide information that will lead to decreased sicknesses and hospital time for their patients. Additionally studies are needed to determine to what extent these findings apply to all other areas of clinical practice. The differences in patient populations may provide different results.

Forth, further research is needed to develop teaching method that are situated in nature, and incorporate authentic actives, reflection-in-action, metacognition, and situated cognition in the curricula planning for respiratory therapy students. There is a heavy reliance on lectures in programs designed to prepare respiratory students for practice. Mishoe (1993) suggested that is was "blatantly obvious" that there is a need for educational reform in health care and the schools that prepares students (p. 283). She considered the continued reliance on lectures and inappropriate means of preparing students to meet the complex issues of respiratory care.

Fifth, There is a need for the development of an overriding theory of clinical reasoning. The difficulty in using the literature of clinical reasoning from so many different healthcare disciplines of practice is in the overlapping of theories and methods of reasoning. Because of this, there is a need for an overriding theory that incorporates all of the types of clinical reasoning. With of the utility of clinical reasoning to many different disciplines of healthcare and other occupations beyond, there is a need for a

better way of looking at these theories or a better way of thinking about clinical reasoning.

Conclusion

This study explored the clinical reasoning of therapists in the intensive care units, their development of expert clinical reasoning, and the factors that facilitated and hindered their abilities to acquire those skills. It was determined that therapists used several different types of clinical reasoning as described in the literature of nursing, medical, occupational and physical therapist. They were capable of using multiple types of reasoning almost simultaneously, and could effortlessly switch between different types of reasoning depending on which aspect of the clinical problem attracted their attention.

This study also identified factors which facilitated the development of good clinical reasoning including; previous similar experiences, a good scientific base of knowledge, well written guidelines from which a strong system of unwritten protocols could be developed, collaborative reasoning, and the expectations and support of physicians. The factors identified which hindered good clinical reasoning included, limited or lack of experiences, lack of time and staffing, limited expectations and nonsupport of physicians.

In agreement with Higg's (1990) description of clinical reasoning, the respiratory therapists in this study used clinical reasoning as the process of using thinking, interpersonal and clinical skills, and knowledge in order to acquire, evaluate, and make sense of the mass of clinical information available to the respiratory care practitioners during interaction with patients and other health care professionals, and thereby made, implemented, and evaluated, in association with colleagues, clinical decisions which

were relevant to the situation and the clinical problem. In conclusion, it was Rogers (1983) who originally suggested:

> the clinician functions as a scientist, ethicist, and artist. The scientific, ethical, and artistic, dimensions of clinical reasoning are inextricably intertwined, and each strand is needed to strengthen the line of thought leading to an understanding. Without science, clinical inquiry is not systematic; without ethics, it is not responsible, without art, it is not convincing (p. 616).

"At first it is all about the rules and later it becomes all about the baby"

Respiratory Therapist

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APPENDICES

APPENDIX A

Table 1 DEFINITION OF COMMONLY USED TERMS

Term	Definitions
Acidosis:	a pathological state characterized by an increase in the concentration of hydrogen ions in the arterial blood above the normal level. May be caused by an accumulation of carbon dioxide or the acidic products of metabolism
Aerosolized medications:	a medication in liquid or particulate matter dispersed in air in the form of a fine mist for therapeutic inhalation purposes
Alkalosis:	a disorder characterized by H-ion loss caused by CO2 loss from hyperventilation (respiratory alkalosis)
Apgar score:	evaluation of a newborn infant's physical status by assigning numerical values to each of 5 criteria
Arterial Blood Gases:	blood drawn from the arteries which has been oxygenated in the lungs before moving to systemic circulation
Arterial Line:	an intra-arterial catheter used for drawing arterial blood
Pulmonary Barotrauma:	lung injury that occurs when a patient is on a ventilator and is subjected to excessive airway pressures
Bilevel Positive Airway Pressure:	a spontaneous breath mode of ventilatory support which allows separate regulations of the inspiratory and expiratory pressures
Bradycardia:	slowness of the heartbeat, usually a rate under 100 beats per minute in a neonate
Bronchopulmonary Dysplasia:	a clinical entity in which newborn infants develop secondary lung injury after prolonged exposure to positive-pressure ventilation and high oxygen concentrations
Campnometer:	an instrument used in anesthesia, respiratory physiology, and respiratory care to measure the proportion of carbon dioxide in expired air
Cardiopulmonary Arrest:	relating to the stoppage of the heart and lungs

Chest Physiotherapy Therapy:	a collection of therapeutic techniques designed to aid clearance of secretions, improve ventilation, and enhance the conditioning of the respiratory muscles; includes positioning techniques; chest percussion and vibrations, direct coughing, and various breathing and conditioning exercises
Continuous Positive Airway Pressure:	a method of ventilatory support whereby the patients breaths spontaneous without mechanical assistance against threshold resistance, with pressure above atmospheric maintained a the airway throughout the breathing
Diaphragmatic Hernia:	protrusion of abdominal contents into the chest through a weakness in the respiratory diaphragm
Echocardiography study:	the use of ultrasound in the investigation of the heart and great vessels and the diagnosis of cardiovascular lesions
Endotracheal tube:	a flexible tube inserted nasally, orally, or through a tracheotomy into the trachea to provide an airway
:	
Endotracheal extubation:	the removal of a endotracheal tube from the trachea through the nose or mouth
Endotracheal intubation:	passage of a tube through the nose or mouth into the trachea for maintenance of an imperiled airway.
Epinephrine:	a catecholamine that is the chief neurohormone of the adrenal medulla. It results in increased heart rate and force of contraction, vasoconstriction, or vasodilation, relaxation of bronchiolar and intestinal smooth muscle.
High Chest Jet Ventilator:	positive pressure ventilation at a rate in excess of 150 breaths per minute and tidal volumes approximately anatomical dead space.
Incubator/Isolette:	a closed space for providing a humidified neutral thermal environment for an infant
Meconium:	the first intestinal discharge of the newborn infant, greenish in color and consisting of epithelial cells, mucus and bile

Nasal cannula:	the tube with nasal prongs that are inserted into the nasal cavity for transportation of air, oxygen or other gas(s) to the patient for inhalation
Nitrous oxide:	A selective pulmonary vasodilator gas used in the treatment of Persistent Pulmonary Hypertension
Oscillator:	a mechanical or electrical device that creates regular and reciprocal waves or vibrations
Oxygen toxicity:	the pathological response of the body and its tissues resulting from long-term exposure to high partial pressure of oxygen; pulmonary manifestations cellular changes causing congestion, inflammation, and edema
Oxyhood:	Plexiglass chambers designed to deliver controlled oxygen concentrations to the head and face of neonates and small infants
PaCO2:	the partial pressure of carbon dioxide in arterial blood
PaO2:	the partial pressure of oxygen in arterial blood
Patient Ductus Arteriosus:	the most common left-to-right shunt seen in neonatal intensive care nurseries because delayed closure of the ductus is associated with both prematurity and respiratory distress syndrome
Pericardial Effusion:	increased amounts of fluid within the pericardial sac, usually due to inflammation
Pneumothorax:	the presence of air or gas in the pleural cavity
Pulmonary Edema:	edema of lungs usually resulting from mitral stenosis, excessive fluids, or left ventricular failure
Pulse Oximeter:	a spechtrophotometric device that noninvasively estimates saturation of arterial oxyhemoglobin by use of selected wave lengths of light
Respiratory Synctial Virus:	the major pathogen causing bronchiolitis; spread by contact of the oral or nasal mucosa with secretions in the in the respiratory tract
Resuscitation:	revival from potential or apparent death

Surfactant:	those surface-active agents forming a monomonlecular layer over pulmonary alveolar surfaces; lipoproteins that include lechitins and sphingomyelins that stabilize alveolar volume by reducing surface tension and altering the relationship between surface tension and surface area
Transilluminater:	the use of a high-intensity light passing through body tissue for the purpose of examining a structure interposed between the observer and the light source
Tracheostomy:	an opening in the neck into the trachea, through which an indwelling tube may be inserted
Ventilation:	movement of gas(es) into and out of the lungs, respiration, in physiology, the tidal exchange of air between the lungs and the atmosphere that occurs in breathing
Ventilator:	a mechanical devise designed to perform part or all of the work of respiration, i.e., of moving gas into and out of the lungs
Volutrauma:	pulmonary airleaks occurring as a complication of the application of positive pressure mechanical ventilation, and the result of excessive volume (over distension) associated with mechanical ventilation
Wheezing:	to breathe with difficulty and noisily; a whistling, squeaking, musical or puffing sound make by air passing through the glottis, or narrowed tracheobroncheal airways in difficult breathing

APPENDIX B

INTERVIEW QUESTIONS

1. In which task or activities do respiratory therapists use clinical reasoning as a method of decision-making?

    - In your job, which activities or tasks, requires that you solve problems (associated with those activities or task) by making a decision and then take an action to correct the problem?
    - What is a problem associated with a task or activity you find more difficult to solve? How do you think through the process of thinking through how to solving it?
    - What is a problem associated with a task or activity you find easy to solve? How do you go through the process of thinking about it and taking action to solve it?
    - Describe a certain situation, which occurs in the NICU or PICU, where you must make a decision a problem and then take an action to solve problem?
    - What is a problem associated with a situation you find easy to solve? How do you go through the process of thinking through it and taking action to solve it?
    - What is a problem associated with a situation you find difficult to solve? How do you go through the process of thinking through it and then taking action to solve it?
    - Can you remember a time when the decision you made, about a task or activity you did, was critical to the patient's health, and describe your thought about and the action you took when making that decision?
    - Are there task or activities that you are required to do as part of your job, where you don't have to make any decision about how you are doing something but you can just take action to do it?
    - Are there task or activities that you are required to do as part of your job, where you don't have to make a decision about what you should do, you just know what has to be done and you do it?
    - Are there task or activities that you are required to do as part of your job, where you don't have to make a decision about why you are doing something, you just do it?

2. Which types of clinical reasoning do respiratory therapists use in their practice within the intensive care unit?
    - Do you make decisions to take an action differently based on the amount of time, equipment, or experience you have? Describe the differences.
    - Do you make decisions to take an action differently based on how critical the patient's condition is? Describe the differences.

- Do you ever think about how ethical it is when you start to do a task, or an activity? Can you describe how it affects your decision-making?
- Do you ever think about the ethical aspect of a situation when you take an action to solve a problem? Can you describe how it affects your decision-making?
- Have you ever been involved in the decision making process of other people when they must take an action to solve a problem? Explain how.
- Have you ever involved other people in your decision making process when you needed to take an action to solve a problem? Explain how.
- Do you use guidelines for the actions you take when making a decision to solve a problem?
- Can you anticipate some of problems and take action before they happen?
- How do you know things are going to happen and what action to take?
- Can you prevent a problem by taking an action before it happens?
- Are there problems or patients, which follow patterns? For example; a specific diagnosis, or a problem that constantly or continually reoccurs?
- Do you ever share the knowledge you have about a specific piece of equipment, patient, or situation and the action to take with other therapists?
- Have other therapists ever shared the knowledge they have with you about an action to take concerning a specific piece of equipment, patient, or situation with you?
- Do you ever think about what will happen to these babies? What will their lives be like while you are tanking care of them? Are you ever concerned about how what you do (your actions) will have an effect on these babies?
- What has the most effects on your decision making in a critical situation?
- What has the least effects on your decision making in a critical situation?

3. What are the differences in the types of clinical reasoning used by novices, competent and expert clinical reasoning?
    - How has the way you thing through and take action to solve a problem changed over the length of time you have worked here?
    - Describe how your ability to reason through a problem and taking an action to solve the problem is different from those who have worked here longer than you?
    - Describe how your ability to reason through a problem and take an action to solve the problem is different from those who have worked here less time than you?
    - What is it about yourself that make others think you good at solving a clinical -problem?
    - Can you remember a time when you made a decision to take an action and it was the wrong one? Do you now what it was that affected your reasoning and caused you to make the wrong decision?
    - Describe a situation where someone, who had more experience than you, helped you make a clinical decision.

- Describe a situation where you helped someone, who had less experience than you, make a clinical decision.
- How do you make a decision and take action to solve a clinical problem when the circumstance is critical?
- How do you make a decision and take action to solve a clinical problem when the circumstance is not critical?
- Can you describe a situation where you have had to make a decision and take an action to solve a clinical problem, without having all of the information necessary to make that decision?
- How do you know when you need to do certain task, such as:
    1. Intubate?
    2. Suction?
    3. Change the ventilator circuit?
    4. Give a bronchodilator treatment?
    5. Make changed in the FiO2?
    6. Change a baby from a conventional ventilator to a oscillator?
    7. Provide initial oxygen and ventilatory support for a premature baby?
    8. Ask for someone else to help/assist you?
    9. Change from your normal pattern of doing a procedure, and do something different?

4. What contextual factors encourage or discourage the development of expert clinical reasoning among respiratory therapists?
    - Think of another therapist, one that you think makes excellent decisions and knows what to do to solve clinical problems, in a situation where they solved the problem. Describe what they were doing and how they made those decisions.
    - Did this have an effect your decision-making?
    - Think of another therapists, one that you think made a poor decision and did not know what to do to solve a clinical problem, and describe why they made the wrong choice. How could they have made a better decision?
    - Did this have an effect your decision-making?
    - When do you think you learned to make good clinical decisions and know the actions necessary to solve the problems you will face in the future?
    - What do you think makes a good therapist, one who can reason through the problem appropriately and take the correct action to solve the clinical-problem?
    - How do/will you know when you are good at solving clinical problems
    - How do you think you learned to make good clinical decisions?
    - How do you know when you have made the correct decision, when you have done something? Do you learn from that?
    - How do you know when you have made the incorrect decision, when you have done something? Do you learn from that?
    - Today you _____. It required that you make a decision to do an activity or take an action. How did you learn to do that? What things helped you

learned to take that action? Are there things, which made it difficult for you to learn to do that?

APPENDIX C

CONSENT FORM

The Clinical Reasoning of Novice, Competent, and Expert Respiratory Therapists Working in an Acute Care Setting

I, _____, agree to participate in the research titled, The Clinical Reasoning of Expert and Novice Respiratory Therapist Working in an Acute Care Setting, which is being conducted by Rhonda Bevis, Occupational Studies Department, University of Georgia, (706) 219-2486 under the direction of Dr. John Schell, Occupational Studies Department, University of Georgia, (706) 542-4206. I understand that this participation is entirely voluntary; I can withdraw my consent at any time without penalty and have the results of the participation, to the extent that it can be identified as mine, returned to me, removed from the research records, or destroyed.

Because the nature of this study is to discover, understand, and gain an insight into the clinical reasoning of respiratory therapists working in the acute care setting, the uniqueness of participants is important. This study will focus on how they experience reasoning, not whether the reasoning is clinical appropriate or inappropriate. This study will not pass judgment on the participant's method of reasoning. For the purpose of this study, there will not be a right or wrong method of clinical reasoning used by respiratory therapists, only the identification of those types used.

I agree to participate in clinical observations and interviews conducted by the researcher. Each observation will occur on the participants scheduled work time, and will last approximately 6-8 hours. Each clinical observation will be followed by an interview, which will last approximately one hour. I agree to participate in the clinical observation by thinking out loud and answering question ask by the researcher when making decision in the clinical area. I agree to answer questions about how I make clinical decision in the interview, which follows the observation.

No discomforts of distresses are foreseen. No risk is for seen.

Any information obtained about you as a participant in this study, including your identity, will be held confidential. Your identity will be coded, and all data will be kept in a secured, limited access location. Your identity will not be revealed in any publication of the results of this research without your permission. The interviews will be audiotaped. After the research is completed, the tapes will be erased. Research is expected to be completed by November 2002. The results of your participation will be confidential, and will not be released in any identifiable form without my prior consent unless otherwise required by law.

The researcher will answer any further questions about the research, now or during the course of the project, and can be reached by telephone at (229) 535-4545 or (478) 471-2784.

Please sign both copies of this form. Keep one and return the other to the investigator.

_____

Signature of Participant and date

_____

Signature of Researcher and date

For questions or problems about your right please call or write: Chris A. Joseph, Ph. D., Human Subjects Office, University of Georgia, 606A Boyd Graduate Studies Research Center, Athens, Georgia 30602-4711; Telephone (706) 542-6514; E-Mail Address IRB@uga.edu.

APPENDIX D
INSTITUTIONAL REVIEW BOARD APPROVAL

The University of Georgia
: of The Vice President for Research
DHHS Assurance ID No. : M1047

Institutional Review Board
Human Subjects Office
606A Graduate Studies Research Center
Athens, Georgia 30602-7411
(706) 542-6514; 542-3199
Fax No. (706) 542-5638

APPROVAL FORM

Date Proposal Received: 2002-02-13 **Project Number:** H2002-10625-0

Name	Title	SS Number	Dept/Phone	Address	Email
Ms. Rhonda Bevis	MI	261157587	Occupational Studies Rivers Crossing +4809	271 Mill Banch Road Warwick GA 31796 (229) 535-4545	bevisr@surfsouth.com
Dr. John W. Schell	CO	492501075	Occupational Studies Rivers Crossing +4809 542-4206		jschell@arches.uga.edu

Title of Study: The Clinical Reasoning of Expert and Novice Respiratory Therapists Working in Acute Care Settings

45 CFR 46 Category: Administrative 2

Modifications Required for Approval and Date Completed:
Revised consent form.

Approved : 2002-04-10 Begin date : 2002-04-10 Expiration date : 2002-11-30

NOTE: Any research conducted before the approval date or after the end data collection date shown above is not covered by IRB approval, and cannot be retroactively approved.

er Assigned by Sponsored Programs: **Funding Agency:**

Form 310 Provided: No

Your human subjects study has been approved as indicated under IRB action above.

Please be aware that it is your responsibility to inform the IRB . . .
. . . of any adverse events or unanticipated risks to the subjects or others within 24 to 72 hours; . .
. . . of any significant changes or additions to your study and obtain approval of them before they are put into effect; . . .
. . . that you need to extend the approval period beyond the expiration date shown above; . . .
. . . that you have completed your data collection as approved, within the approval period shown above, so that your file may be closed.

For additional information regarding your responsibilities as an investigtor refer to the IRB Guidelines.
For your convenience in obtaining approval of changes, extending the approval period, or closing your file, we are providing you with a blue Researcher Request form. Detach this blue form, complete it as appropriate, sign and date it, then return it to the IRB office. Keep this original approval form for your records.

Copy:
Dr. Clifton L. Smith
Dr. Robert C. Wicklein

Christina A. Joseph, Ph.D.
Chairperson, Institutional Review Board

APPENDIX E

RESEARCHER'S JOURNAL

1/30 Met with the Director of the Respiratory Care, to request permission to do the study there. We talked about the study and what my expectations of data collection and whether or not the therapists would be receptive of the idea.

2/6 I sent an e-mail to Dr. Schell. I do not know the numbers, but several of the therapists in the neonatal and pediatric units will be former students of mine. He agrees that it should be mentioned in the methods chapter. He ask how many, and I approximated 25%. I will find out when I am able to get some numbers the therapists.

2/8 Sent an e-mail to Director of Respiratory Care asking whether or not he objected to using the name of the hospital in my study. He responded that he had no rejections to using the name. I also requested that he serve in the capacity of peer review, where I would take the data and results to him and ask him if the results were plausible.

2/8 I talked with Beth Brown, Charles Matson about also reviewing the data.

2/8 Talked with respiratory therapy supervisor. She was concerned with fact that scheduling time with therapists may be difficult because of individuals being "pulled" from the unit to work in other areas. I assured her that I would reschedule until I could obtain the interviews.

3/28 Met with Dr. Schell to go over first three chapters. He felt uncomfortable using the name of the Hospital in Chapter 3. We also discussed the different types of constructivism. I felt that my feeling about individuals acquiring knowledge as a result of their experiences was representative of dialectal constructivism.

4/5 Quick meeting with Pam, the respiratory therapy supervisor of the Children's Hospital team, I have a fear that they are two busy for this study. They have 18 beds in the nursery and 17 neonatal patients on ventilators.

4/22 Talked with Pam, she believes we will have no trouble finding individuals who are willing to participate in the study. She provided me with a list of therapists who have volunteered to participate

4/28 A collection of non-gender names to be used: Jamie, Lynn, Lee, Bobby, Shannon, Casey, Jackie, Meryl, Jean, Kerry, Joe, Randy, Jerry, Pat, Jackie, Jordan,

5/10 The committee provided changes that improved the first three chapters. Major changes included; 1) changing the methodology from a bound case study to a generic or basic qualitative methodology. The reason for this will be some therapists who work on this team, who will not be a part of the study. 2) Changes were made to research question number 4. There had to be a distinct distinction made between the phrases "expert

respiratory therapists" and respiratory therapists who are experts at clinical reasoning" I chose to use the second. 3) The outline of the first three chapters needed better organization; some of the information in chapter one could be moved to chapter two and there were heading which could be eliminated by clumping categories together. 4) There needed to be a pilot study using initial questions needed to determine if they needed revising.

5/11 Changes were made in the first three chapters. They were sent to Dr Schell as an e-mail file.

5/14 Visited the respiratory care supervisor, from the neonatal and pediatric team where this study will take place. We spent some of our time doing an observation of her working in the intensive care unit and then did a taped interview using the initial questions. The observation and interview were transcribed and analyzed. It was obvious that the questions would need changes. However several types of clinical reasoning were evident in the pilot study

5/16 The remanding changes were completed, including those necessary on the questions and were sent to Dr. Schell. Permission to begin collecting data as soon as all changes were submitted was received. I contacted the hospital and set up times for the first two interviews and observations.

5/22 First interview, I'm finding it difficult not getting distracted from gathering data by the actual work being done by these therapists. Instead I find myself cogitatively drifting back into the care of patients instead of monitoring the reasoning of the therapists. For that reason I will have to try to be careful not to overlook what I have come to this unit to do and try to be more focused on the next observation and interview.

5/28 One of the therapists changed his mind about volunteering for the observation and interview, so another expert therapist agreed to work with me. I found it interesting that during the interview, he choose to join us and frequently added his own comments. I ask him to also choose a fictitious name (which he did) sign a consent form. After several weeks of being unable to convince this therapist to sign a consent form, I removed any parts of interview which were his and redid it with the therapist I had observed.

5/31 This is a lot of work. I am surprised how exhausted I am after each observation and interview and how long it takes to type the transcription, and do an analysis of the data. It takes several days (10-16 hrs/day) for each therapist I follow.

6/3. Today during the observation at 4:00 p.m., Jamie is setting up the CPAP for the baby she extubated this morning. The baby's saturation had begun to drop. She was on the other of the covered isolette, getting the setting up ready, when I noticed that the baby turned very ashen and gray and stopped breathing.

I knew she couldn't see the baby and it would still be couple of seconds before the alarms go off. I couldn't see the resuscitation bag, so I thought it must be on the side where she was. The family of the baby next to this baby was sitting in the way. I quickly

called for her to "get over here now and bring the resuscitation bag with you". She pushed her way past the family members and quickly began resuscitating the baby. By now the heart rate had dropped, the monitors alarmed and the nurse had responded to the alarm. They bagged the baby for a couple of minutes, saturation and heart rate improved.

I stepped back to write in my field notes and I remembered Dr. Hill's question would I ever be involved with the resuscitation. If Jamie couldn't have gotten there within a second or two, I would have grabbed the resuscitation bag on the baby next to this baby, dropped my pen and field notes on the floor and begin bagging until someone could relieve me.

I realized that just as all of the other therapists had said, when the baby is in dire need of resuscitating, nothing else in the world matters. I too would forget that I was only a guest in this nursery, the resuscitation bag belonged with another baby, and that I had promised my doctoral committee that there would never be a situation where I would be involved with the resuscitation. I would have bagged the baby until someone relived me.

6/3 The respiratory therapy supervisor met with me today and we went over the data that had already been collected. We discussed the concept of what physiological reasoning using monitors might be, and how and why the expert therapists seem to feel "out of their comfort zone" when new equipment is introduced into the unit.

6/5 This observation was shorter than most because I chose to not attend the delivery of a baby who was most likely going to die. The babies gestational age was 22 weeks and mother's water had broken almost 10 weeks earlier. Because of no prenatal care both the mother and the baby were infected. I didn't want to see this. I choose to leave when the therapist left for the stork squad. Several day's later I learned that the baby was severely infected and only lived a few minutes. For some reason I found my emotions lay to close to the surface do an observation.

6/19 Met with the respiratory supervisor and we went over the analysis of data. In my initial analysis there was almost no Practical or Logical reasoning. We both new that a lot of what these therapists did was the "fine tuning" of treatments, ventilator pressures, and/or oxygen administration. After talking with her, I went back and looked at the data analyzed as Procedural Reasoning. Some of this information did show that the therapist was then making changes which would "fine tune" the procedure. That information was then categorized as Practical or Logical Reasoning. She agreed that these findings did represent the therapists who work on the Children's Hospital Team.

6/19 Met with a colleague, a Registered Respiratory Therapist and also an instructor in the Respiratory Care Department at Macon State College. We went over the data in each categories and she also agreed that the categories were representative of what therapists do in their work in intensive care centers. In looking at the data we also discussed that therapists don't use these types of reasoning exclusively, instead their reasoning seems to include multiple categories, simultaneously. We talked about how we could facilitate that movement from novice to experts in the students we teach, so this fall in my assessment class each student will start a portfolio which the will continue for two years.

7/8 Met with Dr. Schell. We discussed the results of the study. I am having difficulty understanding the reasoning that occurs when therapists respond to an alarm. When writing my results I termed it physiological reasoning. It results when a therapists hears an alarm. It can indicate a problem with heart rate, SaPO2, A disconnects or high pressure alarm on the ventilators, high temperatures on the heater pots or warmers. The therapists selectively determined to which alarms they responded, and how they would respond. At times this seemed to be subconscious. This reasoning is not pragmatic, because they are responding to a potential problem with the babies. It is not scientific, because most times they respond to a particular sound they do not know what the values of heart rate, SpO2, or pressures are until after they have responded. It seems more like inductive reasoning than any other type. I believe it is a very rapid response to multiple parts of a problems which happens so quickly they are difficult to separate.

8/ Rewrote Chapter 4. Much material had to be cut. I don't think we realized what an enormous amount of material we would have. Question one could have been almost every task and activity a therapists does. The two categories of pragmatic and procedural could describe almost every activity they perform.

8/27 Two colleagues and myself read and discussed the conclusions and implications in Chapter 5.

APPENDIX F

LEVEL II ANALYSIS
Scientific Reasoning

Task or Activity	Participant's comments	Participant & line
Changing vent. Settings	"Because of the increased fluid and the need to keep the FIO2 less than 40% because of oxygen toxicity"	Jackie-o-18
----	----	
Teaching rounds	She had received two calls that teaching rounds were going on the PICU and she needed to be there. We grabbed sodas and cookies from a vending machine and pushed chairs from the nursery into a report room which had several nurses, pharmacist, social worker, physician, and a resident sitting in a large circle in front of a x-ray view box. They discussed each aspect of each case, going methodically through each order, lab, problem	--- Shannon-O-188
--- guidelines	----- For some things. We use guideline for high frequency in adult, we don't just put them on every body, they have to have air leaks, they have to meet certain criteria, We're going to use guidelines for our nitric oxide. I'm not going to be putting every twenty something weaker on nitric oxide, they are going to be thirty four weeks, they are going to be showing they are in resistant fetal circulation, there are going to be certain thing. I'm not going to be putting them on because doctor so-and-so wants to put them on that day, because he hasn't used it yet. We have guidelines set up for that. Guide lines are pretty simple, they are yes or no, there are things I don't have to have guidelines to make the decision. Some decision are from experience, sometimes I call the doctor and say look, I don't have a guideline you didn't give me any parameters, what do you want to do. But sometime before I can get in touch with that doctor I have to make that decision to do something.	--- Shannon-I-252
--- this sounds very much like hypothetical reasoning	----- But nine times out of ten your main decision process is going to begin in the delivery room. Whether it be in the stabilization room or in another room off of the floor, delivery...meconium is a given …but we have to decide ok is this baby crying or is he not crying…is the meconium thick or not thick…at this point…regardless of the meconium state of not you…if they are crying you don't do anything…be baby is obliviously crying, stimulated and he got any meconium down there anyway there's not much you can do about it. So, that would be a point…or if you've got a child that wasn't crying you know…do you go a head and	--- Jordan-I-79