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The integration of patient cues, nursing knowledge and clinical judgements by Intensive Care Unit Nurses in simulated situations of urgency

by

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Thesis submitted to the
School of Graduate Studies and Research
in partial fulfilment of the requirements
for the degree of
Master of Science in Nursing

University of Ottawa

August 1996

Abstract

Nurses who work in critical care areas must learn how to make effective clinical judgements about patients under a variety of conditions. The process of making clinical judgements includes attending to cues from the patient and integrating prior nursing knowledge. The study examined this process within the context of simulated patient instability, in which there is minimal time for the nurse to reflect upon the judgements made.

Registered Nurses from four Intensive Care Units (ICU) within the Regional Municipality of Ottawa-Carleton were randomly selected and invited to participate in the study and twenty-four nurses participated. The study employed a 'think aloud' method and verbal protocol analysis to examine the number and types of patient cues from six case studies, that were attended to by the nurses. The relationship between cue recognition, domain-specific knowledge and clinical judgements was examined.

Nurses verbalized a low percentage of the available patient cues, knowledge, and clinical judgements. A significant and moderately positive correlation was found between cue recognition and knowledge verbalized, knowledge verbalized and clinical judgements made and cue recognition and clinical judgements made. The number of knowledge items verbalized were positively correlated with the level of ICU (tertiary or secondary), with higher levels of knowledge items verbalized found in the nurses working in the two tertiary level ICUs.

The results of this study have implications for all nurses as well as those in advanced practice roles. Case reviews, as part of ongoing education, can encourage the nurses to examine and improve their clinical judgements. Teaching nurses to become reflective practitioners would provide them with tools to examine and improve their own process of making clinical judgements. Ensuring that nurses have current nursing knowledge can provide a stronger basis for their clinical judgements. Areas for further research are described.

Acknowledgements

I would like to acknowledge the contributions made by many people that allowed me to complete this thesis and degree.

I acknowledge the support and assistance provided by my thesis supervisor: Dr. Denise Alcock and the thesis committee members: Anne Stolarik, Travis Gee and Dr. Peter Jessamine. Dr. Alcock was always there when I needed her, with her wisdom, knowledge and support, throughout the program. She shared her expertise and time with me and constantly challenged me to reach higher levels. Anne Stolarik generously shared her clinical expertise as my clinical advisor as well as her knowledge and time before and during the program. Travis Gee provided guidance along the journey of statistical analysis and graduate studies. Dr. Jessamine generously shared his expertise and wisdom.

I acknowledge the tremendous and ongoing support, encouragement, assistance and fellowship provided by my fellow classmates Chris Foster, Leslie Newell, Judy Rashotte and Jill Stevenson Gale, without whom this would have been a much more difficult and lonely journey. They inspired and stimulated me to reach for new heights.

I acknowledge the support and assistance provided by all members of the faculty of the School of Nursing. Each, in their own way, has contributed to my pursuit of higher nursing education and completion of the master's program. The examiners: Dr. Margaret Ross and Dr. Betty Cragg; gave the thesis careful attention and provided thoughtful feedback that enhanced the final result.

I acknowledge the support and assistance provided by my employer: the Ottawa Civic Hospital; Wendy Nicklin (Vice President: Patient Services); Kathleen Graham

(Clinical Services Director: Special Services); Dr. Jo Logan (Clinical Services Director: Nursing Research and Professional Development) as well as all my coworkers throughout the ICU and the hospital, who made the leave of absence possible and who continued to encourage and support me throughout the two years.

I acknowledge the strong support and assistance provided by my parents and family who believed in me and were there to help me grow through the experience of graduate school. Their support was always there for me, in many different ways too numerous to mention.

I acknowledge the assistance provided by my patients, who have taught me continuously throughout my nursing career and who provided many stimuli for pursuing graduate education in nursing.

I acknowledge the contribution made by the nurses who participated in this study, either as participants or experts. You willingly shared your knowledge and self in the interests of nursing research.

I also acknowledge, with thanks, the many different ways in which my friends and colleagues provided support to me along this journey.

I am very grateful to those nurses who lived their vision of Nursing, stimulating and encouraging me to continue learning and working in Nursing.

Finally, I acknowledge, with gratitude, the financial support that I received from the Ontario Ministry of Education and Training, the Ottawa Civic Hospital Nursing Bursary Fund, the Canadian Nurses Foundation, the Registered Nurses Association of Ontario Foundation and the University of Ottawa through their scholarship and bursary programs.

Table of Contents

List of Tables

List of Figures

1.0 Introduction

Intensive Care Units (ICU) were created to provide close nursing observation and care of critically ill patients in an effective and efficient manner by clustering these patients in one location (Bendixen, 1977). The concept grew out of the post surgical recovery area recommended by Florence Nightingale (Hilberman, 1975). Caring for critically ill people has provided a variety of challenges to the members of the patient care team. Over time, the need for knowledge and skill specific to ICU nursing was recognized by nurses working in the ICU, as well as other members of the patient care team. Formal orientation programs and ongoing inservice education have been the main routes to meet these informational needs.

Most ICU orientation programs have extensive lists of the technical skills and knowledge required for nurses to be able to function effectively. The new nurse employee must demonstrate competence in each of these skills as well as mastery of the applicable nursing knowledge during a preset time frame to successfully complete the orientation period.

Less well described is the nursing knowledge (Tanner, Benner, Chesla & Gordon, 1993) and the clinical judgement processes that the nurse must use to be an effective ICU nurse. McGee (1975) has defined nursing as a

> nurse-patient interaction that stems from assessment of a patient's needs and levels of functioning and is designed to optimize the

> patient's adaptability through modification and/or reinforcement of the environment, modification and/or reinforcement of behaviour and biological care and maintenance provided through the use of nursing care strategies in appropriate measure (p. 127).

Johnson (1959) described nursing knowledge in terms of ultimate and specific knowledge. Ultimate knowledge was described as knowledge of people, while specific knowledge was scientific, both basic and applied. In 1978, Carper described four patterns of nursing knowledge: empirical, aesthetics, personal and ethical. Empirical knowledge is the factual and descriptive knowledge that is publicly verifiable. The art of nursing is described as aesthetic knowledge. Personal knowledge, or knowing the self is necessary to use the self as a therapeutic agent in the nurse-patient interaction, for to know the patient, one must first know oneself (Egan, 1994). Carper stated that personal knowledge was "the most difficult to master and to teach" (p. 18). Ethical knowledge "is focused on matters of obligation or what ought to be done" (Carper, 1978, p. 20). Carper goes on to state that the reason nurses need ethical knowledge is that:

> nursing is deliberate action, or a series of actions, planned and implemented to accomplish defined goals. Both goals and actions involve choices made, in part, on the basis of normative judgments, both particular and general. On occasion, the principles and norms by which such choices are made may be in conflict (p. 21).

White (1995) proposes a fifth pattern of knowing, that of sociopolitical knowing. This is knowledge of the context of the persons involved and their interaction. White believes that nurses must also have knowledge of the broader context within which nurses work at both the individual and professional level.

Schultz and Meleis (1988) have identified three types of knowledge considered to be specific to nursing: clinical, conceptual and empirical. They state that clinical knowledge is the individual's personal knowledge of the practice of nursing, and the credibility of clinical knowledge has been determined by its usefulness. Conceptual knowledge is defined as "abstracted and generalized beyond personal experiences" (p. 220). It results from nurses' reflection on their nursing practice and acquired knowledge. Knowledge gained from research is empirical knowledge and is often used to support actions and procedures and to stimulate new research. The authors' premise is that each type of knowledge has its own criteria for acceptance.

Baumann and Deber (1989a) define clinical judgement as a cognitive process that involves gathering data and using these to determine the correct nursing diagnosis. Chase (1995) has described clinical judgement as " the complex cognitive process by which a clinician interprets patient behaviours and builds a communicable description of the status of patients" (p. 154). Clinical judgement is considered to be different from decision making, which involves making a choice from two or more possible alternatives (Baumann & Deber, 1989a). Gordon (1987) describes several types of judgements that are included in the making of clinical judgements:

determining the data to collect, determining the meaning, significance and relationship between the data bits and determining whether the cues can be clustered to fit patterns. This process is complicated when a person needs to make rapid and frequent clinical judgements, based on patient data, or cues, which are constantly changing and which may fit many different patient problems (Baumann & Deber, 1989a). This is the usual situation in critical care settings.

A growing body of knowledge is emerging, that is based on Benner's (1984) work, describing expert nursing practice and the clinical judgement process. It is not complete, especially regarding Critical Care Nurses (CCN) practicing in mixed adult critical care units. The present study examines the way in which critical care nurses use their nursing knowledge and the cues obtained from the patient when making clinical judgements.

1.1 Review of Relevant Literature

In order to review the literature that contributes to a clearer understanding of the relationships between patient cue recognition, nursing knowledge and the clinical judgement process, it is helpful to briefly review the literature on information processing. Information processing begins when a person attends to (pays attention to) a stimulus. A person must attend to the stimulus within one half to three seconds in order for the stimulus to be retained and be transferred into the working memory (Carnevali & Thomas, 1993). The information then must go through several processes in the short term memory if it is to be retained. These include encoding, rehearsal, chunking and transferring information to and from long term memory

(Levin & Vuckovich, 1991, p. 69). This information is then stored in long term memory for later retrieval. Newell and Simon (1972) state that long term memory is associative, in that pieces of information are turned into symbols that may be linked with other symbols. These linked patterns of symbols are called chunks. When putting the information into chunks, the person puts together the experience itself, new knowledge about the experience, and links to previously stored related information.

Long term memory is a richly indexed and cross indexed data base, laid down by previous learning and experiences (Newell & Simon, 1972). The information in the data base includes domain-specific knowledge acquired through experience, informal and formal learning. Information coming from different sensory sources has different features and will be represented by different knowledge structures (Frederiksen, 1984). These knowledge structures may contain sensory-perceptual information such as smells, declarative knowledge such as learned facts and meanings, and procedural knowledge, which includes motor and cognitive skills (Frederiksen). Knowledge structures also contain the person's knowledge of heuristic rules (Chi, 1981). Most information can be accessed through multiple routes and multiple cues, indicating the richness of the interconnecting links within the long term memory (Kail & Bisanz, 1982).

The working memory controls the sequence of processing information (Newell & Simon, 1972). In this phase, the new information is examined in light of the information retrieved from the long term memory. The two subprocesses that appear

to work together at this stage are that of understanding and of search. How the person understands the problem produces the type and structure of the information retrieved into the working memory. This information structure then drives the search process that is responsible for determining the solution for the problem (VanLehn, 1991).

The next step in the information processing model is the generation of possible hypotheses. Further information is then gathered to confirm or negate these hypotheses. During this stage, the person continues to generate possible hypotheses that appear to fit with the available information (Radwin, 1990). A clinical judgement is made when the person considers that a good fit has been obtained between the information available and the hypothesis.

Hampton (1994) describes three theories of the structure of memory that relate to expertise and linkages: chunking theory, network theory and schema theory. Expert problem solvers are thought to have superior abilities when organizing data into chunks of related information rapidly. They are also thought to have highly developed linkages and pathways in their long term memory between multiple chunks of data relating to their area of expertise. This allows them to access this information quickly and efficiently, while the novice struggles to retrieve individual bits of somewhat relevant data. The novice often becomes overwhelmed with many cues and so must engage their global resources. This often results in the loss of new information. Larkin, McDermott, Simon and Simon (1980) suggest that the difference between the novice and the expert is the amount of information or

detail in these data chunks. Experts are able to encode larger chunks of data that are also more easily recalled. The richer store of relevant information in the long term memory that is also well organized for rapid retrieval allows the expert to handle familiar tasks more efficiently and leads to more efficient resolution of the problem.

Simon (1974) suggests that chess masters store between 25,000 and 100,000 chunks in their long term memory. He presents many examples of how a person can increase the speed and accuracy of memorization if the data bits are not random, but organized and linked in some manner. He also states that the short term memory can handle between five and seven chunks at once and that it takes five to ten seconds to fix a chunk into long term memory.

The literature which contributes to an understanding of patient cue recognition by nurses, nursing knowledge and clinical judgements have been reviewed under the headings of: knowledge and experience; expertise; cue recognition; task complexity; heuristic processing; overconfidence and context.

Knowledge and Experience.

Sims and Fought (1989) examined the congruence between the identification of a problem and knowing what to do about it in a group of critical care nurses. They found that over four decision points in a sample case, only 17% of the nurses made the right decisions for the right reasons. The authors suggest that knowledge deficits may have caused nurses to miss cues and come to the wrong conclusion, although they may have chosen the correct action. They believed that this reflected the valuing by nurses of "knowing how" rather than "knowing why" (p. 83). This is in

contrast with the results found by Baumann and Bourbonnais (1982) and Thompson and Sutton (1985), who found that nurses made appropriate decisions (Baumann & Bourbonnais, p. 443) as judged by a panel of expert clinicians. The nurses' knowledge and experience were the two most important factors that influenced the rapid clinical judgements made. Baumann and Bourbonnais also asked their participants to rank various factors as to their influence on the nurses' clinical judgement: knowledge, experience, stress, role modelling and values. Ninety-eight percent of the participants "ranked knowledge, either alone or in combination with other factors as influencing decision making" (p. 443).

Sims and Fought (1989) defined expertise only in terms of years of experience, which does not match Benner's (1984) definition of an expert. This may have an influence on the lack of significant difference between the groups of novices and experts in their paper. The article included minimal demographic or sample information and analyzed the data using actual counts and percentages only. The authors did not provide support for the assumptions they stated about the presumed deficits in their participant's nursing knowledge.

Jenks (1993) described "knowing the patient" as one of several types of knowing that nurses use in making clinical decisions. The other two types of knowing that her subjects described were "knowing peer nursing staff" and "knowing physicians" (p. 402). Tanner, Benner, Chesla and Gordon (1993) described what critical care nurses mean by knowing the patient. One of the main themes was knowing the patient's "pattern of response," which included the patient's responses

to therapeutic measures, routines and habits, coping resources, physical capacities and endurance and body topology and characteristics. This information is based on cues that nurses have collected while caring for the patient. Jenny and Logan (1992) also described "knowing the patient" as an important element in patient assessment. These studies all used qualitative methodology and appear to be the first research evidence of the concept "knowing the patient." This concept needs further development and testing.

Expertise.

Kluwe (1993) stated that when acting in complex environments, knowledge is crucial for reaching and establishing goals. Regardless of the domain of the expert, significant knowledge levels are "an essential prerequisite to expert skill" (Larkin, McDermott, Simon & Simon, 1980, p. 1342). Dreyfus and Dreyfus (1986) identified five developmental stages of competencies: novice, advanced beginner, competent, proficient and expert. They state that there are three general changes that occur in the person's development through the stages: "a shift from reliance on abstract principles to the use of past experience to interpret problems; a shift from a piecemeal to a holistic grasp of situations; and a shift from a detached to an involved stance" (Gordon, 1986, p. 953). These three changes are reflected in the problem solving processes used by practitioners as they move through the various stages. Shanteau (1992) states that there are three themes in expertise. "Expertise is *domain-specific* . . . the thinking of experts relies more on automated processes

. . . and expert thinking is reflected by and can be studied through *verbal protocols*" (p. 13).

Cue Recognition.

Crandall and Getchell-Reiter (1993) identified the cues used by nurses in their study to diagnose sepsis in neonatal patients. There were seven cues identified that had not been previously identified in the literature on sepsis in neonates. Jacavone and Dostal (1992) described some of the cues used by coronary care nurses in the assessment and management of cardiac pain, including subtle physiologic changes in the patient's response to the intervention. Their findings also confirmed the importance of nurses' knowledge in their ability to make continuous and rapid complex clinical judgements. The expert nurses possessed both the detailed knowledge of the actions of the vasoactive drugs used, and the effective range of infusion rates that was required to aggressively adjust the dosage. They had detailed knowledge that allowed them to evaluate the effectiveness of the adjustments they made. Expert nurses were also able to interpret the patients' responses and decide which of the multiple medications needed to be adjusted. Novice nurses were more hesitant to titrate the medications, and used formal protocols for guidance.

Itano (1989), in comparing the clinical judgment process of registered nurses and student nurses, found that the registered nurses collected significantly more cues than the students and believed that this could be explained by the fact that the registered nurses had greater knowledge and more experiences. The registered nurses' increased knowledge about diseases and human responses to illness was

perceived to have provided a basis for their data collection, although this was not explored. Joseph and Patel (1990), using verbal protocol analysis, examined the clinical judgements of two groups of physicians, one with expertise in the clinical area of the case and the other with expertise in a different clinical area. They found that there were no significant differences between groups in the number of relevant and significant cues collected, but there was a difference in the way cues were used. Physicians whose area of expertise matched that of the case tended to make their hypotheses early and use the remaining cues to validate the hypotheses while the other physicians tended to collect many more cues before generating hypotheses.

Fonteyn and Grobe (1994) used verbal protocol analysis to elicit twenty types of cues used by expert critical care nurses. They described the "pattern matching" used to identify patient problems and to separate relevant data from irrelevant data. The processes that the nurses appeared to use to make clinical judgements were: study, conclude, choose and explain. Pattern matching was also identified by Benner and Tanner (1987) and Benner, Tanner and Chesla (1992) as one of the tools used by expert nurses when making clinical decisions.

Task Complexity.

Corcoran (1986a, 1986b) used verbal protocol analysis to examine the relationship between task complexity and the planning processes used by novice and expert nurses. She found that "there was no relationship between task complexity and the quality of the plans developed, and that experts developed better final plans than did novices" (1986a, p. 160). Based on the same research study, the

author (1986b) reported that experts developed better plans for the most complex case, and novices tended to develop better plans for the simplest case. Hughes and Young (1990) found that the agreement between the clinical decisions generated by nurses and a normative decision model, that was based on comprehensive knowledge (Cahill, 1994), decreased as task complexity increased. Bakken Henry (1991) used a computer simulation to examine the effect of patient acuity on the clinical judgement of critical care nurses. She found that inexperienced nurses collected more data and made the correct decisions in the less acute situation (atrial fibrillation) while nurses with Advanced Cardiac Life Support certification (ACLS) collected fewer cues and had higher numbers of correct decisions. The author hypothesized that this may be due to the ACLS course or increased nurse confidence because of the certification. Both groups of nurses collected fewer cues when dealing with the more acute situation (ventricular tachycardia). Overall, the relationship between task complexity and clinical judgement is not yet clear.

Heuristic Processing.

Heuristic processes are used by people as a faster and easier way of making judgements (O'Neill, 1995). Heuristics are cognitive shortcuts "that people use to judge probabilities and make decisions under uncertain circumstances" (Heath & Tindale, 1984, p. 1). Based on research done in laboratory simulations with college students asked to make judgements about fictional events, Tversky and Kahneman (1974) presented three heuristics: (a) representativeness, (b) availability, and (c) adjustment and anchoring. Since then, the list of heuristics and biases, as well as

the testing of the applicability of these heuristics in applied settings such as health care, the judiciary and organizational behaviour have expanded (Dawes, 1994; Garb, 1994; Guyton-Simmons & Mattoon, 1991; Lurigo, Carroll & Stalans, 1994; Schwartz, 1994; Stalans, 1994; Wiener & Pritchard, 1994). In the area of genetic counselling, the heuristic of representativeness was found to contribute to either over or underestimation of the risk of recurrence of the birth of an abnormal child (Shiloh, 1994). For example, representative thinking has led people to ignore the effect of the size of the sample they are dealing with as well as the effect of randomness. Thus, the parents of a child born with non-inherited genetic defects may feel strongly that they have an increased risk to have another child with this genetic change (Schwartz, 1994).

The heuristic of availability is a rule-of-thumb used to estimate probability and is based on the ease with which a person can recall similar or associated information. Thus a woman is more likely to believe that her breast lump is cancerous if she knows people with breast cancer or if the issue has received an increased amount of media attention (Schwartz, 1994). Friedlander and Stockman (1983) found that the order of information presented in two case studies disproportionately affected the diagnosis made by a group of psychiatrists, psychologists and social workers.

The heuristic of anchoring and adjustment is based on the assumption that people often start their judgement process based on some initial value, an anchor, and then adjust from that value based on other available information (Tversky &

Kahneman, 1974). One example of this is physicians' use of initial diagnoses as anchors and the subsequent reluctance to change the diagnosis based on additional information (Schwartz, 1994; Garb, 1994).

Overall, heuristics may increase the speed of decision making. Heuristics usually have face validity and may also be empirically valid. They can, however, lead to biases that can affect the quality of the decisions made (Fischhoff, 1988).

Overconfidence.

Several authors have reported on the phenomenon of overconfidence, particularly with physicians and nurses. Overconfidence occurs when the practitioner believes that the judgement they made is correct, even when it is not. Clinical psychologists and physicians have been found to increase their confidence in their diagnosis as the amount of information increases (Oskamp, 1965; Heller, Saltzstein & Caspe, 1992; Fischhoff, 1975; Arkes, Wortmann, Saville & Harkness, 1981).

Baumann, Deber and Thompson (1991), found that "both physicians and nurses were highly confident that they had made the right choice, even when there was massive disagreement across clinicians" (p. 172). This has clinical significance as the treatment plan for the same patient would differ significantly from clinician to clinician. The clinicians also were clearly not aware of using any 'gold standard' or 'practice guideline'. The authors have termed this lack of a 'gold standard' macro-uncertainty while the conviction held by the clinicians was termed micro-certainty. This combination of overconfidence may have implications for both the definition of

who is the 'expert' in the situation and how well clinicians adopt clinical practice guidelines based on empirical evidence.

Context.

Several researchers have identified situational context as an influencing factor in the making of clinical judgements (Bakken Henry, 1991; Ceci & Liker, 1986; Corcoran, 1986a; Crandall & Getchell-Reiter, 1993; Jenny & Logan, 1992; Tanner, Benner, Chesla & Gordon, 1993; Scribner, 1986; Thompson & Sutton, 1985). Gillespie (1992) states that examinations of cognition must also examine the context as "thought is always engaged in the world" (p. 47). She suggests that to examine cognition without the context is to disconnect from the world and see cognition as disembodied and abstract. Scribner (1986) states that "it is as valid to describe the environment as part of the problem-solving system as it is to observe that problem solving occurs "in" the environment" (p. 23).

All nurses, including CCNs, often must make their clinical judgements in situations that are multi-faceted (Pless & Clayton, 1993). There are multiple stimuli present, many of which are not directly related to their patient. Patients are physiologically unstable and may deteriorate quickly. The patients often have more than one illness that increases the level of diagnostic skills required. For this reason, case studies can only simulate situations of urgency.

Baumann and Deber (1989b) suggest that the "nature of crisis may impede the usefulness of decision analytic approaches" (p. 71). Based on their review of the research that had examined decision analysis in critical care nursing (Baumann &

Bourbonnais, 1982; Baumann & Bourbonnais, 1983), Baumann and Deber (1989a) state that a rapidly changing situation may make it very difficult to define the problem at hand. As well, other elements considered in decision analysis, such as estimating probabilities and utilities of possible alternatives, may change too rapidly to be applicable in a crisis.

Summary.

Several authors agree that there is still a large gap in the understanding of how nurses process information to make clinical judgments in urgent situations. The quantitative studies used case studies that could not and did not simulate the urgency of the clinical judgement processes they were trying to examine. As well, some studies asked the subjects to explain their thoughts and the rationale behind their decisions. It has been shown that requiring subjects to explain 'why' during the collection of the verbal protocol can interfere with their usual thought patterns (Ericsson & Simon, 1993, P. 93), and may have contaminated these results.

The studies have examined how two combinations of patient cues, nursing knowledge and/or context are associated, but not how the three factors relate to the quality of the clinical judgements. Some common threads have been suggested, but their limitations, including methodology of data collection and analysis, may account for some of the conflicting findings. The literature review points to the importance of examining how these three factors: cue recognition, nursing knowledge and context, are integrated to produce clinical judgements. As well, the quality of the clinical judgements that are made must be examined.

1.2 Purpose

The purpose of this study is to:

1. describe how patient cues are used by CCN's when making clinical judgements,
2. describe how CCN's integrate patient cues and their nursing knowledge when making clinical judgements, and
3. describe the clinical judgements made by CCN's within the context of simulated situations of urgency.

These objectives were pursued in the context of patients suffering from an acute respiratory or septic insult because recognition of cues, nursing knowledge and appropriate clinical judgements pertaining to these conditions of risk to patients are common to all ICU nurses.

Most patients are admitted to the ICU because of actual or threatened respiratory compromise. Pulmonary complications are the most common complications treated after abdominal or cardiothoracic surgery and are significantly related to patient outcome and resource utilization (Ephgrave, et al., 1993). In the United States of America, there is an average of 11,419 ventilator-dependent patients in acute care hospitals every day (Clochesy, Daly & Montenegro, 1995). As well, the physiological processes of ventilation, oxygenation and acid-base status are very closely associated with the outcome of all critically ill patients (Szaflarski, 1996).

The incidence of sepsis continues to increase (Bone, 1994; Centers for Disease Control, 1990; Murray & Kamar, 1991; Sibbald & Vincent, 1995). Factors

that contribute to this increased incidence include an aging society and technological advances with the increasing use of invasive procedures (Moroney & Vaca, 1995, Sibbald & Vincent, 1995). Despite the advances in medicine and pharmacology, the mortality rates for severe sepsis remain near 50% (Murray & Kumar, 1991).

Both sepsis and respiratory compromise are commonly found in all of the ICUs that participated in the study. Both conditions have high volumes and are considered high risk, carrying significant potential for mortality and morbidity. Much of ICU nursing work is aimed at preventing or treating these conditions and so ICU nurses should have current knowledge in these areas. This allowed for the inclusion of nurses from all of these ICUs in the study.

1.3 Conceptual Framework

The conceptual framework for this study is based on Newell and Simon's information processing model (1972). This model is a closed system in which the person actively processes bits of information into units of thought (Gillespie, 1992, p. 42). Working memory, or short term memory and long term memory are core structures of the system.

The working memory has a limited capacity and can only store data for a limited time period. It is where active processing of data occurs. The working memory processes both the information that has been attended to most recently and any information retrieved from the long term memory (Ericsson & Simon, 1993). The information in the long term memory is thought to be stored in chunks that vary in

size according to the familiarity of the content, the number and nature of the items involved and the strategies available (Miller, 1956).

Various estimates of the numbers of bits or chunks of data that can be handled at any one time in the working memory range between four (Ericsson & Simon, 1993) and seven (Simon, 1974). Information that has not been encoded in some way into the long term memory may be lost when new stimuli are attended to. Only information that is in the working memory is available for verbal reports (Ericsson & Simon).

Long term memory has a large capacity for data storage on a relatively permanent basis. Retrieval of information from the long term memory requires that the working memory can find an access path to the information. This access depends on the way that the information has been indexed and cross-referenced at the time it was learned or last accessed by the working memory. Each time the information is used by the working memory, there is an opportunity to add new referencing material, which may increase the ease of use for the next time. Expertise develops as the person challenges, refines or rejects currently held information in light of new experiences (Benner, 1983). The ease of future retrieval as well as the quality of the clinical judgement made with the use of any information chunk depends on how well defined the chunk of information is and the specificity to the current problem. Thus, a novice may have difficulty recalling relevant information that is in the long term memory because of the indexing used. An expert may have the same

amount of theoretical knowledge as a novice and yet be able to retrieve and use it better (Kolodner, 1984).

When a particular thought process becomes highly practiced, it becomes increasingly automated. This automation allows for the intermediate steps of processing to occur without interpretation and thus without entering the working memory. As a result, the process is much faster and the steps in the process are not available for verbal reports as they are not available to the working memory. However, the resulting clinical judgement that is made is present in the working memory prior to the person taking action (Shiffrin & Schneider, 1977).

The contents of working memory are able to be verbalized. Ericsson and Simon (1993) describe three levels of verbalization of thought processes and the content of thoughts. The first level is the vocalization of concrete encodings such as written language. One example of this is reading aloud. This level includes no intermediate processes. 'Talk aloud' verbal reports correspond to this first level of verbalization.

The second level of verbalization is a concurrent explication of the thought content and processes as they occur in working memory. The person is asked to verbalize all thoughts as they occur during a cognitive exercise such as the generation of a clinical judgement.

The third level of verbalization incorporates the explanation of the thoughts. This includes the linking of this information to additional data stored and retrieved from the long term memory. To obtain this level of verbal report, probing questions

and requests for 'why' the person made a statement are used. This methodology is usually called retrospective probing. This is in contrast to concurrent probing which allows the researcher to obtain information while the data are still in the short term or working memory. After the task-directed process is complete, the technique of retrospective probing can be used to explore the person's recollection of the cognitive process used by the working memory and some of the contents of the long term memory (Ericsson & Simon, 1993).

Both 'talk aloud' and 'think aloud' are considered to be concurrent verbal reports and are thought to most closely reflect the cognitive processes in the mind (Ericsson & Simon, 1993). The only significant effect of concurrent verbalization that has been found has been an increased time to the solution of the research problem (Deffner, 1983; Karat, 1983; Russo, Johnson & Stephens, 1989 as cited in Ericsson & Simon, 1993). There is no evidence of changes in the actual structure of the cognitive processes or the content because of the request for 'talk aloud' or 'think aloud'. Ericsson and Simon (1993) have found that almost all adults are quickly able to learn how to 'talk aloud' and 'think aloud' with the appropriate instruction.

McNeill (1975) has stated that "normal speech seems to be uttered as it is organized" (p. 356). Over the past twenty years there has been a large increase in the number of studies that have used verbal data to study cognitive processes in areas such as psychology (Deffner, 1990), education (Faerch & Kasper, 1987), medicine (Elstein, Shulman & Sprafka, 1978), nursing (Corcoran, 1986a, 1986b; Tanner, Padrick, Westfall & Putzier, 1987) and cognitive science (Ericsson, 1988).

Conceptual Model.

The current study examined both the way in which the critical care nurses use their knowledge and cues obtained from the patient when making clinical judgements and the clinical judgements they make. The conceptual framework was developed from the information processing model described by Newell and Simon (1972) and is shown in Figure 1.

Cue recognition initiates the process. A cue that are attended to by the person is entered into the working memory. Here, patterns are created, using the cue and various chunks of information from the long term memory (Fonteyn & Grobe, 1994). The chunks of information are selected because they initially appear to fit with the cue in some way. The long term memory is represented for this study by the domain specific knowledge of nursing. These two steps were examined in this study by looking at the rate of cue recognition and the integration of nursing knowledge.

The next steps in the information processing model include the generation of possible hypotheses and the gathering of additional cues to allow the person to clarify the patterns created earlier and to accept or reject the hypotheses generated. The conclusion of this process is the creation of a clinical judgement. At this point, the long term memory adds any new information gained to the information already held and creates the indexing that will allow for future retrieval. At the same time, any action that is included in the clinical judgement that has been made would be

initiated. Generation and testing of hypotheses was not a focus of the current study. As well, the process of adding to the long term memory was not examined.

Many authors have stated that the context of the situation influences the processing of information and the generation of clinical judgments (Gillespie, 1992; Scribner, 1986). Context within the critical care environment is multifaceted. A significant factor that affects the context is the care needs of the patient. For this reason, this study used case studies which were designed to simulate situations of urgency in patients whose care needs simulated those of patients in the ICUs participating in the study.

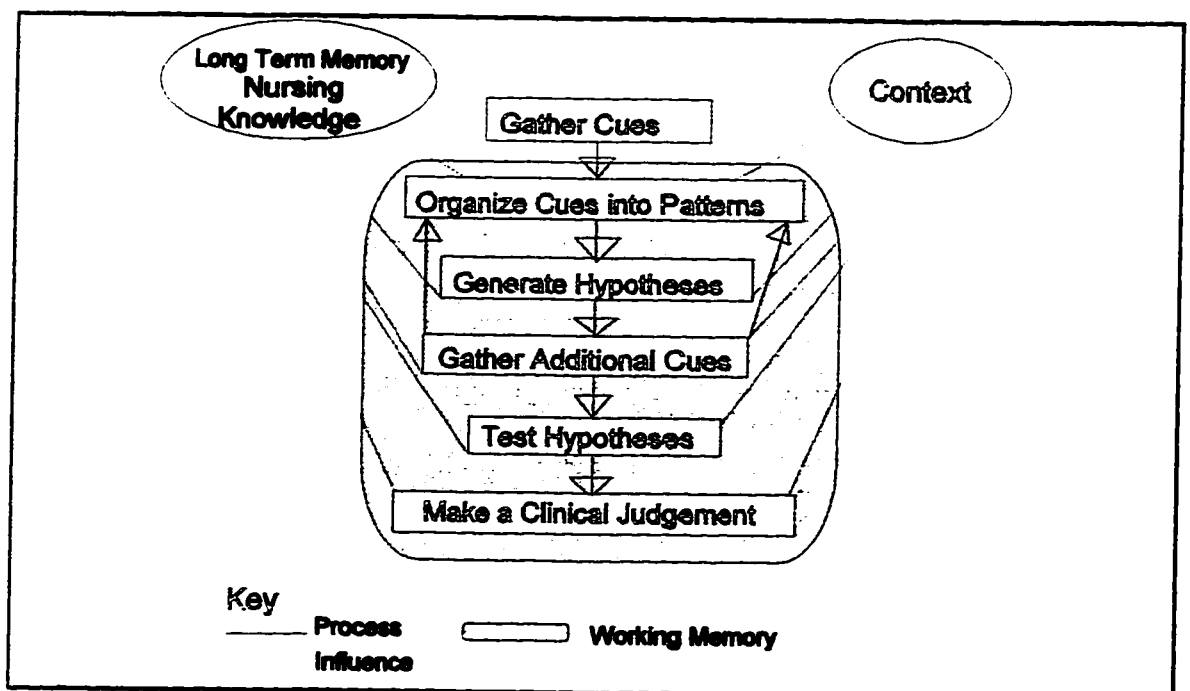

Figure 1. Information processing model with the addition of knowledge and context

2.0 Research Methods

2.1 Research Design

This descriptive study used case studies and the guidelines for collection and analysis of verbal protocols of Ericsson and Simon (1993). Participants were asked to 'think aloud' while working through a case study, and the sessions were audiotaped. Transcripts of the tape recordings were checked for accuracy..

Ericsson and Simon (1993) state that if the researcher wishes to examine the commonalities of behavior, those shared by a whole group of subjects, then the researcher may encode the protocol at an aggregate level (p. 272). These aggregate levels of analysis include aggregation by episodes, by solution steps and by processes. Aggregation by episodes examines the problem solving episodes that make up the overall process when the problem requires multiple different steps for solution. In this method, the episodes that are of interest can be examined in detail. Aggregation by solution steps examines the problem solving process by coding the process steps in the transcripts and comparing aspects of these steps between subjects. Aggregation by processes examines the transcripts by looking at specific processes used in solving the problem and coding each process as a whole. This level of analysis is used when the area of interest to the researcher is the specific information, free of context, that the person needs to carry out the specific process of interest.

Analysis was done through aggregation by solution steps for the current study. This level of analysis allowed for comparison between participants on specific steps in the information processing model. Because the focus of this research was not the individual nurse, but, rather, the commonalities across critical care nurses, analysis by solution steps was determined to be an appropriate level of analysis.

2.2 Data Collection Tools

Case studies.

Six case studies were developed to simulate situations of several different levels of urgency within which ICU nurses would need to gather and organize patient data quickly in order to determine the best course of action to take. Three of these case studies represented situations with a respiratory focus and three represented situations with a sepsis focus that could be expected to be found on the study units (see Appendix A).

Other patient focused elements that are included in the case studies are sedation, analgesia and the use of inotropic medications. Pain management, including the use of pharmacological agents, is often considered to be a very difficult area in critical care, particularly with patients who are suffering from multi-system insufficiency (Rosenthal, 1993). Inotropic agents are one of the most commonly used pharmacological interventions in critical care (Lindeborg & Pearl, 1993).

The case studies were based on composite descriptions of patient situations encountered by the researcher in clinical practice. The pertinent clinical literature was reviewed and the case studies refined as required. Expert critical care nurses

reviewed the case studies and provided suggestions for improving the case studies. The case studies were then piloted with a diverse group of critical care nurses who worked in an intensive care unit in another part of the province and who were not part of the sample for the study.

The ICU nurses in the study were expected to have previously stored information about critical care patients at high risk for or with actual sepsis or respiratory failure. The cues in the case studies closely replicated the types of cues that would have been stored with these data. Six different case studies were developed with a variety of cues, three contained cues associated with sepsis and three with cues associated with respiratory failure.

Paper case studies could not be expected to replicate the rich and stimulating environment of critical care units. However, many researchers have used case studies to explore aspects of the clinical judgement process (Bakken Henry, LeBreck & Holzemer, 1989; Baumann & Bourbonnais, 1982; Corcoran, 1986a; Grobe, Drew & Fonteyn, 1991; Itano, 1989; Joseph & Patel, 1990; Pichert, 1985; Sheidler, McGuire, Grossman & Gilbert, 1992; Thompson & Sutton, 1985). As well, asking clinicians to 'think aloud' while caring for patients during situations of urgency may compromise patient care because the 'think aloud' process has been shown to slightly increase the time it takes to make a clinical judgement (Deffner, 1983; Karat, 1983; Russo, Johnson & Stephens, 1989; as cited in Ericsson & Simon, 1993).

Another aspect that was considered when looking at the critical care environment, was that the participants were drawn from four different ICUs. It would

not have been possible to recreate environments that were familiar to all of the participants. Four different environments would have added another layer of variables to the analysis. Instead, the use of the same six case studies for all participants and a similar environment for all of the interviews allowed the researcher to examine the area of interest: the process of making clinical judgements by ICU nurses.

The case studies included cues that should be recognized plus extraneous cues. Information in the case studies was presented in a way that closely represented the pattern of information presented by critically ill patients within the ICU environment. The patient scenarios represented a variety of unstable situations that ranged in acuity from low to high. In all case studies, there was an expectation that the nurse make a clinical judgement that included a decision to act in order to prevent further deterioration in the patient's physiological stability.

Scoring tool.

The scoring tool for the transcripts of the protocols that were provided by the participants was developed in several stages. First, preliminary grids of the expected knowledge and the embedded cues were developed during the creation of the case studies. The clinical literature was reviewed to ensure currency and accuracy of information. Then, the clinical judgements that would be expected to occur as a result of the cues in the case studies, based on both the clinical experience of the researcher and the current clinical literature, were added to the grid. The grids with the case studies were then reviewed for content validity by a clinical expert and by

at least three nurses from the ICU in a different municipality that had been used to trial the case studies during their development. The clinical expert was a practicing clinical nurse who had worked full time for more than ten years both at a secondary and a tertiary level intensive care unit and was a clinical expert, acknowledged by the peer nurses. The remote ICU cared for patients that were similar to those found in the study units and was outside of the Regional Municipality of Ottawa-Carleton and therefore the nurses were not included in the study population. After their feedback, the scoring tool was created from the grids. The final step in the development of the scoring tool was the examination of the verbal protocols created by the participants. Relevant cue, nursing knowledge and clinical judgement items included by the participants were added to the scoring tool. There were 166 items on the final version of the scoring tool (See Appendix B).

Demographics.

Demographic information about the participants was collected on a self-report demographic questionnaire (see Appendix C). The demographic questionnaire was adapted from the questionnaire used by Alcock (1995), thus allowing for comparisons. A question about the certification status of the participant was added to reflect the recent certification that was available in critical care.

Perceived Relative Stress Tool.

Paper case studies can not begin to replicate the rich and complete context within which the nurse and patient would normally exist. Stress has been described by several authors (Gillespie, 1992; Baumann & Deber 1989b) as an important part

of the context when examining judgement. Tache & Selye (1985) have stated that a given stimulus has a different meaning and a different amount of stress for each person. Lazarus (1985) has stated that even though some authors have suggested otherwise (Selye, 1974), individuals are so different that stressors can not be labelled as either positive or negative for all persons, or even for the same person at different time points. Thus, the use of a global indicator for perceived relative stress "may be a more valid measure of the concept of interest" (Youngblut & Casper, 1993, p. 459). Wewers and Lowe (1990) have also supported the use of single-item measures to capture the phenomenon of interest.

The Perceived Relative Stress Tool (PRST) (see Appendix F) was designed for this study as a holistic measure of the perception of stress experienced by the participants during the verbal protocols. The PRST was based on the visual analogue scales used to measure perceptions of sensations such as pain and dyspnea. Visual analogue scales have been found to have significant and positive correlations with other measures of the same perceived sensation (Brown, 1988; Carrieri-Kohlman, 1991; Wewers & Lowe, 1990). For this study, the participants were asked to compare the level of stress they were experiencing during the interview with their perceptions of the level of stress they would have felt, had they been caring for these patients in their usual work environment and record this on the PRST.

2.3 Sample

Participants were recruited from the nurses working in four critical care units in the Regional Municipality of Ottawa Carleton, following receipt of administrative and ethical approval in each institution(see Appendix G). Two of the units are within tertiary care or teaching institutions and two are within secondary care or community institutions. Multiple units were used in an attempt to obtain a representative sample of CCNs.

Inclusion criteria were: employment as a clinical nurse providing direct patient care in the intensive care unit, registration on the general register of Registered Nurses of the College of Nurses of Ontario, ability to read, write and speak English, and consent to participate in the study. Exclusion criteria included: being on maternity, extended sick or education leave, or having less than one year of experience working in critical care.

2.4 Sample Size

Managers of ICUs involved in the study reported that there were 238 registered nurses working in direct patient care in the four ICUs who met the inclusion criteria. Examination of staff lists revealed that three nurses worked in more than one ICU. Therefore there were 235 nurses in the population of interest for this study.

Sample size was determined by examining the sample size employed by other studies using verbal protocol methodologies. These studies usually had nine (Grobe & Drew, 1991; Joseph & Patel, 1990) to eleven participants (Corcoran, 1986a).

Roberts and Ogden Burke (1989) have recommended that there should be at least five participants of each type in the sample. Ten participants would be preferable. There were two levels of ICU included in the population of interest. The minimum sample size using these considerations would be five per level of ICU or ten participants overall. Ten nurses per level of ICU would provide a more complete database. Polit and Hungler (1995) state that sample size must be increased when sub-group analysis is desired. A sample size of 20 nurses per level of ICU was planned in order to allow for examination of possible relationships between demographic characteristics and the verbal protocols. A desired sample size of forty nurses, or 17% of the total population was chosen. This would allow for ten nurses to be included from each ICU, representing between 10 and 33% of the registered nurses working on each unit. Random selection of potential participants increased the potential of the sample to reflect the overall population of interest (Polit & Hungler).

Staff lists from each ICU were used as the sampling frame. The sampling unit was one nurse, and the sampling process involved a stratified random plan. Each ICU was considered to be a stratum and one quarter of the desired number of subjects was randomly selected from within each stratum.

Each nurse was assigned a number, and the required sample was selected by using a random number draw with replacement for each ICU. All nurses had equal opportunity to be selected as compared to other nurses in their ICU. The numbers of the population and the sample are summarized in Table 1.

Table 1.

Population of ICU nurses and sample size

Unit	N	$n_{Desired}$	$\%_{Desired}$
1	96	10	10
2	30	10	33
3	31	10	33
4	81	10	12
Total	238	40	17

2.5 Ethical Considerations and Administrative Approval

This study was designed to respect the Canadian Nurses Association's Ethical Guidelines for Nurses in Research Involving Human Subjects (1994). Confidentiality of subjects was assured through careful and prudent management of the raw data and separation of the raw data from any identifying information except a code. The one document that contained both the study codes and the identifying information was kept separately in a secure place. Subjects' anonymity was protected by ensuring that no identifying personal information would be released and that the findings would be reported as group data (Brink & Wood, 1994, p. 204).

Ethical and administrative approval was obtained from each institution. As well, the study was approved by the Human Research Ethics Committee of the Faculty of Health Sciences at the University of Ottawa (see Appendix G).

Initial contact with potential subjects was made through a letter requesting their participation (see Appendix D). Letters were sent to the nurses at their place

of work to minimize any possible feelings of coercion. Only nurses who returned the participation form, enclosed with the letter, to the researcher were contacted to continue in the study.

2.6 Data Collection Methods

After administrative and ethical approval was received from the institution, lists of Registered Nurses working in each ICU were requested from the agency. The nurses in the ICU's were informed of the study through inservice sessions and notes included in the unit news books. The potential participants, selected through the random selection process outlined above, were sent letters informing them of the study and soliciting their involvement (Appendix D). If they were interested in participating, they returned the form enclosed with the letter to the researcher who then made personal contact. A time limit of two weeks to return the participation form was imposed, in order to allow for timely completion of the study. If there was no response after two weeks, the next subject on the random list was solicited. The two week time frame was chosen after discussion with critical care nurses. Only one participation form was returned late. This supported the utility and appropriateness of the two week time frame.

After returning the participation form, an appointment was set up between the nurse and the researcher for the interview at a mutually agreeable time and place. Minimum requirements for the location of the data collection meeting were: privacy, and a quiet and reasonably comfortable environment. The minimum time expected

to be required for the interview was an hour and this was taken into account when making the appointment. All data were collected by the researcher.

At the appointed time and place, the researcher met with the nurse for the data collection interview. After a review of the study purpose and methods, the nurse was asked to sign the informed consent (see Appendix E). The nurse was then asked to complete the demographic questionnaire (see Appendix C). Next, the researcher assisted the nurse to practice the verbal protocol procedure to increase the comfort level with both the audio-recording and the process of the 'think aloud' protocol. Once the nurse was comfortable with the procedure and the researcher was assured that the recording equipment was working properly, the first of the six case studies was presented to the nurse. The order of case presentation was randomly varied for each nurse to eliminate any possible effect of presentation order. Nurses were asked to read the case aloud and to 'think aloud' what they are thinking of during the reading. Then, five predetermined questions were presented and, again, the nurses were asked to think aloud as they answered the questions. These questions were the same for each case study and were designed to stimulate the participants' thinking. Some of the participants found that they had already answered the questions while they were reading and thinking aloud. The researcher remained silent and took a passive role during the 'think aloud' work by the participant. The only prompting from the researcher was to encourage the nurse to "keep talking" when there was silence for more than fifteen seconds (Ericsson & Simon, p. 83). After the nurses had completed the case studies, they were asked to indicate the

relative amount of stress they had felt while working through the case studies, compared to caring for similar patients in their work environment (see Appendix F). The number that represented their answer was then recorded by the researcher.

The data were gathered on an audiotape recording of the interview. It was transcribed from audio to written record by the researcher. The transcription was checked for accuracy by having a second person, who was knowledgeable in nursing and had experience with verifying transcripts of interviews, listen to three (12.5%) of the twenty four tapes and verify the written record. These transcripts were randomly selected from the total number of transcripts. The initial transcriptions were found to be accurate with fewer than five minor errors made per tape. These errors did not change the intent or content of the transcripts.

2.7 Data Analysis

The audiotapes which had been transcribed were then analyzed, following the framework provided by Ericsson and Simon (1993, p. 261-372). Each transcript was scored using the cue, knowledge and clinical judgement grid (see Appendix F). Three clinical experts were asked to score the transcripts using the same tool in an independent and blinded manner, following the same set of instructions (see Appendix H). Data were entered into a computer program, SPSS/PC+ (Statistical Package for the Social Sciences, 1992).

Interrater reliability

Interrater reliability was determined by examining the scoring of the four raters (three clinical experts and the researcher) for congruency. Percentage agreement

was chosen to assess interrater reliability based on the nature of the data, which were nominal and had limited options (Goodwin & Prescott, 1981). The interrater reliability was determined using a two-staged approach. First, the final score for each item for each participant was determined. Then, the item was examined for overall agreement across the participants.

For each participant, a minimum of 75% agreement was used to determine the final score for each of the 216 items contained in the Cue, Nursing Knowledge and Clinical Judgement grid (see Appendix B). This level of agreement occurred whenever three of the four raters agreed on whether the item was present or absent in the transcript. Each item, for each participant, that did not meet the criterion of 75% agreement was assigned the score of zero, indicating that the transcript did not show evidence of the particular cue, knowledge or clinical judgement. The decision to treat these variables as 'not present' was based on the fact that at least two of the four raters did not find evidence of the information in the transcript.

Across all the participants, cue, knowledge and clinical judgment items that had more than six nurses' scores with agreement rates of less than 75% were rejected and removed from further analysis. Table 2 shows the number of items rejected for each case study. In all, a total of twenty-two items were rejected as they lacked the required clarity. The items that were removed appeared to cause the raters difficulty in determining the presence or absence of the item in the transcripts. The items removed were shown on the Cue, Knowledge and Clinical Judgement Grid (Appendix B) with an asterisk. The number of valid items for each case study,

after the interrater reliability process had been completed, varied from sixteen to thirty-four (see Table 2). As well, the number of valid items in each category, patient cues, nursing knowledge and clinical judgements, varied from three to nineteen.

Table 2

Numbers of items and their status in the final analysis, by case study

Case Study	Case Code	Number of Possible Items				Number of Rejected Items				Number of Items Used			
		C	K	CJ	T	C	K	CJ	T	C	K	CJ	T
Mary Warren	MW	7	9	13	29	0	1	3	4	7	8	10	25
Fred Mann	FM	19	7	11	37	0	2	1	3	19	5	10	34
George Collins	GC	10	5	13	28	5	2	1	8	5	3	12	20
Susan Smith	SS	6	4	11	21	0	1	0	1	6	3	11	20
Larry Bird	LB	15	9	9	33	1	2	1	4	14	7	8	29
Grace Keely	GK	4	4	10	18	0	0	2	2	4	4	8	16
All Cases		61	38	67	166	6	8	8	22	55	30	59	144
Percentages		37	23	40	100	4	5	5	13	38	21	41	100

C Numbers of Cue Items
K Numbers of Knowledge Items
CJ Numbers of Clinical Judgement Items
T Total numbers of items

Statistical Analysis

Descriptive statistical tests were used to analyze the data, which were nominal in nature. Total scores were calculated for individual nurses across all

elements (cues, knowledge and clinical judgements) as well as for various elements across all nurses. The data were also examined for patterns of association, using a Chi-square analysis and Spearman rank correlations (Brink & Wood, 1994). These included examinations for associations among patterns of use of patient cues, nursing knowledge and the clinical judgements made, or associations between any of these and the demographic information collected. As well, the data were examined for any patterns of association among the relative stress scores, the patterns of use of patient information, nursing knowledge and the clinical judgements made. The level of significance for detecting a difference was set a priori at $p < 0.05$.

3.0 Results

The results are reported in three sections. First, the sample is described, using the information from the demographic questionnaire (see Appendix C). The responses and the analysis of the responses to the case studies are presented next. Then, the results of the Perceived Relative Stress Response Tool (see Appendix F) are reported. Limitations and strengths of the study are addressed.

3.1 Description of the sample

Over the period of eight months, October 1995 to May 1996, a total of one hundred and seventy three contact letters with offers of participation (see Appendix D) were sent to registered nurses working in the four ICU's involved in the study (173/235, 73.6%). Twenty eight (11.9%) nurses returned the participation form. Of these, one (0.4%) potential participant was a nurse manager and not eligible to participate. Another nurse could not be reached by telephone, in spite of multiple attempts. A third nurse was not available for the interview during the data collection period. A fourth nurse returned the participation form after the data collection period had ended. Therefore, twenty four (10.2%) nurses participated in the study. The numbers of possible and actual participants are shown in Table 3.

Table 3

Number of possible and actual participants

Unit	N	Letters of Invitation	Number of Acceptances	Number of Participants	% of N
1	96	36 (37.5%)	9	9	9
2	30	30 (100%)	4	2	7
3	31	29 (93.6%)	9	9	29
4	81	78 (96.3%)	6	4	5
Total	238	173 (73.6%)	28	24	10

In unit two, all of the Registered Nurses were eventually sent contact letters. In all of the other units, the effect of random selection of participants remained. The final sample of twenty-four participants was 10.2% of the population of interest and 60% of the desired sample size. However, the participants were fairly evenly divided by level of ICU, secondary (46%) and tertiary (54%), which allowed for analysis by level of ICU (Polit & Hungler, 1995). The size of the sample impeded analysis by demographic characteristic.

Employment Status.

All nurses who participated in this study completed a copy of the demographic questionnaire. Nine nurses (37.5%) worked in regular full time positions. Fifteen nurses (62.5%) were in other than full time positions. The nurses working in temporary full time positions were classified as part time. No data were collected on the actual number of hours worked in any position. There is no maximum number

of hours that a nurse may work over any time period. Several of the participants informally reported that they had several part time or casual positions with different employers. Table 4 summarizes the employment status of the study participants. The proportion of nurses who were in full time and not in full time positions (37.5:62.5) reflects the current trends of employment in nursing. While no data were collected from the study units as to their percentage of full time and not full time staff, informal discussions with managers in these and other ICU's suggest that the ratio of full time to non-full time nurses in ICU's ranges from 40:60 to 60:40. The proportion of full time nurses in this study appears to be consistent with that found in the ICU environment.

Table 4

Employment status of participants

Employment Status	Number of participants	Percentage of total
Full Time	9	37.5
Temporary Full Time	2	8.3
Job-share	2	8.3
Part Time	7	29.2
Temporary Part Time	1	4.2
Casual	3	12.5
Total Participants	24	100.0

Tertiary level ICU's were located in teaching hospitals. Secondary level ICU's were located in community hospitals. The distribution was relatively even between the levels of ICU (see Table 5).

Table 5

Distribution of participants in each level of ICU

Level of ICU	Number of participants	Percentage of total
Secondary	11	46
Tertiary	13	54
Total	24	100

Years of critical care nursing experience.

The nurses who participated in this study had at least three years of critical care nursing experience (see Table 6). Several of the participants had worked in critical care for more than twenty years. Twelve participants (50%) had worked for more than ten years in critical care.

Table 6

Nursing experience in critical care and years worked in the current ICU

Number of years	Worked in Critical Care		Worked in Current ICU	
	N	%	N	%
less than one	0	0	0	0
1 - 2	0	0	2	8
3 - 5	5	21	9	38
6 - 10	7	29	5	21
11 - 15	4	17	2	8
16 - 20	4	17	3	13
more than 20	4	17	3	13
Totals	24	100	24	100

All of the participants had at least one year of nursing experience in their current ICU, as outlined in Table 6. This ensured that none of the participants was still struggling to learn a new unit's culture and patient population. In a new work environment or with a new patient population, even experts function at a lower level of expertise until they learn the realities of the new environment (Benner, 1983). Six participants (25%) had worked in their current ICU for more than fifteen years.

Level of Education.

All of the participants became Registered Nurses before 1990 (see Table 7). Eleven participants (45.8%) had been Registered Nurses for more than twenty years. Eight participants (33.3%) became registered between 1981 and 1985.

Table 7

Number of years since registration

Years since registration	Number of nurses	Percentage of total
Less than 1	0	0
1-5	0	0
6-10	3	13
11-15	8	33
16-20	2	8
More than 20	11	46
Totals	24	100

Given that eleven participants (45.8%) had become registered more than twenty years ago, it is, perhaps, not surprising that sixteen nurses (66.7%) had a diploma or a diploma with a speciality certificate as their highest level of nursing

education (see Table 8). None of the participants had a graduate degree. Fifteen participants (62.5 %) had a speciality certificate in some aspect of nursing. Eight participants (33.3%) had a baccalaureate in nursing.

Table 8

Highest level of education

	Education in Nursing		Non-nursing Education	
	N	%	N	%
Diploma	4	17	11	46
Diploma + Certificate	12	50	1	4
Baccalaureate	1	4	0	0
Post-RN Baccalaureate	4	17		
Bacc. + certificate	3	13	0	0
Masters'	0	0	0	0
Other	0	0	2	8
No response	0	0	10	42
Totals	24	100	24	100

Fourteen participants (52.3%) indicated that they had some post secondary education in a domain other than nursing (see Table 8). Most of these had a certificate or diploma. The content and type of non-nursing education was not determined. Ten nurses (41.7%) did not answer this question. Those nurses were assumed to have no formal non-nursing education beyond the secondary level.

Given the rapidly changing nursing environment (Grif Alspach, 1995), it is perhaps surprising that such a small number of the participants were currently

enrolled in an educational program (see Table 9). Only five (20.8%) nurses on two units were currently pursuing formal education. Of these, two were registered for a baccalaureate program, two were studying towards a certificate and one was studying "life skills."

Table 9

Currently enrolled in an educational program

Is the nurse currently enrolled ?	Number of nurses	Percentage of total
Yes	5	21
No	19	79

Certification.

Certification in Critical Care nursing in Canada was offered for the first time in January, 1995. Certification provides "an opportunity for nurses to confirm their competence in a designated nursing specialty and, in turn, obtain the appropriate recognition" (Canadian Nurses Association, 1994, p. 1). There is also a requirement to participate in continuing education in order to maintain certification. Three participants (12.5%) volunteered the information that they would be writing the certification exam in March, 1996. The exam tests a broad scope of knowledge at three levels of competency testing (knowledge and comprehension, application and critical thinking). This prompted many nurses who were planning on writing the exam, to study both individually and through study groups. During the winter of 1995-1996, the Ottawa Region Chapter of the Canadian Association of Critical Care Nurses held a series of lectures to assist this process (Kirkham, 1996) and at least

three of the study participants said that they had been attending them. The nurses who indicated that they were currently certified in critical care might be expected to have a certain level of current knowledge in critical care nursing. Unfortunately the percentage of nurses who were certified was fairly low (25%) and this number limited the applicability and utility of any association between responses to the case studies and certification status (see Table 10).

Table 10

Number of participants certified in critical care

Is the nurse certified in critical care nursing?	Number of nurses	Percentage of total
Yes	6	25
No	18	75

3.2 Responses to the case studies

All of the participants completed at least five of the six case studies. Two participants asked to stop and not complete one case each for personal reasons. This request was honoured and so the case studies of Grace Keely and Larry Bird had only twenty-three responses.

The use of patient cues.

Participants identified between two and 29 of the 55 patient cues (3.6%-52.7%) included in the scoring grid (see Appendix B). There was marked variation in the way cues were verbally identified by each participants. Only one nurse identified all four of the four scored cues (100%) in one of the case studies. Another

nurse identified five of the six cues (83.3%) scored in another case. The number of nurses who did not score a single cue item on one of the case studies ranged from 1 nurse (4.2%) to 9 nurses (37.5%). A summary of the total possible scores, the mean scores and the mean percentage of available cues used by the nurses for each case study is provided in Table 11.

Table 11

Use of cues by participants

Case Study	Total possible score	Mean score	Mean %
Mary Warren	7	1.63	23.2
Fred Mann	19	4.17	21.9
George Collins	5	0.92	18.3
Susan Smith	6	2.46	41.0
Larry Bird	14	3.75	26.8
Grace Keely	4	1.29	32.3

For the case study that involved Mary Warren (MW), 19 nurses (79.2%) demonstrated that they attended to fewer than 30% of the available cues that were included in the scoring grid. None of the nurses attended to the cue that the patient was stable overnight and only one nurse (4.2%) noted that MW's previous arterial blood gases were acceptable. Both of these cues indicated relative stability. The other nurses may have noted these cues silently, as they were looking for signs of the instability they are accustomed to in the ICU. Yet, if these two cues were eliminated from the analysis, then the result was very similar to the overall numbers of cues recognized. Thus, the physiological stability implied by these two cues did

not lead to the nurses treating them differently from the other cues. Twenty nurses (83.3%) attended to none, one or two of the cues that represented some degree of instability. Only one nurse's transcript (4.2%) showed evidence of attending to all five of the cues of instability. The cue most frequently attended to was that the patient's oxygen saturation had dropped from 97% to 91%. This cue was attended to by thirteen nurses (54.2%).

For the second case study, involving Fred Mann (FM), seventeen nurses (70.1%) verbalized attending to fewer than 30% of the available cues. None of the nurses (0%) attended to the cue that the patient was sucking on ice chips. While this may appear to be a minor cue, there are several significant interpretations possible. One is that the patient's stomach should be empty as he may soon need urgent airway management through intubation. Another is that as the patient's neurological status appears to be deteriorating, he may not be able to prevent aspirating the melted ice water into his lungs. Yet another could be that this is how the previous nurse had been stimulating his cough reflex.

Only seven nurses (29.2%) indicated that they attended to the cues that were suggesting that FM's neurological status was deteriorating. The cues that indicated that FM's ability to maintain independent ventilation was deteriorating, such as persistent hypoxia as measured by oxygen saturation (12 nurses, 50%), tachypnea (ten nurses, 41.7%), decreased air entry with crackles heard (seven nurses, 29.2%), requiring frequent chest physio (five nurses, 20.8%) and thick green mucous (four nurses, 16.7%) were attended to in varying amounts. Thirteen nurses (54.2%) noted

that the patient's supplemental oxygen was set at only one litre per minute. The cues that related to the patient's fluid status were attended to as follows: (a) seven nurses (29.2%) noted the intravenous infusion rate and the volume of urine output; and (b) one nurse (4.2%) noted the dark urine and small diuresis after receiving IV Lasix.

The cue most frequently attended to in the third case study (George Collins (GC) was that the patient's respirations had become very laboured. This is a very obvious cue of impending respiratory failure. Ten nurses (41.7%) mentioned this cue. It was interesting to note that this was the cue that represented the most immediate threat to GC's life. It indicated that the patient's ability to maintain his airway and breathe effectively was being compromised. Three nurses (12.5%) identified the cue that it was difficult to insert an intravenous catheter, which could have been interpreted as reflecting the fact that the patient's blood pressure and blood volume were very low. Five nurses (20.8%) noted that the patient had not been receiving any medications at home. Interestingly, some of these nurses stated that this indicated that the patient was healthy. Others felt that this may have been a result of the patient not receiving regular health assessments. This case study resulted in the lowest mean percentage (18.3%) of cues recognized by the participants.

The fourth case study, Susan Smith (SS), involved a patient whose signs of possible instability were quite subtle. Eighteen nurses (75%) noted that the patient's temperature was elevated. Thirteen nurses (54.2%) found the patient's other vital signs to be borderline abnormal. Six nurses (25%) attended to the cue that SS had

suffered significant chest injuries, while only three nurses (12.5%) noted that she had fallen off a horse two days ago. These two cues were the only past health history provided for this case study. Fourteen nurses (58.3%) attended to the cue that there were problems with the abdominal incision, such as blisters and reddened edges. Overall, this case study resulted in the highest mean percentage of cues (41.0%) being recognized by the participants.

Several nurses noted that the name of the patient in the fifth case (Larry Bird, (LB)) was shared by a famous basketball player. (This cue was not included in the scoring system.) Six nurses (25%) noted that the patient had undergone a transurethral resection of the prostrate (TURP) three days ago. Several of the cues were each noted by seven nurses (29.2%). Only five nurses (20.8%) noted that the patient was intubated and receiving assisted ventilation. While seven nurses (29.2%) noted that the patient was receiving both a sedative and an analgesic by intravenous infusion, only two nurses (8.3%) attended to the cue that these drugs were being administered in an attempt to decrease the patient's work of breathing. The physiological cue of hypotension was attended to by fourteen nurses (58.3%), while the tachycardia was attended to by eleven nurses (45.8%). Five nurses (20.8%) noted the patient's tachypnea, while one nurse (4.2%) noted that the patient's respiratory rate was twice the set rate on the ventilator. The unusually high FiO_2 (fraction of inspired Oxygen) and the high peak airway pressure were each noted by eight nurses (33.3%). Eleven nurses (45.8%) noted that the patient was requiring large volumes of fluid and inotropic drugs to maintain a blood pressure that was

barely adequate. Five nurses (20.8%) noted that the patient was sleepy but could be aroused.

For the case study involving Grace Keely (GK), eleven nurses (46%) attended to the cue that the patient was confused. Fourteen nurses (58.3%) attended to the cue that the patient was hypotensive. Few nurses provided evidence of attending to the cues of the patient's past health history, that of being newly diagnosed with leukemia (2 nurses, 8.3%) and starting chemotherapy (four nurses, 16.7%).

Overall, the nurses verbalized recognising few of the cues included in the case studies. The case study with the highest mean percentage score of verbalized cues was SS (41%), while the case study with the lowest mean percentage score of verbalized cues was GC (18.3%). SS was the patient with the least urgent physiological threat, while GC was one of the more unstable patients among the case studies.

The integration of patient cues and nursing knowledge.

The nurses did not provide substantial verbal evidence to indicate integration of the specific nursing knowledge items included in the scoring grid. Table 12 displays the total possible score, the mean score and the mean percentage of knowledge items used for each case study. It is pertinent to note that the nurses may have assimilated and used this knowledge without verbalizing it during the study. Evidence of this would be seen in the number of clinical judgements made by the participants.

Table 12

Knowledge score by participants

Case Study	Total possible score	Mean score	Mean %
Mary Warren	8	0.83	10.4
Fred Mann	5	1.21	24.2
George Collins	4	1.29	32.3
Susan Smith	3	0.21	5.2
Larry Bird	6	0.63	10.4
Grace Keely	4	0.25	6.3

Ten participants (41.7%) did not verbalize any of the scorable knowledge items while working through MW's case study. The knowledge item that was most frequently identified in the transcripts for this case was that of strategies to assess the respiratory status of MW (nine nurses, 37.5%). This was consistent with the high percentage of cue recognition for the drop in oxygen saturation (13 nurses, 54.2%).

Eight nurses (33.3%) did not score on any of the knowledge items for the case study of FM. Eight nurses (33.3%) verbalized twenty percent of the knowledge items. The remaining eight nurses (33.3%) verbalized between forty and eighty percent of the knowledge items. The knowledge of signs of impending respiratory failure and the knowledge of strategies to manage respiratory failure were each described by eight nurses (33.3%). As well, five nurses (20.8%) indicated knowledge of the effects of fluid status on the functioning of the patient's lungs. The knowledge item that was used with the least frequency (three nurses, 12.5%) was that of the possible implications of the patient's age on their overall health status.

For GC, sixteen nurses (66.7%) talked about the importance of letting the family know what is happening to their relative. This was the knowledge item that was scored with the highest frequency. Surprisingly, none (0%) indicated that the patient also might need to know what was happening. The knowledge that the priority for intervention: securing the patient's airway and ensuring that the patient has effective respirations, was identified by ten respondents (41.7%) and was the knowledge item with the second highest frequency. Five nurses (20.8%) identified possible sequelae that would fit with the patient's history of an abdominal mass and hypotension. These included a ruptured abdominal aortic aneurysm, a ruptured viscus, bowel obstruction and sepsis. Overall, only one nurse (4.2%) did not mention any of the knowledge items in their transcript for this case. Fifteen nurses (62.5%) mentioned one (25%) knowledge item while eight nurses (33.3%) verbalized two knowledge items (50%).

The knowledge items for the case study of SS were not well represented in the transcripts. This contrasts with the nurses' cue recognition, which was quite high for this case study. Twenty nurses (83.3%) did not talk about using any of the scorable knowledge items. The knowledge of the usual pattern of healing following chest injuries was described by four nurses (16.7%). Only one nurse (4.2%) indicated that the patient would need information and teaching in this situation.

Eleven nurses (47.8%) did not score on any of the knowledge items for the case study involving Larry Bird. Ten nurses (43.5%) identified using one of the knowledge items. The knowledge item most frequently used was the knowledge of

the effect of fluids and inotropic drugs on a patient's hemodynamic status (six nurses, 26.1%). This fit with the high recognition level for the cues that were suggestive of shock (hypotension: fourteen nurses, 60.9%; tachycardia: eleven nurses, 47.8%). No nurse (0%) talked about the possible effects of the patient's ventilator parameters on his hemodynamic status. Three nurses (13%) described some elements of the usual post operative course of a patient after a TURP. The knowledge that the priority for assessment and intervention should be the patient's airway, breathing and circulation (ABC's) and the knowledge of acceptable ventilator settings and parameters were each identified by one participant (4.4%). This would fit with the low recognition of the cues that indicated possibly ineffective ventilatory settings (tachypneic: five nurses, 21.7%; high airway pressures: eight nurses, 34.8%).

The knowledge item with the highest frequency (five nurses, 21.7%) for GK's case study was that of the relationship between confusion and hypotension. These two cues were verbalized by almost one half of the nurses (confusion: eleven nurses, 47.8%; hypotension: fourteen nurses, 60.9%). Only one nurse (4.4%) verbalized knowledge of the expected patient responses to chemotherapy. None of the nurses said that the priority for assessment was the patient's ABC's or that they knew what the usual course of leukemia was. It is important to note that the nurses working in the secondary level units stated that they would not expect to care for this type of patient in their unit.

The means of the knowledge item score that was verbalized by participants ranged from 5.2% to 32.3%. The case study with the lowest mean percentage score was SS. This case study had the highest mean percentage score for verbalized cue recognition and represented the most physiologically stable patient of the group. GC was the case study with the highest mean percentage score of verbalized knowledge items. At the same time, GC, who represented someone with crisis-level needs for physiological intervention, had the lowest mean percentage score for verbalized cue recognition.

Description of the clinical judgements made.

The nurses made between one and twenty three of the fifty nine clinical judgements included in the scoring tool across all six case studies. The mean number of clinical judgements made was nine (SD 5). The total possible score, the mean score and the mean percentages of clinical judgements made are summarized in Table 13 by case study. Overall, GC's case study yielded the highest mean percentage of clinical judgements.

Table 13

Clinical Judgement scores by participants

Case Study	Total possible score	Mean score	Mean %
Mary Warren	10	2.00	20.0
Fred Mann	11	1.33	13.3
George Collins	11	2.83	25.0
Susan Smith	11	1.83	16.7
Larry Bird	9	1.25	13.9
Grace Keely	8	1.54	19.3

The nurses made fifty percent or less of the possible clinical judgements (10) for the case study involving MW. The most frequently made decision was to increase the amount of ventilatory support for MW, through such measures as increasing the FiO_2 or placing the patient back on a set rate on the ventilator. Fourteen nurses (58.3%) made this decision. The clinical judgement with the next highest frequency was to assist the patient in clearing her airway (9 nurses, 38%). Seven nurses (29.2%) said that they would seek assistance from others, including other nurses, respiratory therapists and physicians. Few of the nurses decided to assess the patient for pain (4 nurses, 16.7%), assess the effects of changes in ventilatory support (4 nurses, 16.7%), provide emotional support to the patient (3 nurses, 12.5%), assess the patient's readiness to wean (2 nurses, 8.3%), or provide information about the weaning process (1 nurse, 4.2%). None of the nurses (0%) identified that they would assess the patient's psychological status.

Twenty-one nurses (86%) made fewer than three clinical judgements when dealing with FM's case study. The judgement most frequently made was to increase FM's FiO_2 (10 nurses, 41.7%). The decision to consult others was made by seven nurses (29%). Five nurses (20.8%) would initiate strategies to assist the patient in maintaining a patent airway. Four nurses (16.7%) would assess FM's current neurological status. The decision to determine the effectiveness of the interventions made was indicated by three nurses (12.5%). Only one nurse (4.2%) would assess FM's fluid status. None of the nurses (0%) stated that they would provide the patient with psychological support or information.

Of the ten clinical judgements included in the scoring tool for GC, one nurse (4.2%) made seven (70%) of them. Seventeen nurses (70.8%) made three or fewer judgements. The most frequently made judgement was to initiate strategies that would support GC's circulation (16 nurses, 66.7%). Fifteen nurses (62.5%) would ensure that the family was called and informed about the changes in GC's condition. Nine nurses (37.5%) wanted to consult others. Eight nurses (33.3%) would prepare the required equipment for intubation of the patient's airway. Seven nurses (29%) would provide supplemental oxygen. Supporting GC's ventilation with positioning was mentioned by four nurses (16.7%). Four nurses (16.7%) would assess the patient's pain level. Few nurses would prepare the patient for the upcoming procedures that were expected. Two nurses (8.3%) would physically prepare the patient while only one nurse (4.2%) would provide information or psychological support. One nurse (4.2%)would ask GC how he was feeling.

There were eleven clinical judgements included in the scoring tool for SS's case study. No nurse (0%)verbalized making more than four of these. Eleven nurses (45.8%) would inform the physician that the patient might have an infection. Eight nurses (33.3%) would assess SS for other signs of sepsis. Six nurses (25%) would delay SS's transfer to the ward. Five nurses (20.8%) would assess the adequacy of SS's respirations. Each of the following clinical judgements were made by three nurses (12.5%): asking the patient how she is feeling; assessing SS for possible reasons for the abnormal vital signs; assessing for adequacy of pain control and documenting on the patient record. The decision to provide SS with information about her injuries and her breathing was made by one nurse (4.2%).

There were nine possible clinical judgements included in the scoring tool for LB. Three nurses (13%) made the highest number of four clinical judgements. Seven nurses (30.4%) would assess LB for possible causes of his continued instability and two nurses (8.7%) would then use appropriate strategies based on the results of this assessment. Seven nurses (30.4%) would assess the effectiveness of LB's current ventilation parameters. Two nurses (8.7%) would intervene to decrease the patient's work of breathing. None of the nurses (0%) would intervene to decrease LB's airway pressures. Six nurses (26.1%) would consult others.

Of the eight possible clinical judgements included on the scoring tool for GK's case study, only two nurses (8.3%) made four clinical judgements. Fifteen nurses (62.5%) made the clinical judgement to initiate strategies to support GK's circulation. While seven nurses (29.2%) decided to assess the patient's current neurological

status, none indicated that they would then initiate any protective measures that would be required based on the results of the neurological assessment. Only two nurses (8.3%) indicated that they would determine the effectiveness of the intervention strategies they chose to use for GK.

The mean scores of verbalized clinical judgements ranged from 13.3% to 25%. The case study with the lowest mean score, FM, prompted many of the participants to make comments, such as " well, he's got pneumonia, so I'd just keep going" or "I'd just keep doing more of the same." This approach to FM's care may have provided the reason for the low number of clinical judgements scored. Two of the three most frequently made judgements related to the pneumonia: to increase the FiO_2 and to assist the patient in maintaining a patent airway. However, this approach does not deal with FM's deteriorating neurological status, or his obvious fluid imbalance. The case study with the highest mean score of verbalized clinical judgements was that of GC. The most frequently made clinical judgement was to initiate strategies to support GC's circulation. This was clinically relevant, since GC`s hypotension was not responding to the usual treatments of fluids. However, in the priority for assessment and intervention used in urgent situations, the top priority would be airway and breathing.

Common themes examined across the case studies.

A post-hoc analysis of the responses to the case studies was conducted by identifying themes in each of the case studies. The analysis of theme-related responses was designed to determine if there were areas where there were different

patterns of responses, based on such issues as familiarity with the theme, or the degree of threat to life implied by some themes.

The respiratory compromise and sepsis themes had been established when the case studies were built. Additional themes were identified by examining the scored items for each case. Cue, knowledge and clinical judgement items were examined for their fit with a physiological or other patient care theme. Themes that were apparent in at least two case studies were then included in the theme examination. The sepsis theme was not included as there were inadequate numbers of scored items across the case studies that related to sepsis. Four themes were identified: (a) respiratory, (b) neurological, (c) unstable vital signs, and (d) recent patient events.

Total scores for each theme were calculated by adding together the cue, knowledge and clinical judgement items associated with each theme. The total theme scores were examined in order to determine if there were any differences in the way that the nurses managed the clinical judgement process, across the case studies, depending on the theme of information involved. These results are summarized in Table 14. In order to compare the means across case studies and themes, they were converted into percentages of the total possible scores.

Table 14 (a)

Themes compared across case studies (a)

Case Study	Respiratory Theme			Neurological Theme		
	Mean # (%) of items	Range	Number of items included	Mean # (%) of items	Range	Number of items included
MW	3.0 (21.4)	0-6	14			
FM	4.5 (23.7)	0-12	19	1.0 (25.0)	0-3	4
GC	2.1 (30.0)	0-5	7			
SS						
LB	2.1 (16.2)	0-6	13	0.7 (23.3)	0-3	3
GK						

Table 14 (b)

Themes compared across case studies (b)

Case Study	Recent Patient Events			Unstable Vital Signs		
	Mean # (%) of items	Range	Number of items included	Mean # (%) of items	Range	Number of items included
MW	0.4 (10.0)	0-4	4			
FM				1.7 (21.3)	0-6	8
GC				1.6 (26.7)	0-3	6
SS	1.1 (12.2)	0-6	9	1.9 (27.1)	0-4	7
LB	0.4 (13.3)	0-3	3	2.8 (23.3)	0-8	12
GK	0.2 (6.7)	0-1	3	2.7 (24.6)	0-6	11

For each case study and each theme, the mean score never represented more than 30% of the possible items. Across the case studies, the mean score for the respiratory theme was between 16.2% and 30% of the total number of items. For the neurological theme, the mean score was between 23.3% and 25%. The mean score for the theme involving recent patient history ranged from 6.7% to 13.3 %. The theme of unstable vital signs had a mean score of 21.3% to 27.1%. The recent patient history theme had the lowest overall mean scores across the four case studies that included this theme.

An integral part of the nursing process is the evaluation of the effectiveness of the interventions chosen by the nurse. This was scored as one of the clinical judgements for each of the case studies. Of the six possible decisions to evaluate the effectiveness of the interventions, only one nurse (4.2%) made the decision three times, or in half of the case studies. One nurse (4.2%) made this decision twice and nine nurses (37.5%) made it once. Thirteen participants (54.2%) did not make this decision in response to any of the case studies. The actual evaluation, itself, may occur as an automatic collection of cue data. However, the judgement process that would result in the initiation of the evaluation actions should have appeared in the working memory as a clinical judgement and, thus, should have been verbalized in the verbal protocol.

Relationships between cues recognized, knowledge items stated and clinical judgements made.

The relationships between the percentage of cues recognized, knowledge stated and clinical judgements made were examined using Spearman Rank Correlation Coefficients. These relationships were examined for each case study as well as across all case studies. Table 15 summarizes the correlations between verbalized recognition of cues and the statement of nursing knowledge. It is important to note that the numbers of nurses and the distribution of the scores limit the power of the correlational analysis and, thus, the applicability of any significant correlations found. Many of the scores cluster near zero. This increased the effects that out-lying or extreme results could have on the overall correlations. Case studies that resulted in larger numbers of valid scorable items also can be considered to have more power for the correlational analysis.

Table 15

Spearman Correlations (rho) for comparisons between (a) cues recognized, (b) nursing knowledge stated, and (c) clinical judgements made, by case study

Case Study	Cue recognition and Nursing Knowledge	Nursing Knowledge and Clinical Judgements	Cue recognition and Clinical Judgement
MW	0.41912 *	0.45518 *	0.28093
FM	0.54780 **	0.18581	0.17088
GC	- 0.13100	0.39958	0.06922
SS	0.38708	0.10634	0.25989
LB	0.54022 **	0.64564 **	0.44903 *
GK	- 0.13100	0.39958	0.06922
All Cases	0.53527 **	0.76127 **	0.59575 **

* $p < 0.05$. ** $p < 0.01$.

There was a significant and moderately positive correlation between the percentage of patient cues attended to and the percentage of nursing knowledge items for three specific case studies, Mary Warren, Fred Mann and Larry Bird. As well, there was a significant and moderately positive correlation between cue recognition and nursing knowledge when the case studies were all combined. These relationships are similar in slope and direction and would suggest that the more cues the individual nurses recognized, the more knowledge items they indicated that they were using.

However, when plotting the mean scores for each case with cue recognition against nursing knowledge, the opposite relationship appears. Figure 2 plots the mean scores for cue recognition and nursing knowledge by case study. Case studies

that had higher cue recognition means showed lower knowledge score means while case studies with higher knowledge score means showed lower cue recognition means (Spearman's correlation -0.98561, $p < 0.001$).

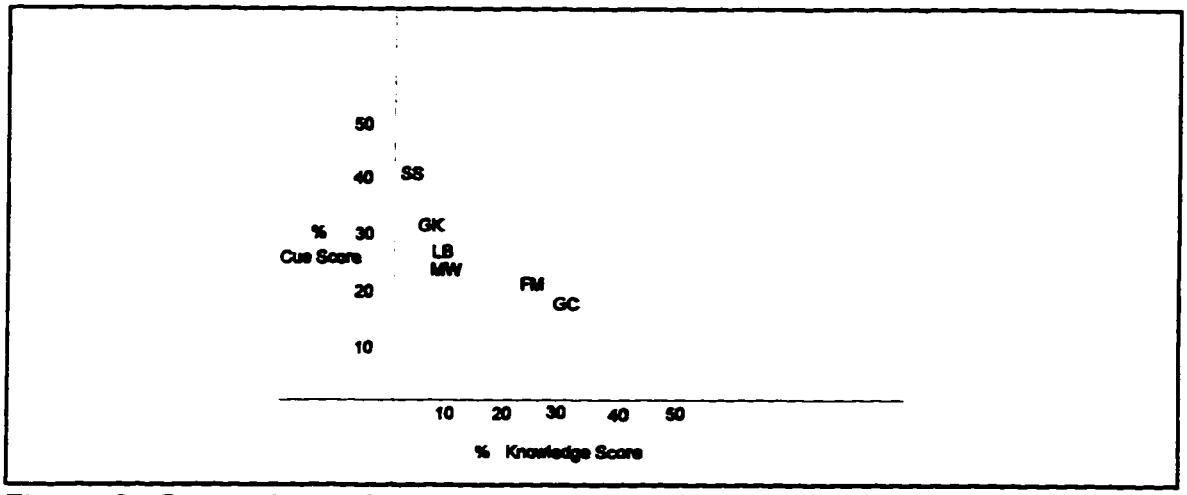

Figure 2. Comparison of the mean scores for the percentage use of cues and knowledge items by case study

There was a significant and moderately positive correlation for the case studies of Mary Warren and Larry Bird. As well, there was a significant and positive correlation when all of the case studies were combined. Figure 3 displays the means for nursing knowledge scores and clinical judgements by case studies. There was no significant relationship found between these two items.

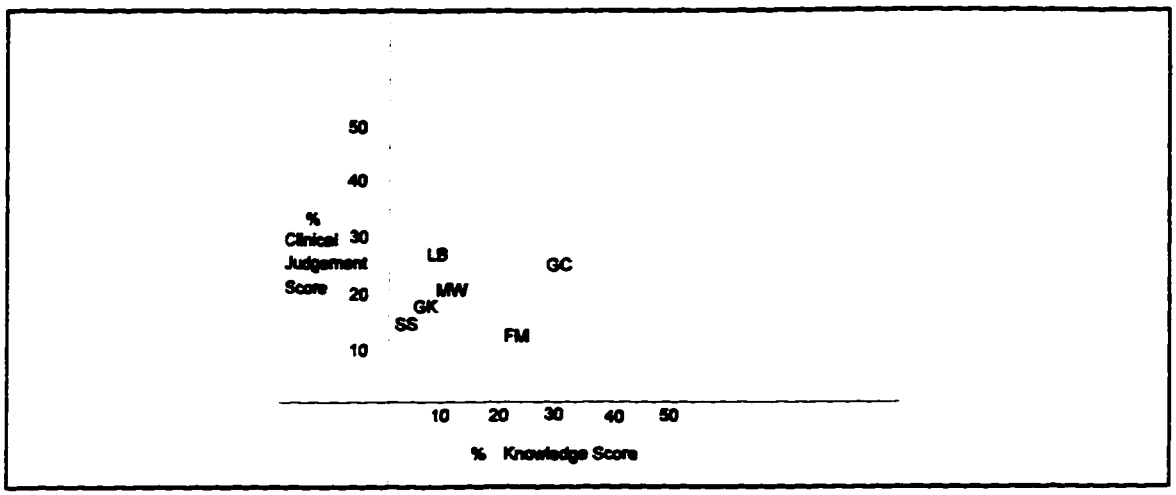

Figure 3. Comparison of the mean scores for the percentage of knowledge items with the clinical judgements made by case study

As was shown in Table 15, there was a significant and moderately positive correlation between the percentage of patient cues recognized and the clinical judgements made for the case study of Larry Bird. Combining the case studies revealed a significant and positive correlation between cue recognition and clinical judgements. This correlation would support the relationship between attending to a patient cue and being able to make a clinical judgement about a patient. Figure 4 shows the mean scores for cue recognition and clinical judgements by case study. There was no significant relationship found between these two items.

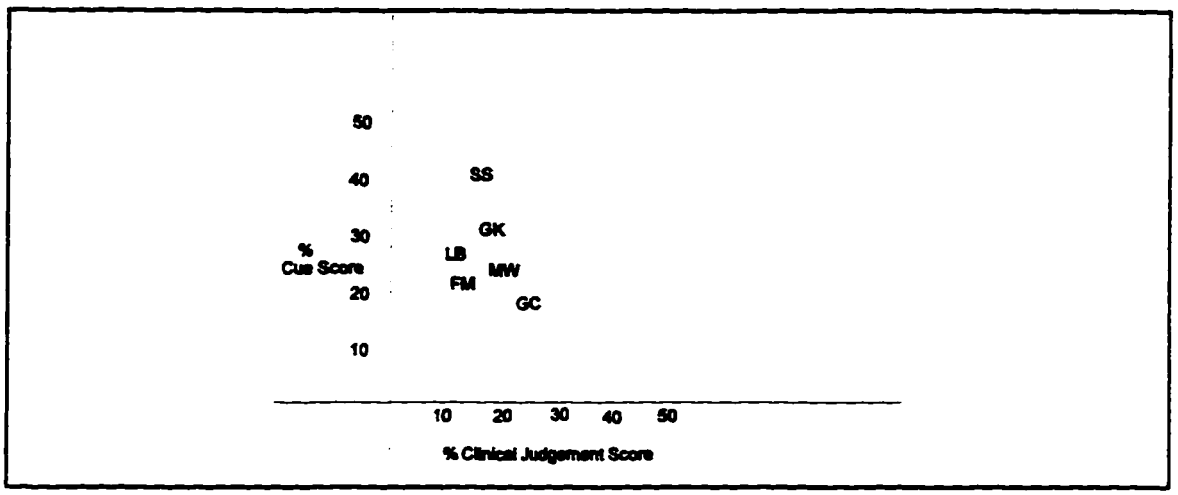

Figure 4. Comparison of the mean scores for the percentage use of cues and clinical judgements made by case study

Overall, there was a significant and moderately positive correlation between attention to patient cues, nursing knowledge and the making of clinical judgements by individual nurses for the case study of Larry Bird and across all of the case studies when they are combined.

The positive correlation (Spearman's rho 0.53527, $p < 0.01$) between verbalized cue recognition and knowledge items stated support the information processing model (Newell & Simon, 1972) where attending to a cue allows the cue to enter the working memory and triggers the retrieval of the stored knowledge from the long term memory that appears to be appropriate. The positive correlation (Spearman's rho 0.76127, $p < 0.01$) between nursing knowledge stated and clinical judgements verbalized supports the strong relationship between knowledge retrieved from the long term memory and the clinical judgements made. Recognition of the cue

as the trigger of the clinical judgement process is supported by the positive correlation between verbalized cue recognition and clinical judgement (Spearman's rho 0.59575, $p < 0.01$)

Relationships between: (a) demographic characteristics, (b) cue recognition, (c) knowledge, and (d) clinical judgements.

Overall cue, knowledge and clinical judgement scores were created for each nurse by adding the individual cue, knowledge and clinical judgement scores by case study. These overall cue, knowledge and clinical judgement scores were then examined for any significant correlation with the demographic characteristics of the sample. The only significant relationship found was between overall knowledge scores and the level of ICU (Spearman's Correlation 0.43931, $p < 0.05$; Mann-Whitney U 35.5, $p < 0.05$). Thus, the mean knowledge items stated score was likely to be somewhat higher if the participant worked in a tertiary level ICU than in a secondary level ICU.

3.3 Responses to the Perceived Relative Stress Tool

The responses to the Perceived Relative Stress Tool (PRST) are summarized in Table 16. One nurse did not complete this tool.

Table 16

Responses to Perceived Relative Stress Tool

	All Units
Minimum Score	1.0
Maximum Score	4.0
Mean Score	2.3
Total number of respondents	23

Overall, the participants perceived that working through the case studies for the study to be less stressful than caring for the same patients in their own units. Several of the participants offered comments to explain their score. Some of the informal comments that supported the low perceived stress scores included: "well, it's just paper" and "nobody's going to die here." Some of the informal comments that supported the higher stress scores included: "there was no one else to ask for help" and "I'm used to having the patient there, so I can really see what is going on." The tape recorder was not reported to add stress to the study situation. The order of presentation of the case studies was examined for any effects of the order on the scores obtained on cue recognition, knowledge items and clinical judgement. No relationship between the order of the case study and the score achieved was found. This would support the finding of the lack of effect of any perceived relative stress on the nurses' scores.

The relationships between the relative stress scores and the summarized scores were examined using chi-squares and Spearman correlations. No significant

relationships were found. This overall lack of correlation suggested that the nurses' perceived relative level of stress did not affect their overall responses to the case studies.

3.4 Limitations of the Study

Simulation of the actual patient situation.

Because of the nature of the critical care environment and the exploratory nature of this study, it was considered to be neither feasible nor in the patient's best interest to ask the nurses to think aloud during actual crises. Actual crises would, of course, have provided the most realistic environment for data collection. However, for the current study, case studies were used. The content of the case studies was designed to simulate usual ICU patients as much as possible. The information in the case studies was presented in an order similar to how this information would normally be available to the nurse in the situation. For example, FM's information was structured as if the nurse was receiving report from the previous shift. GC and GK's case studies were structured to represent the information received from another nurse when a patient is received in transfer from the ward.

Generalizability.

Another limitation of this study is the use of only four ICU's to collect the sample. For this reason, no efforts at generalizability beyond the four units can be made based on the data collected. The four sites were involved in the study, along with random selection of participants, in order to minimize selection bias within the units.

The generalizability of the findings depends, in part, on the rate of participation in the study. In one site, only four nurses (13.3%)responded in spite of randomly selecting, in several rounds, the entire nursing staff (n=30). One of these nurses was not eligible to participate because the nurse was the unit manager. The researcher was unable to reach the other nurse, in spite of repeated attempts. Two sites had nine participants each, selected through the random process. In the fourth site, six participants volunteered through the same sampling technique. Consequently, the sample may not be representative of the target population. In at least one of the sites, some degree of self selection must be acknowledged. After all of the nurses on this unit were invited to participate, only 13% accepted the invitation and 7% actually participated. The acceptance rates from the other units ranged from 8% to 31%. Overall, the acceptance rate across all four units was 16% and the participation rate was 14%.

Several factors may have influenced the acceptance rate. Unfortunately, the data collection coincided with a period of cost cutting, down sizing and re-engineering in the participating hospitals. For two of the ICU's, the process of job loss resulted in 'bumping' where nurses with more hospital seniority displaced nurses with less seniority in order to maintain paid employment. Nurses with significant hours of seniority and experience within the ICU were concerned about their ability to maintain high quality patient care with increasing numbers of inexperienced co-workers. Nurses with fewer hours of seniority were concerned about maintaining their position. While the participants might be considered to be

fairly senior, having had more than two years of seniority in their ICU, this did not protect them in an environment where the seniority of those nurses being bumped was often more than 6 full time years (A. Henson, personal communication, December 7, 1995). This may have negatively affected the willingness of nurses to participate in research studies such as this one.

An external event that may have also affected the willingness of CCNs to participate in this study was the health care reconfiguration project carried out by the Ottawa-Carleton Regional District Health Council. During the time of data collection, two of the four hospitals were, at times, named in the District Health Council's working documents as being slated either for closure and/or significant changes to their mandate that would directly affect the functioning of their critical care units (Options Development Task Group, 1995). This may have had a negative effect on the rate of recruitment into the study.

Research methodology.

This study used a verbal protocol analysis approach to study the process of making clinical judgements. The relationship between the number of cues recognized, the number of nursing knowledge items verbalized and the clinical judgements made was examined by counting these and examining the relationship between the numbers of each. A qualitative examination of the patterns of how the nurses move between the cues, their nursing knowledge and the clinical judgements they make could form the basis for a secondary analysis of the transcripts in the

future. This would provide a more complete understanding of the relationship between cue recognition, use of knowledge and the making of clinical judgments.

'Think-aloud' verbal protocol research methods do not permit probing or requests for clarification to ensure that the participants' thought processes are not altered by the researcher. This method did not allow the researcher to clarify the clinical judgements made with the participants. Nor was there an opportunity for the participants to explain the reasons behind the judgements they made. Several of the participants expressed a desire to obtain more information from the researcher as they were working through the case studies. These actions would have violated the study methodology. However, an analysis of the questions asked may have provided a more complete representation of the process of making clinical judgements used by these nurses, if they had stated the information they wanted.

The questions that were included with the case studies may not have been the right stimulus to trigger the nurses' thought processes in the direction that was of interest to the researcher (see Appendix A). Three of the five questions asked the nurse what they would do. The question that asked the nurses to state what they thought was occurring with the patient appeared to startle several (at least three) of the participants. This may have been a reflection of the era when many of the participants received their basic nursing education. In 1972, DuGas described the nurse's responsibility as making intelligent observations to "aid the physician in his diagnosis of the patient's condition" and "identifying nursing problems" (p. 66). Nurses who were educated before and during this era would not have been

expected to make these types of statements about their patients and may not have accommodated to current practice expectations of nurses.

Only the correct clinical judgements were scored on the scoring tool. No attempt was made to examine the clinical judgements that were made that were not deemed to be appropriate by the people involved in developing the scoring grid. As well, no attempt was made to priorize the clinical judgments made by the nurses. Given that process of making the clinical judgements was of interest to the researcher, the priority of the clinical judgement was not included. Including these factors may have provided another perspective on the use of cues and knowledge, specifically in the verification of hypotheses that were generated. This would form a suitable part of any secondary analysis of these transcripts.

The Perceived Relative Stress Tool (PRST) was designed for this study and, as such, had only face validity. However, the PRST was based on the visual analogue scales used to measure perceptions of sensations such as pain and dyspnea. Visual analogue scales have been found to have significant and positive correlations with other measures of the same perceived sensation (Brown, 1988; Carrieri-Kohlman, 1991; Wewers & Lowe, 1990). As well, Youngblut and Casper (1993) support the appropriateness of a single-item indicator for obtaining holistic information about the effect of a phenomenon on a person.

3.5 Strengths of the study

Case studies.

The participants reported that the case studies represented intensive care patient situations well. While many participants reported that they had little experience looking after patients with leukemia, the patients and scenarios all appeared realistic to them. Several participants asked if the case studies had been developed from one or another patient that the case study reminded them of. This substantiated the results of the pretesting of the case studies and confirmed that the information presented in the case studies was appropriate for the study population of interest.

Research methodology.

The use of think aloud verbal protocol allowed the participants to follow their own train of thought, with minimal intrusion by the researcher (Ericsson & Simon, 1993). For this reason, the patterns of information organization and clinical judgement making can be considered to be a reflection of the thought process used by the nurses in actual clinical situations. Other researchers have used this methodology to examine different aspects of the clinical judgement process (Corcoran, 1986a, 1986b; Fonteyn & Grobe, 1994; Grobe, Drew & Fonteyn, 1991; Joseph & Patel, 1990; Tanner, Padrick, Westfall & Putzier, 1987). Bakken Henry, LeBreck and Holzemer (1989) compared three different methods of eliciting nurses' cognitive processes and found that "direct verbalization does not affect performance"

(p. 192). Their results supported "the continued use of verbalization of cognitive processes as a strategy for the examination of clinical decision making" (p. 192).

Random selection.

Random selection of nurses from a number of ICUs that provided different levels of care increases the appropriateness and applicability of the findings to the population of interest, the critical care nurses in the Ottawa-Carleton region. While a variety of factors influenced the participation rate, the overall result was that ten percent of the target population was included, rather than the seventeen percent that was in the original proposal. Descriptive research in this area has tended to use convenience samples (n=43, Tanner, Padrick, Westfall & Putzier, 1987); volunteers (n=10, Fonteyn & Grobe, 1994; n=7, Grobe, Drew & Fonteyn, 1991; n=9, Joseph & Patel, 1990) or purposeful samples (n=11, Corcoran, 1986a, 1986b) with small numbers of participants. None of these studies described the size of the population from which their sample was derived. As well, these studies did not use a random selection process to obtain their sample.

4.0 Discussion

Kearns (1982) has stated that to truly understand the process of making clinical judgements "one must measure not only the choice which has been made but also the cognitive process by which it has been reached" (p. 218). The results of this study are discussed in several ways. First of all, they are examined with the perspective of the stated purposes of the research and the literature is compared to these results. Then, implications for the practice of nursing and for nurses in advanced nursing practice roles are presented. Finally, the methodology is examined for appropriateness regarding the purpose of the research and for implications for future research in this area.

4.1 Relating the purpose of the research to the results

How critical care nurses use patient cues.

The results of this study indicate that critical care nurses verbalized using few of the cues that were available from patients to make clinical judgements. For each case study, nurses used, on average, between eighteen and forty one percent of the cues that were provided. There was no significant difference found in the pattern of cue recognition and use between the case studies. As well, there was no pattern of cue recognition seen when the themes were examined within and across the case studies. Overall, the nurses used between two and 29 of the 55 cues available in the case studies (mean = 14.2, SD = 7.1).

The cues that were verbalized with the least frequency were those that provided information about the patient's past health history or those that suggested physiological stability of the patient. The finding was the same when the themes were examined. The theme of 'recent patient events' had the lowest overall mean percentage score of 10.6% of the items relating to that theme. The findings relating to the cues of the patient's past health history are somewhat surprising, as this information is known to be a very important part of the patient assessment (Bulechek & McCloskey, 1992). The cues that suggested that the patient was physiologically stable may have been attended to and dismissed immediately rather than being taken into the working memory and verbalized.

The cues most frequently verbalized were those cues relating to the patient's physiological instability. These included low oxygen saturation (MW, FM), abnormal vital signs (FM, SS, LB, GK), laboured respirations (GC) and abnormal wound status (SS). Since patients are admitted to ICU because of actual or potential physiological instability, the higher scores in this area are not surprising. This was also found when the themes were examined. The overall mean percentage score for the theme 'unstable vital signs' was 24.6%, which was higher than any of the other overall mean percentage scores. However, it is surprising that these cues were not verbalized by all of the nurses in the study. This may partly be a result of the method of data presentation. Critical care nurses rarely receive patient cues through written or spoken media. Instead, these nurses are accustomed to being in close contact and proximity to their patients and use their senses of sight, hearing, touch and smell

to collect data from the patient. In this type of setting, nurses can obtain many patient cues through the use of their senses. This provides a multi-dimensional picture of their patient, rather than the one-dimensional picture created by the paper case studies. Nonetheless, this raises other concerns.

In today's climate of fiscal restraint, many administrators are seeking ways to decrease their costs. Some settings have chosen to change their staffing mixes by decreasing the number of registered nurses and increasing the number of less qualified staff who provide direct care to patients (Holzemer, 1996; Ingersoll, 1995; Shamian & Chalmers, 1996). It is usually expected that the other levels of staff will report any changes in patients' conditions to the registered nurses. In these situations, the information would probably be presented to the registered nurse in a manner similar to these paper case studies. If the low level of cue recognition that was found in this study were also to occur in that situation, then this would be an important area of concern for patient safety. Nurses in this situation may need to be educated differently, so that they can learn how to deal effectively with patient information that is presented indirectly through a second person.

How critical care nurses integrate patient cues and their nursing knowledge.

Most of the nurses did not verbalize much of their use of knowledge while working through the case studies. Overall, the nurses mentioned between one and fourteen of the thirty possible knowledge items (mean = 4.4, SD = 2.9). Thus, the results of this study can add little to the understanding of the process of integration of patient cues and nursing knowledge. Across all of the case studies, there was a

moderately positive and significant correlation between the number of cues recognized and the number of knowledge items verbalized (Spearman Correlation 0.53527, $p < .001$). These correlations indicate that as the number of cues verbalized increased, the number of knowledge items verbalized also increased. This suggests that there is a relationship between these two processes.

The association between cue recognition and knowledge scores for individual participants as compared to the means for the case studies is of interest. The positive association for individual participants supports the process of information processing described by Newell and Simon (1972), while the negative association may indicate the nurses' difficulty in managing unfamiliar situations. Case studies that reflected situations that the nurses may have been more familiar with, such as SS and MW resulted in relatively higher mean cue scores and lower mean knowledge scores. The case study that reflected a patient situation that were less definitive, that of GC, resulted in the lowest mean cue recognition score and the highest mean knowledge score. This may have been a result of the nurses having difficulty determining which chunks of information in their long term memory would be appropriate to help them solve this situation.

The nursing knowledge verbalized was consistent with the cues that had been recognized and mentioned by the nurses. For example, thirteen nurses recognized that MW's oxygen saturation had fallen. In the same case study, nine nurses described some of the ways that they would assess her respiratory status.

Surprisingly, the case study (SS) that yielded the highest mean percentage of cues recognized had the lowest mean percentage of knowledge items verbalized. In contrast, the case study (GC) that had the highest mean percentage of knowledge items also had the lowest mean percentage of cues recognized. While no explanation for this interesting relationship is evident from the data, there are some possible interpretations. The case study of SS featured a young woman with fairly subtle signs of possible instability. The nurses may have felt that the cues did not indicate enough instability to warrant serious attention. Many nurses focused on continuing to prepare the patient for transfer to the ward. Even some of the nurses who described feelings of discomfort about the patient's condition continued with the transfer. Only six nurses would delay the transfer to the ward.

The case study of GC featured a man who had deteriorated fairly rapidly over the previous few hours to the point that he now required admission to the ICU. He was, therefore, an unknown entity to the nurses and they did not have the advantage of the usual ICU monitoring information as the patient had not yet been attached to the various pieces of monitoring equipment. Most of the information available in this case study was second-hand, coming from the nurses transferring the patient to the ICU. For whatever reason, the nurses did not appear to recognize and use the cues that were available in the case study. Yet, the nurses did verbalize the highest use of their nursing knowledge, with a mean score of 32% of the scorable knowledge items. As well, almost all of the nurses (96%) scored at least one of the four knowledge items (25%).

The case study (GK) that featured a patient with leukemia scored very low in the use of nursing knowledge category. This may be related to the lack of experience many of the nurses stated that they had with this type of patient. Patients in the acute phase of leukemia are usually considered to require tertiary care and so the secondary level units had little exposure to this type of patient. Even in the tertiary units, these patients are not that common. This case study was included in the study in order to elicit the clinical judgement process that nurses used with unfamiliar situations and patients. Eleven nurses (45.8%) did verbalize knowledge of the possible relationship between the patient's confusion and hypotension. None of the nurses (0%) stated that the priority for assessment should be the patient's airway and breathing for this case. This occurred despite the fact that the patient's confusion could have suggested a decreased level of consciousness and therefore a decreased ability to protect one's airway. The scores for this case study suggest that the nurses had difficulty dealing with patients who presented unfamiliar information.

Informally, several of the nurses said that they had difficulty working through the paper case studies because they did not "know the patient." This was not included in formal part of the data collection and came about during the informal discussions that many of the nurses engaged the researcher in after the tape recorder was turned off. Therefore, no attempt was made to explore the relationship between this statement and the cues that the nurses recognized and used in the case studies. These statements by some of the participants support the literature on

the concept of "knowing the patient" by Jenks (1993) and Jenny and Logan (1992). The use of knowledge of the patient in making clinical judgements has implications for the situation, described earlier, where registered nurses are responsible for a number of patients and where they direct the care received by the patient from others, including registered practical nurses, nursing aides, care partners and multi-skilled workers. In these situations, the registered nurse working in critical care can not be expected to have the same indepth knowledge of the patient that they currently have within their nurse:patient ratios of 1:1 or 1:2.

Descriptions of the clinical judgements made by critical care nurses.

Three out of the five questions that accompanied the case studies asked the nurses what they would do in this situation (questions 1, 2 and 5, see Appendix A). These questions were intended to elicit the clinical judgements made by the nurses. Therefore, the low numbers of clinical judgements that were verbalized could not be related only to the difference between the verbal report and the actual cognitive process. The nurses verbalized between one and twenty of the forty-eight clinical judgements included in the scoring tool (mean = 9, SD = 5).

GC's case study elicited the highest mean percentage of clinical judgements made. This case study also elicited the lowest mean percentage of cues and the highest mean percentage of knowledge items. There are several factors that could have led to this result. GC was clearly very ill and his physiological status was deteriorating quickly. He represented an acute admission to the ICU and was clearly in urgent need of airway management. This is an common occurrence in the ICU

and the nurses would have dealt with this type of scenario many times in the past. They may have had substantial chunks of data in their long term memory that were easily retrieved and applied to this case study (Newell & Simon, 1972). This may partially explain the low percentage of cues attended to as well. The nurses may have felt that they needed few cues before they determined which chunk of data was appropriate for this situation.

The case study of GC contrasts with that of GK. GK's case study represents the situation in which most of the nurses did not have much stored information about patients like her or about her leukemic condition. In GK's case study, the nurses collected more cues, with a mean percentage of thirty-two percent of the total cues available. This represented the second highest mean percentage of cues recognized across all six case studies. In contrast, the mean percentage of knowledge items verbalized was only six percent, the second lowest across the case studies. This suggests that the nurses kept looking for cues that would somehow link with the information stored in their long term memory (Kail & Bisanz, 1982). The knowledge that the nurses did talk about had little to do with the patient's disease or chemotherapy. Instead, they focused on the patient's hypotension and confusion, both familiar areas for ICU nurses. The clinical judgements made by the nurses also focused on this area, with more than sixty percent of the nurses implementing strategies to support GK's circulation. The relationship between the elements of cue recognition, use of nursing knowledge and making clinical judgements was neither directional nor significant for this case study.

One aspect of expertise is the enhanced ability to manage complex data (Corcoran, 1986b; Shanteau, 1992). The case study of LB provided the most complex set of patient cues and the most multifaceted situation. This was the only case study where the correlations between: (a) cue recognition and nursing knowledge stated; (b) nursing knowledge stated and clinical judgements made; and (c) cue recognition and clinical judgements made, were moderately positive. The mean percentage scores for this case study had a consistent central distribution. This relationship is somewhat unexpected as many of the cues were of a more complex nature. For example, the patient's respiratory rate was reported at twenty eight, yet the ventilator was set at a rate of fourteen. In addition, the patient was receiving medication to decrease his work of breathing. Perhaps not surprising, one of these cues was attended to by only two nurses (8.7%) and the other cue by only one nurse (4.3%). A more likely explanation of the significant relationship lies in the fact that several nurses did not identify either a cue (two nurses, 8.7%), an item of nursing knowledge (11 nurses, 47.8%) or a clinical judgement (nine nurses, 39.1%). For this case, the correlation suggests that the same nurses had no scores in each of the three areas. This patient had a pulmonary artery catheter in situ and a hemodynamic profile was provided to the nurses. It is possible that this information distracted the nurses from the other information provided and led to the low scores. None of the scoring items that related to the pulmonary artery catheter had acceptable interrater reliability and thus were dropped from the analysis.

When thought processes become so well practiced that they become automatic, then the process of cue recognition and integration with chunks of information from the long-term memory bypasses the working memory. This makes the process invisible in verbalizations such as those used by this study (Shiffrin & Schneider, 1977). However, the automatic process results in the making of a clinical judgement and direction for action. These clinical judgements would have been apparent in the verbalizations if they had occurred (Ericsson & Simon, 1993).

4.2 Relating the results to the literature

Cue Recognition

Results fit with the information processing model (Newell & Simon, 1979) used as the basis for the framework for this study. Making clinical judgements requires the person to attend to a stimulus in order to begin the process. This is supported by the overall positive correlations found between the numbers of: (a) cues recognized, (b) the nursing knowledge used, and (c) the clinical judgements made. Since the cues must be attended to within a short period of time, the low scores in the cue recognition indicate that many of the cues available in the case studies did not enter the working memory (Carnevali & Thomas, 1993).

There was a significant and moderately positive correlation between cue recognition and various demographic characteristics for two case studies (FM, GC). These characteristics reflected the years of nursing and critical care experience that the nurses had. The elements were the time since registration and the number of years worked in the current ICU. These elements of increased time as a registered

nurse and as a critical care nurse should indicate an increasing ability to detect and use cues as well as an increased knowledge base as the nurse's experience increases. This is congruent with the findings of Itano (1989), who found that registered nurses collected significantly more cues than nursing students. The increased knowledge held by the registered nurses was felt to be an important factor in Itano's study.

Since the working memory has a limited capacity (Ericsson & Simon, 1993), the rate at which the cues were presented through the use of the paper case study may have affected the rate of cue recognition. The mean number of cues attended to by the nurses varied from one to four for each case. The number of cues that can be handled at one time is thought to be between four (Ericsson & Simon, 1993) and seven (Miller, 1956; Simon, 1974). Since Ericsson and Simon state that only the information that is in the working memory is available for verbal reports, this may have affected the number of cues reported. It is pertinent to note that the nurses were able to refer to the case study as long as they wished while they were working through it and answering the questions. This may have affected the verbalized cue recognition as the cues were present for the nurses throughout the case study. This is in contrast to the actual clinical situation where the patient cues need to be sought out and frequently vary over time. In these changing situations, the nurse may attend to the cues differently because they may be rapidly changing and are not presented in an organized fashion.

Use of Nursing Knowledge

This study was not designed to test the level of knowledge of the nurses. The area of interest was the ways in which the nurses used their knowledge to make clinical judgements about the case studies. The nurses may have had more knowledge in their long term memory, but they did not enter it into their working memory during the verbal protocols. When particular thought processes are so familiar that they become automatic, the process does not involve the working memory. In these instances, the steps used in the process are not available for verbal reports (Shiffrin & Schneider, 1977).

The knowledge items that were verbalized fit with the processes described by Levin and Vuckovich (1991). These included encoding, rehearsing and chunking the data. The transcripts revealed that many of the nurses talked about the cue and the related knowledge items several times in slightly different ways. For example, Newell and Simon (1979) have stated that information is turned into symbols that are then linked with other symbols and previously stored related information.

In two of the case studies (LB and GK), nurses stated that they had little knowledge about this type of patient or this sequence of events. Thus the nurses were unable to access any relevant information they may have had in their long term memory as they could not find the right linkages. The way a person has understood the problem and the way the information in the long term memory is structured affects the effectiveness of the retrieval process (VanLehn, 1991). While this lack of familiarity was expected for the case study of GK, it was an unexpected finding

for the case study of LB. The use of the pulmonary artery catheter has been widespread throughout most ICU's in the region and it would be expected that the nurses would use some of the information obtained from this monitoring device while caring for their patients.

Twelve nurses (50%) had been working in critical care nursing for more than ten years. During this time period, theory based and research based nursing care were introduced into the practice setting (Meleis, 1991). The nurses would also have seen many other changes in critical care nursing including the introduction of continuous invasive hemodynamic monitoring (Swan et al., 1970; Swan & Ganz, 1975). For example, in 1978, Allardyce stated that tertiary level critical care units should be able to monitor patients at the level of pulmonary capillary wedge pressure and cardiac output and subsequently the level of monitoring available in tertiary level units has been upgraded over the next few years. Many secondary ICU's currently also have the capacity to monitor patients at this level.

Benner (1983) has stated that the number of years of experience is no indication of expertise. Yet, in order to develop expertise, one must have domain-relevant experience in order to create the rich data chunks and linkages that are part of expertise (Gordon, 1986; Kolodner, 1984; Shanteau, 1992). No attempt was made to determine the level of expertise of the nurses in this study. While they all had at least three years of nursing experience in their current ICU, this experience would not translate directly to levels of expertise (Benner, 1984), but the large number of experienced nurses probably included some varying levels of expertise. Since

expertise is related to significant knowledge levels (Larkin, McDermott, Simon & Simon, 1980) and the automation of many commonly used judgement processes (Shanteau, 1992), the knowledge scores may have been low because many of the nurses did not need to bring this information into their consciousness in order to deal with the case studies. However, if this was occurring, the clinical judgement scores should have been higher as this automatization of the process should still result in the appropriate outcomes, the appropriate clinical judgements about the patient.

This study did not explore, with the nurses, the rationale for their judgements. This would have changed the dynamic of the methodology from "Think Aloud" to "Explain Aloud." While Sims and Fought (1989) found that nurses in their study tended not to have the right reasons behind the clinical judgements they made, this was not supported in the works by Baumann and Bourbonnais (1982) and Thompson and Sutton (1985).

The findings of the current research are congruent with recent studies which identify low knowledge and clinical judgement scores of nurses with regard to the population of patients they serve. The research methodologies of these studies varied and included paper and pencil tests, case studies, computer and video simulations. Sims and Fought (1989) found that only 17% of the nurses in their study on clinical decision making in critical care made the right decision for the right reasons. Sheidler, McGuire, Grossman and Gilbert (1992) found that only 26% of a possible 708 questions were answered correctly when they examined the abilities of RN's to make appropriate decisions regarding analgesic administration. Hughes

and Young (1990) found that between 18 and 38 of the 101 nurses in their study made the correct clinical decision regarding the post-operative care of the surgical patients in their case studies. They also found that as the case increased in complexity, the correct answers decreased in frequency. Legget-Frazier, Turner & Vincent (1994) found that nurses working in long term care with many diabetic patients produced a mean score was 67% on a diabetes knowledge test (a pass mark was 70%). As well, the categories related to patient assessment had mean scores of less than 40%. Nurses working in both tertiary and long term care settings responding to case studies similar to the patient population they served, produced low scores on knowledge and clinical judgement (Alcock, 1995). Since so few studies have been conducted in the area of the appropriate level of nursing knowledge required to care for patients, there is no normal or acceptable level established. More research in this area would assist nurses in determining their level of competence and provide guidance for continued learning.

Several of the nurses described a feeling of frustration that the paper case studies did not allow them to get to "know the patient." The statements about "knowing the patient" support the work of Jenks (1993), Jenny and Logan (1992) and Tanner, Benner, Chesla and Gordon (1993) who described "knowing the patient" as an important aspect of nursing knowledge. A method, such as the use of video or live actor simulation, of presenting the patient information in a way that allows the nurses to get to "know the patient" in some way may provide an interesting addition to the literature on nurses' use of their nursing knowledge.

Hypothesis generation

In the conceptual model (see Figure 1), the next step would be the generation of possible hypotheses and then the examination for fit with the cues and knowledge (Radwin, 1990). The current study did not focus on this aspect of the clinical judgement process. Although the nurses were asked to say what they thought was going on, many did not answer this question during their verbalization. Because of the lack of data in this area, no results were available to examine this aspect of the process of making clinical judgments.

Making the Clinical Judgements

The nurses in this study made 23 of the possible 59 clinical judgements (39%) that were included in the scoring tool. The most common clinical judgements made were those related to physiological threat to life. Nurses would assess the patients' respiratory status and intervene to support the respiratory and cardiovascular systems. These judgements are often appropriate first line decisions within the ICU environment.

Several authors (Baumann & Deber, 1989b; Baumann & Bourbonnais, 1982 & 1984) have suggested that decision-making is very difficult to analyze in crisis and rapidly changing situations, given the difficulty in defining the problem and exploring alternatives. It is possible that the nurses may have made a number of judgements at the same time and only verbalized one of the judgements they made. However, they scored so low on the clinical judgements included on the scoring tool that there would appear to have been time for them to make the clinical judgements in

sequence, rather than all at once. There was no time limit imposed on the participants while working through the case studies.

The context that surrounded these case studies was a simulation of the critical care environment. Nurses were asked to deal with these patients as if they had been working in their usual ICU during an average shift. One aspect of the context of the study that was significantly different from the ICU was asking the nurses to deal with six patients. In all of the study units, the nurses would not be caring for more than two patients at a time. The scores were examined for any trends over the order of case studies answered. No relationship was found between the order of the case study and the overall score. If the unusually large number of case studies affected the nurses' ability to make clinical judgements, this was not discernable at this level of analysis.

The case studies ranged from fairly simple to fairly difficult in complexity for critical care nurses. The only significant positive correlation between the clinical judgements score and a demographic characteristic was for the case study of LB. In this case study, the nurses in the tertiary level units tended to score higher in this area than the other nurses (Spearman's correlation 0.67151, $p < 0.001$). In the case study of SS, the nurses with higher education in nursing or with more years of critical care experience tended to make fewer judgements. Since the incorrect judgements were not scored, the results found by Corcoran (1986), Hughes and Young (1990) and Bakken Henry (1991) could not be compared to the current study.

This study did not explicitly investigate the heuristics used by the nurses. Two nurses may have been using representative thinking when they stated that the patient's temperature was normal in case studies where no information about the patient's temperature had been provided. Since no probing was done, the use of this heuristic was not verified with these participants. The nurses then appeared to use anchoring and adjustment as they dealt with the cues based on their fit with the 'known temperature.' Since this occurred with only a very small number of nurses, it was not possible to make any statements about the quality of the decisions made.

All of the nurses made clinical judgements about each case study. However, only the judgements that were considered as significant, relevant and appropriate by the experts and after a review of the critical care nursing literature were scored. One example of the type of clinical judgement not scored that was made by the participants in response to the case study of MW. The nurse would "try a little bit of, of pain control, see if you can slow down her respiratory rate a bit." It is difficult to see where the cue to trigger this clinical judgement came from, as the only respiratory rate cited in the case study was 10 breaths per minute. This rate usually considered to be on the low end of the normal range. No attempt was made to determine the level of confidence that the nurses had in the judgements that they made.

Appropriateness of the research methodology.

Ericsson and Simon (1993) have stated that concurrent verbal reports reflect the cognitive process and are appropriate methods to examine this process. The

'think aloud' verbalization is thought to reflect the information that is in the working memory. This requires the cognitive process of interest to occur in the working memory. Since experts tend to automatize many commonly used thought processes, these processes would not appear in 'think aloud' verbalizations (Shiffrin & Schneider, 1977). However, the clinical judgement appears in the working memory, prior to action (Ericsson & Simon, 1993).

Verbal protocol analysis using a think aloud methodology has been used in many studies that examine cognitive processing and decision-making (Bakken Henry, LeBreck & Holzemer, 1989; Corcoran, 1986a, 1986b; Fonteyn & Grobe, 1994; Grobe, Drew & Fonteyn, 1991; Joseph & Patel, 1990; Tanner, Padrick, Westfall & Putzier, 1987). This methodology may need to be developed further in order to explore the link between cue recognition and use of domain-specific knowledge. For example, the questions that accompanied the case studies may have been too general. More information about the linkages in the nurses' minds might have become explicit if the nurses had been asked to explain why they were thinking what they were thinking. If this had occurred after the nurses had completed the case studies, their thought processes would not have been interrupted. However, retrospective probing might not reveal these linkages as people are rarely aware of the linkages that they have used to bring stored knowledge into their working memory Ericsson & Simon (1993).

4.3 Implications for Nursing Practice

Nurses must be able to effectively integrate patient information and nursing knowledge when making the clinical judgements required to plan and provide the nursing care required by the patient. The results of this study suggest that there is room for improvement in both the process of the making of clinical judgements and the actual judgements made. There are several strategies that could be used to change this. Activities such as case reviews and critical incident reviews allow nurses to examine the nursing judgements that have been made on previous occasions and to help each other develop alternative strategies that could be used in a similar situation (Rich & Parker, 1995).

Another strategy is the use of active reflection to assist nurses to gain insight into both the level of knowledge and clinical judgement required to care for their patients and their own level of knowledge and clinical judgement. Egan (1994) has said that people in the helping professions must know the self in order to be able to use the self as a therapeutic instrument. Carper (1978) stated that knowledge of the self was the most difficult type of knowledge to master and to teach another. Many nurses would need education and support to learn this technique. Once active reflection is learned and integrated into daily practice, it can develop and expand their clinical knowledge. The active exploration of the professional self, both thought and action, can lead to new understandings and improve the nurse's ability to solve complex practice-based problems (Walker, 1996).

The results of this study also support the importance of having relevant information that is well linked and interconnected within the long term memory to increase the ease of retrieval in times of need. Nurses should continue to provide new information to their long term memory. The information should come from a variety of sources, including formal and informal education as well as from experiencing a variety of different types of patients (McMurray, 1992). This will create new linkages between chunks of data as well as increasing the depth and richness of each chunk (Hampton, 1994).

The findings from this study show, once again, that many nurses continue to use interventions that are not supported by current research findings (Riegel, Thomason, Carlson & Gocka, 1996). For example, three nurses (12.5%) suggested that the patients with hypotension should be placed into Trendelenburg position. While this intervention had been previously accepted for hypovolemic shock (DuGas, 1972), several years ago the evidence showed that this was an ineffective and often dangerous intervention (Gulanick & Ruback, 1992). Nurses need to be aware that the nursing knowledge they learned in their basic education can not necessarily be expected to remain current and applicable. They must each develop strategies to continue to learn throughout their professional career.

Interdisciplinary collaboration is based on sharing a common knowledge field. The implementation and use of both care mapping and clinical practice guidelines depend on the active involvement of all members of the health care team (Riddle, Dunstan & Castanis, 1996). As well, the current fiscal realities have highlighted the

need for each member of the team to contribute to the patient's health outcome to their full extent (Hoppe, 1996). The results of the current study indicate that the nurses have difficulty making explicit the domain-specific knowledge they have. This difficulty would limit their ability to contribute fully to the working knowledge base of the health care team. Nurses must improve both the clinical judgements they make and their ability to communicate their thought processes to ensure that their patients receive the quality of care they require.

If care delivery systems are changed so that registered nurses have less direct patient contact, education must be provided to teach nurses how to handle and interpret information received second hand through another level of care provider. While many nurses who move away from the bedside may learn this, they rarely have retained the accountability and responsibility for patient care that is being expected of nurses within the context of these new models of care delivery.

4.4 Implications for advanced nursing practice

The findings of this study have many implications for nurses in advanced nursing practice roles, such as that of the Clinical Nurse Specialist (CNS). "*Patient care* is the practice base, the raison d'être, for CNSs" (Priest, 1989, p. 147). As an expert practitioner, the CNS is expected to provide nursing care to individual patients or groups within the CNS's area of specialization. Nurses in advanced nursing practice roles should examine their own process for making clinical judgements. Active reflection can be utilized, both during practice and in retrospect to explore the decisions made.

Many CNSs are involved with formal and informal education for patients and their families, the nursing staff they work with, students and other members of the health care team. While the skills required for making effective clinical judgements should be part of the basic nursing preparation, opportunities for continued improvement in this area should be utilized. The CNS is often situated to assist nurses in cultivating their judgement skills through their common work with patients. Making the process explicit to the nurses may assist them in examining their own judgement process. As well, the CNS is often in a position to support nurses who are learning to become reflective practitioners. Challenging nurses to examine the heuristics they use for their appropriateness and applicability may improve the overall decisions made. Modelling the process of examination of and reflection on the clinical judgements made may also have an impact on both the quality and quantity of the clinical judgements. As well, the College of Nurses of Ontario has mandated that as of September 1996, both RNs and RPNs must be able to provide "a theory based rationale for decisions" (1996, p. 8). This will increase the need for both a demonstrated knowledge base and a fluid and effective clinical judgement process.

There are many research-related activities with which nurses in advanced practice are involved. These include: identifying researchable problems; supporting, contributing to and conducting research; disseminating research findings and implementing evidence-based nursing practice (McGuire & Harwood, 1989). Implementing evidence-based nursing practice is an area that requires much

attention. The use of the Trendelenburg position as an intervention to treat hypotension by three nurses (12.5%) in this study shows that there are current nursing strategies that are contrary to established research findings. Current knowledge needs to replace the stored and outdated knowledge in the nurses' long term memory. Research could be conducted on the effectiveness of various strategies to replace outdated knowledge with new knowledge, rather than the addition of new knowledge to old.

Collaboration provides nurses with an opportunity to demonstrate their domain knowledge and abilities. It can also expose knowledge deficits to the other health care providers. Nurses must be prepared to describe both nursing and their individual practice to the other team members. They must also be able to explain reasons why they made their patient care decisions. A clear understanding of the way in which nurses make decisions will assist them in explaining their own decisions to the team as well as assisting other nurses in this process. Interdisciplinary collaboration is increasingly recognized as an important component of an effective health care system (King & Lee, 1994). Nurses in advanced practice are expected to be leaders in developing and maintaining interdisciplinary teamwork and collaboration. (Spross, 1989).

The consultation process provides an opportunity for others to obtain the perspective of nursing in relation to an issue. The other person can accept none, part or all of the recommendations made by the consultant. Barron (1989) states that the goal of consultation is to improve the consultee's skill and ability to master future

problems of a similar type. A clearer understanding of the process of making clinical judgements will assist the nurse in meeting this goal.

Clinical leadership is usually an important expectation of the nurse in advanced practice (Gournic, 1989). The Canadian Nurses Association's policy statement on the Clinical Nurse Specialist states that "in the role of leader, the CNS promotes quality care. . ." (1993). The draft standards of the Canadian Clinical Nurse Specialist Interest Group state that "leadership is required to advance nursing pracice [sic] and to promote quality client care" (1996, p. 16).

Nurses in advanced practice roles are often seen as change agents (Alcock, 1994). Sills (1983) states that "inherent in all that the C.N.S. [sic] does is the fundamental notion of attempting to alter or change the course of some human experience. . ." (p. 571). One aspect of implementing changes in nursing practice is the modification of nurses' patterns of clinical judgement so the new practice can become integrated in the nursing process used by each nurse. The results of this study suggest several factors that should be considered. One factor may be the appropriateness of the nursing knowledge used by the nurses in their regular work. This was shown by the use of outdated knowledge, the use of Trendelenburg positioning for hypotension, to make clinical judgements about nursing action. Another factor may be the commitment to lifelong learning held by the nurses and the organization. Only five nurses (20.8%) were currently enrolled in any kind of educational program. There are other ways for nurses to engage in learning behaviour. Data on such activities as attending unit inservices, reading clinical

journals and working through self-directed learning packages was not collected for the current study. The organizational philosophy may affect the environment and the ability of the employees to encompass change. Any of these factors may influence the process and acceptance of change in practice.

4.5 Implications for future research

The integration of patient cues with nursing knowledge has not been well understood. The current study used the think aloud verbal protocol analysis to elicit the linkages between cue recognition, nursing knowledge and the subsequent clinical judgements made. The results do show that there are some linkages between the cues recognized and the clinical judgements made. The nurses verbalized few of the knowledge items that were included on the scoring tool. Additional studies that use this or any other methods are necessary to determine the breadth of domain-specific nursing knowledge held by practising nurses and how cue recognition, knowledge and clinical judgement are related.

Once the relationship between cue recognition, domain-specific knowledge and clinical judgement has been adequately described, the next step would be the development and testing of interventions that affect these cognitive processes. It is important to establish more than one valid methodology to explore cognitive processing and the components of interest such as cue recognition, knowledge and clinical judgement. This would assist with validation of the findings.

It is very important to note that the study was not designed to capture a complete picture of the nursing knowledge of participants. The addition of other data

collection strategies that would specifically seek out nurse's knowledge levels, may have utility in attempting to understand this area. Current testing methods are better at determining the amounts of knowledge than the application of knowledge. An area of challenge remains in assessing the knowledge used by clinicians in their practice. Further research needs to be done to determine valid and practical methods of assessing the working knowledge of nurses.

During informal discussions held with participants after the data collection was completed, they identified a number of factors that they considered important to the process of making clinical judgements, such as: (a) the organizational and unit philosophy; (b) the nursing care delivery model; (c) the types and levels of physician staff in the unit (for example: house staff, certified intensivists, general practitioners); and (d) the presence of resource nurses. Nurses who work in environments where they are not expected to make clinical judgements about their patients may have difficulty making and describing their clinical judgements. Future research in this area to examine the effects of some of these factors would determine their impact on the process of making clinical judgements.

Strategies to improve the quantity and quality of clinical judgements need to be studied for their applicability and appropriateness in different clinical settings. The strategies that are effective in one setting may not work well in another. Additional methodological research needs to be conducted to determine the best ways to measure these clinical judgements.

Effects of organizational initiatives and changes on clinical judgement need to be examined. The philosophy and structure of the organization and the unit can restrict or encourage clinical judgement. Research needs to be conducted on the effect various models have on the quality and quantity of clinical judgements made by those working within each model.

4.6 Summary

The research that has been done in the area of clinical judgement-making has attempted to describe various aspects and attributes of this process. The use of verbal protocols as data has been accepted in this area of cognitive research.

This study used a 'think aloud' method and verbal protocol analysis employing six simulated case studies to examine the relationship between cue recognition, domain-specific knowledge and clinical judgements for a group of critical care nurses. The current findings were consistent with those found by other researchers. Overall, the nurses verbalized few cues, knowledge items or clinical judgements. Associations between these elements were explored and described. Implications for nursing practice and future research were described.

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Appendix A

Questions for All Case studies:

1. What is the first thing you would do?
2. What else would you do in this situation?
3. What other information would you want to get?
4. What do you think is going on?
5. What would you do next?

Respiratory Case 1:

Mary Warren is a patient in your ICU. She had major abdominal surgery yesterday and since then, has been on a mechanical ventilator. The plan is to wean her off the ventilator and extubate her today. She has been stable overnight and is currently on low dose dopamine to optimize mesenteric perfusion. She is drowsy, but has a vital capacity of 1.2 L.

Twenty minutes ago, her ventilator settings were adjusted from FiO_2 0.4, Respiratory rate 6 bpm, Tidal Volume 650 mls, PEEP 5 cm H_2O, SIMV mode to FiO_2 0.4, CPAP 5 cm H_2O. Her arterial blood gases were satisfactory on the previous settings. Her respiratory rate was 10 bpm after the ventilator was adjusted.

You approach her to draw another set of arterial blood gases, and notice that her oxygen saturation, by pulse oximetry, has dropped from 97% to 91%.

Respiratory Case 2:

Fred Mann is a 63 year old man who was admitted to the ICU last night with pneumonia. The report from the night nurse includes the following information:

CNS: -he arrived awake, alert, and oriented to person, place and time. During the night, he had periods of restlessness and agitation. He is now asleep. He moves all limbs appropriately. His pupils are equal and reactive to light at 3 mm.

RESP: -he is tachypneic, between 28 and 40. His respirations are regular. Air entry is heard bilaterally, decreased to the bases with coarse crackles heard throughout. He is coughing up thick green mucous well on his own, a sample was sent for C&S. He has required frequent chest physio to keep his oxygen saturation above 88%. At 5 am, he was started on oxygen at 1 LPM after his saturation dropped to 82% and would not come up with physio.

CVS: -he is in sinus tachycardia @ 108 bpm, with no ectopics seen. He has an IV with NS @ 50 cc/hr in his left forearm and a saline lock in his right hand. His arterial line is in his left wrist and it is within 10 mm of his cuff pressure. His blood pressure has been running about 140/90. His skin is clear and he has all his pulses.

GI: -he is NPO, has been sucking on ice chips. His abdomen is soft and rounded and has good bowel sounds.

GU: -he has a foley catheter and it is draining 30-45 cc per hour of dark yellow urine. He diuresed 300 cc after 10 mg of Lasix given IV at 4:30 am.

Respiratory Case 3:

George Collins has just been transferred to your ICU from the ward, because of hypotension and tachycardia. He is in the hospital for assessment of his abdominal mass. The nurse from the ward is giving you report:

- Mr. Collins stated that he felt unwell when the nurse made rounds immediately after shift report.
- At that time, his vitals were: BP 110/70, P 88, RR 20. He had no specific complaints or symptoms.
- A while later, the nurse checked back with the patient. He was pale and his vitals were: BP 90/60, P 114, RR 28.
- The nurse called the physician, who ordered an IV to be started and a bolus of 500 cc Normal Saline.
- After some difficulty, an IV was started in the patient's left antecubital fossa and the fluid bolus was given.
- The physician came to assess the patient and requested an ICU transfer as the patient continued to have hypotension, in spite of an additional fluid bolus of 1000 cc Normal Saline.
- Mr. Collins' family does not know that he is being transferred to ICU as they left the hospital just before he started to feel unwell.
- He is not on any medications at home.

As you assist with his transfer from the stretcher to the bed, you notice that his respiration are very laboured and he is having a lot of difficulty answering your questions.

Septic Case 1:

Susan Smith is a 24 year old woman who fell off her horse two days ago. Her injuries include multiple fractured ribs right chest with a flail and a right pulmonary contusion. She underwent an exploratory laparotomy and suturing of several liver lacerations. She was kept in ICU for observation of her respiratory status. She is to be transferred out to the ward today.

You are preparing her for transfer. Her VS are: BP 100/60, P 92, RR 26, T 38.1 (oral).

You decide to change the abdominal dressing. There is minimal old sanguinous drainage on the old dressing. The edges of the incision are well approximated and the clips are intact. You notice a couple of blisters around the incision and the wound edges are slightly reddened.

Septic Case 2:

Grace Keely was diagnosed with leukemia two weeks ago. She is undergoing her first session with chemotherapy. Today, she was found by the nurse on the ward to be confused and hypotensive. The nurse called the physician and initiated oxygen therapy by mask. The physician requested a transfer to ICU and the patient has just arrived.

Her last blood pressure on the ward was 85/60.

Septic Case 3:

Larry Bird had a TURP three days ago. He was admitted to the ICU six hours ago with increasing shortness of breath and decreasing oxygen saturation. He was intubated and placed on a mechanical ventilator. Morphine and Versed infusions were initiated to decreased the patient's respiratory efforts. He was hypotensive, requiring large volumes of fluid and inotropic support and placement of a pulmonary artery catheter.

His current status is: BP 90/50, P 120, RR 28, T 36.1.

His ventilator settings are: FiO_2 0.7, TV 800 mls, Respirations 14, PEEP 5, Airway Pressure 42 cm H_2O, mode SIMV. Neurologically, he is sleepy, arousing to loud verbal stimuli.

His hemodynamic profile is:

CVP = 16	Pulmonary Artery Occlusion Pressure = 18
MAP = 70, PAP = 30	Pulse = 120
Cardiac Output = 3 LPM	Cardiac Index = 1.9 LPM/m^2
SVR = 1440	PVR = 320
LVSWI = 11	RVSWI = 3

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Appendix B
Cue, Knowledge and Clinical Judgement Grid

#	Item	101	102	103	104
Did the nurse identify the following patient cues?					
1.	drowsy				
2.	vital capacity of 1.2 litres				
3.	respiratory rate of 10 breathes per minute				
4.	was stable overnight				
5.	previous gases were satisfactory				
6.	oxygen sat drops from 97% to 91%				
7.	had surgery yesterday				
Did the nurse show evidence of using the following nursing information:?					
8.	usual progression in weaning				
9.	usual patient response to weaning				
10.	drowsy patient's may have decreased respirations				
11.	*a drop in oxygen sat from 97% to 91% is significant				
12.	strategies to assess patient's respiratory function such as chest auscultation, observation of respiratory pattern and chest movement				
13.	the need to assess physiological response to changed ventilator settings				
14.	the need to assess psychological response to changed ventilator settings				
15.	the need to assess pain level after surgery				
16.	the relationship between pain level and ability to breathe effectively				
Does the nurse show evidence of making the following clinical judgements?					
17.	*To assess the patient's physiological status (ABC's)				
18.	To assess the patient's psychological status				
19.	To assess the patient's readiness to wean				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
20.	To assess the effect of changes in the ventilator settings				
21.	To assess patients level of pain				
22.	*To determine significance of saturation drop				
23.	To assist the patient in clearing their airway (ie: suction, Deep Breathing & Coughing)				
24.	To increase amount of ventilatory support				
25.	To provide emotional support to the patient				
26.	To provide information about the weaning process to the patient				
27.	To position the patient for effective breathing				
28.	*To evaluate the effectiveness of the interventions				
29.	To seek assistance from others				
Did the nurse need additional Information? If so, please indicate which items were requested.					
	Age				
	Vital Signs				
	Why she was kept ventilated overnight?				
	What Surgery did she have?				
	Level of consciousness				
	Colour				
	Work of breathing				
	Respiratory mechanics				
	Amount of analgesia received				
	Condition of dressing				
	Level of sedation				
	Amount of dopamine				
	Patient's weight				
	What did the nurse think was going on?				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse identify the following patient cues?					
30.	was awake, alert, oriented but is now asleep				
31.	had periods of restlessness and agitation				
32.	tachypneic				
33.	regular respirations				
34.	decreased air entry to bases with coarse crackles				
35.	thick green mucous				
36.	sputum has been sent for C&S				
37.	cough				
38.	requiring frequent chest physio				
39.	O_2 sats remain very low (82-88%)				
40.	oxygen is at one litre per minute				
41.	IV is running at 50 cc/hr				
42.	blood pressure is 140/90				
43.	tachycardia				
44.	NPO				
45.	sucking on ice chips				
46.	urine is dark				
47.	urine output is barely adequate				
48.	had a small diuresis with Lasix				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse show evidence of using the following nursing information?					
49.	*the usual pattern of pneumonia				
50.	meaning of patient's age, ie: increased possibility of having co-morbid conditions				
51.	signs that indicate impending respiratory failure, such as decreased neuro status				
52.	effects of fluid status on lung function				
53.	*strategies to support patient in maintaining a patent airway				
54.	strategies to support patient in maintaining effective respirations, ie: positioning				
55.	strategies to deal with respiratory failure, ie: assisted ventilation				
Does the nurse show evidence of making the following clinical judgements?					
56.	*to assess ABC's				
57.	to initiate strategies to maintain patent airway in patient				
58.	to increase FiO_2				
59.	to prepare to assist patient's ventilation with "bagging" and intubation by MD				
60.	to assess current neuro status				
61.	to assess for altered fluid status				
62.	to provide psychological support to patient				
63.	to provide information to patient about his immediate future				
64.	to consult others				
65.	to determine effectiveness of interventions				
66.	to notify family				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse need additional information? If so, please indicate which items were requested.					
	past health history				
	temperature				
	does the patient have pain?				
	why was the Lasix given?				
	Chest xray				
	hemoglobin				
	Arterial blood gas				
	is the patient on antibiotics?				
	what are the results of the C&S?				
	patient's baseline vital signs				
	patient's WBC				
	has the patient received sedatives?				
	what medications?				
	What did the nurse think was going on?				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse identify the following patient cues?					
67.	*deteriorating vital signs				
68.	statement of feeling unwell before symptoms appeared				
69.	*undiagnosed abdominal mass				
70.	difficulty starting IV				
71.	*continued deterioration (hypotension)				
72.	received 1500 cc normal saline				
73.	*family is unaware of change in patient's condition				
74.	patient is not on any medications at home				
75.	respirations are now very laboured				
76.	*having difficulty answering questions				
Did the nurse show evidence of using the following nursing information?					
77.	*Priorities for assessment: ABC				
78.	Priorities for intervention: Airway and Breathing				
79.	possible sequelae associated with abdominal mass: ? ruptured AAA, ? ruptured viscus, ? pulmonary embolus				
80.	patient's need for information and support				
81.	family's need for notification and information				
Does the nurse show evidence of making the following clinical judgements?					
82.	*to assess patient's ABC's				
83.	to support patient's ventilation with oxygen				
84.	to support patient's ventilation with positioning				
85.	to ask the patient what he is feeling and how he is doing				
86.	to prepare for possible intubation				
87.	to support patient's circulation with fluids and ? medications				
88.	*to assess for S&S of possible cause for deterioration (see above)				
89.	to prepare patient for impending procedures (physical)				
90.	to prepare patient for impending procedures (psychological)				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
91.	to have the family called				
92.	to consult others				
93.	to assess patient's pain level				
94.	to determine effectiveness of interventions				
Did the nurse need additional information? If so, please indicate which items were requested.					
	urine output				
	oxygen saturation				
	age				
	cardiac history				
	respiratory history				
	what is the mass?				
	level of consciousness				
	level of unwellness				
	Hemoglobin				
	pain				
	CXR				
	temperature				
	blood work				
	patient's request for treatment				
	ECG rhythm				
	results of abdominal assessment				
	patient' current vital signs				
	other medications				
	is patient having chest pain?				
	how long has patient been deteriorating?				
	What did the nurse think was going on?				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse identify the following patient cues?					
95.	fell off a horse two days ago				
96.	chest injuries: #ribs, flail, contusion				
97.	Vital signs borderline				
98.	Temperature elevated				
99.	Incision: edges approximated, minimal old sanguineous drainage-good healing				
100.	Incision: blisters, edges reddened- problems with healing suggested				
Did the nurse show evidence of using the following nursing information:?					
101.	*signs and symptoms of possible would infection				
102.	signs and symptoms of early sepsis				
103.	usual pattern of healing after flail chest and pulmonary contusion				
104.	patient's need for information and support may be increased after trauma				
Does the nurse show evidence of making the following clinical judgements?					
105.	to assess for other signs of sepsis				
106.	to assess for adequacy of respiratory function				
107.	to ask patient how she is feeling				
108.	to assess for other reasons for abnormal vital signs				
109.	to assess for adequacy of pain control				
110.	to document on patient's chart				
111.	to notify physician of possible sepsis				
112.	to delay the transfer				
113.	to provide patient with information and support re: injuries				
114.	to determine effectiveness of interventions				
115.	to provide information and support re: breathing with major chest injuries				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse need additional information? If so, please indicate which items were requested.					
	any allergies				
	is there subcutaneous emphysema present?				
	pain				
	abdominal bloating or rigidity				
	ventilated				
	was there a head injury/neuro VS				
	ABG's, O_2 sat, chest assessment				
	family status				
	other abdominal injuries				
	? cardiac injuries				
	is the patient on antibiotics?				
	hemoglobin / bloodwork				
	was patient ventilated?				
	patient's usual vital signs				
	urine output				
	what medications is the patient on?				
	is patient eating?				
	how much oxygen is the patient on?				
	x-ray				
	last dressing change				
	are there any drains?				
	is the patient having nausea?				
	What did the nurse think was going on?				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse identify the following patient cues?					
116.	had a TURP 3 days ago				
117.	having increasing SOB and decreasing SaO_2				
118.	now intubated and ventilated				
119.	on a morphine and versed infusion				
120.	attempting to decrease respiratory efforts with infusions				
121.	hypotensive				
122.	tachycardia				
123.	tachypneic				
124.	hypothermia				
125.	respiratory rate twice the set rate on the ventilator				
126.	FiO_2 is 0.7				
127.	airway pressure is 42				
128.	patient requires large volumes of fluid and inotropes to maintain BP				
129.	patient is sleepy but arouses to loud verbal stimuli				
130.	*has a pulmonary artery catheter with the information available				
Did the nurse show evidence of using the following nursing information:?					
131.	priority for assessment and intervention, ABC's				
132.	usual post-op course for TURP patients				
133.	possible effects of morphine and versed on neuro status				
134.	normal and acceptable ventilation parameters				
135.	*possible reasons for abnormal ventilation parameters				
136.	*normal hemodynamic values				
137.	*implications of abnormal hemodynamic values				
138.	effects of fluids and inotropes on hemodynamic parameters				
139.	effects of ventilatory parameters on hemodynamic parameters				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Does the nurse show evidence of making the following clinical judgements?					
140.	to assess the effectiveness of ventilation				
141.	to change ventilator parameters to decrease airway pressure				
142.	to change ventilation parameters to decrease work of breathing				
143.	to obtain parameters for inotropic infusion(s)				
144.	to assess for pain				
145.	to assess for possible reason for continued instability: cardiac, sepsis, respiratory				
146.	to use appropriate strategies, based on suspected cause of instability				
147.	to consult others				
148.	to determine effectiveness of interventions				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse need additional information? If so, please indicate which items were requested?					
	fluid intake				
	oxygen saturation / PaO_2				
	is he bleeding from TURP?				
	past health history / status				
	type & amount of inotropic Rx				
	age				
	normal mental status				
	urine output / kidney function				
	bloodwork				
	surgical problems				
	amount of pain medication				
	level of consciousness				
	level of anxiety				
	chest x-ray				
	oxygen delivery and consumption status				
	patient's usual vital signs				
	time of the most recent numbers				
	patient's tidal volume				
	patient's height, weight, body surface area				
	ECG rhythm				
	What did the nurse think was going on?				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse identify the following patient cues?					
149.	newly diagnosed with leukemia				
150.	on first session of chemotherapy				
151.	confused				
152.	hypotensive				
Did the nurse show evidence of using the following nursing information?					
153.	priority of assessment: ABC				
154.	usual course of leukemia				
155.	expected response to chemotherapy				
156.	relationship between confusion and hypotension				
Does the nurse show evidence of making the following clinical judgements?					
157.	*to assess patient's ABCs				
158.	to protect patient's airway				
159.	to initiate strategies that support patient's circulation				
160.	to determine patient's neurological status				
161.	to initiate any required protective measures based on neuro status				
162.	*to collect any available information to determine reason for patient's deterioration				
163.	to provide psychological support				
164.	to notify patient's family				
165.	to consult others				
166.	to determine effectiveness of interventions				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

#	Item	101	102	103	104
Did the nurse need additional information? If so, please indicate which items were requested.					
	WBC				
	current neuro status				
	age				
	usual vital signs				
	temperature				
	medications				
	bloodwork				
	SaO_2				
	status of leukemia				
	allergies				
	amount of FiO_2				
	is patient receiving the chemotherapy now?				
	does patient have an IV?				
	what type of leukemia?				
	urine output / fluid balance				
	pain				
	patient history				
	type of chemotherapy				
	is patient nauseated or vomiting and how much?				
	x-ray				
	patient's treatment goals and desires				
	heart rate				
	What did the nurse think was going on?				

* ITEMS REMOVED FROM ANALYSIS BECAUSE OF INADEQUATE INTER-RATER RELIABILITY

Appendix C

Demographic questionnaire

Please tell me a little about yourself by answering the following questions:

1. What is your employment status?

- ☐ Full Time
- ☐ Temporary Full Time
- ☐ Job-share
- ☐ Part Time
- ☐ Temporary Part Time
- ☐ Casual

2. How long since you became a registered nurse?

- ☐ less than 1 year ago
- ☐ 1 - 5 years ago
- ☐ 6 -10 years ago
- ☐ 11-15 years ago
- ☐ 16-20 years ago
- ☐ more than 20 years ago

3. What is your highest level of nursing education?

- ☐ Diploma
- ☐ Diploma and Speciality Certificate/Diploma
- ☐ Baccalaureate
- ☐ Post-RN Baccalaureate
- ☐ Baccalaureate and Speciality Certificate/Diploma
- ☐ Masters' degree

4. Please identify the highest level of education obtained in a non-nursing field:

- ☐ Certificate/diploma
- ☐ Baccalaureate
- ☐ Masters' degree
- ☐ Other_____

5. Are you currently enrolled in an educational program?

- ☐ Yes
- ☐ No

If yes, what program_____

6. How many years have you worked in critical care?

- ☐ less than 1 year
- ☐ 1 - 2 years
- ☐ 3 - 5 years
- ☐ 6 -10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ more than 20 years

7. How many years have you worked in this intensive care unit?

- ☐ less than 1 year
- ☐ 1 - 2 years
- ☐ 3 - 5 years
- ☐ 6 -10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ more than 20 years

8. Are you currently certified in critical care?

- ☐ Yes
- ☐ No

Thank you for participating in this study. Remember that information from this study will be presented in such a way that no one person will be identified.

Riek van den Berg

Appendix D

Letters of initial contact and participation form
(see next three pages)

Université d'Ottawa • University of Ottawa

Faculté des sciences de la santé
École des sciences infirmières

Faculty of Health Sciences
School of Nursing

Date

Subject RN
Intensive Care Unit
A Hospital

Dear Subject RN

I am writing to request your participation in a study that is the focus of my thesis, required to complete my Masters of Science in Nursing at the University of Ottawa.

This study will explore some of the unique skills that you, as a critical care nurse, use when making clinical judgements. It is essential that this process is described so that the practice of critical care nursing is more clearly understood.

You have been selected through a random process, so that the nurses who are included in this study can be described as representing critical care nurses. If you agree to participate in this study, your identity will be kept absolutely anonymous. No one in your work place will be informed of whether you chose to participate or not.

This project has been approved by the Faculty of Health Sciences Human Research Ethics Committee at the University of Ottawa, and (A Hospital).

If you agree to be part of this study, you will be asked to spend about an hour talking through several case studies, which represent typical patient situations found in ICU's similar to the one you work in. This will be tape-recorded. You will also be asked to provide some basic demographic information. The session will be scheduled at a time and place that is agreeable to you during <months, year>.

Your name will not be used to identify the information collected for this study. The results will be pooled so that no one individual can be identified. After the transcripts of the tapes are verified, the tapes will be erased. After the study is complete, I would be pleased to share the results with you.

If you have any questions or concerns, please call me. Thank you for considering participation in this study. You may withdraw at any time, if you change your mind.

If you are willing to participate, please fill out the attached form and place it in the envelop with my name on it in the coffee room by (Due Date). I will collect them on that day and then contact you to set up an appointment.

Yours truly

Rieka van den Berg, R.N. 725-2051

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Faculté des sciences de la santé
École des sciences infirmières

Faculty of Health Sciences
School of Nursing

<date>

<nom>
Unité des Soins Intensifs
l'Hôpital Général d'Ottawa

Cher(e) <nom>

Je vous écris afin de vous inviter à participer à un projet de recherche. Ce projet est affectué dans le but de satisfaire aux exigences du programme de maîtrise en sciences infirmières à l'Université d'Ottawa.

Le projet de recherche vise à étudier le processus des jugements cliniques uniques aux infirmiers(es) des Soins critiques. Si vous décidez de participer, soyez assurés que votre identité sera gardée anonyme. Les gens dans votre milieu de travail ne seront pas informés de votre participation.

Ce projet fut approuvé par le comité d'éthique de la recherche de la Faculté des Sciences de la Santé aussi par le conseil d'Éthique de la recherche de l'Hôpital Général d'Ottawa.

Si vous decidez de participer à ce projet, on vous demandera de discuter de quelques études de cas. Les situations retrouvées dans ces études de cas sont similaires aux situations existantes dans votre milieu de travail. La discussion sera enregistrée. On vous demandera aussi de fournir quelques données démographiques. Le tout durera environ une heure. La rencontre se fera à un endroit et à l'heure de votre choix durant les mois de mars et avril 1996.

Tel que mentionné auparavant votre nom ne sera pas utilisé afin d'identifier l'information recueilli. Les résultats d'entrevue et des discussions seront amalgamés afin de garantir l'anonymat des participants(es). Suite à la vérification du contenu des cassettes, celles-ci seront détruites. Il me fera plaisir de discuter et de partager les résultats de la recherche lorsqu'ils seront terminés.

Je vous remercie de considérer à participer à cette étude et vous pouvez me contacter en tout temps si vous désirez en discuter. Soyez assurés que vous pouvez retirer votre participation en tout temps.

Si vous êtes d'accord de participer, veuillez remplir l'information requise sur la page suivante, déposez le tout dans l'enveloppe fournie à cet effet et laissez celle-ci dans la salle pause-café. Je ramasserai les enveloppes la journée même et Je vous contacterai afin de prendre rendez-vous.

Sincèrement,

Riek van den Berg 725-2051

451, ch. Smyth
Ottawa (Ontario) K1H 8M5 Canada

451 Smyth Rd.
Ottawa, Ontario K1H 8M5 Canada

(613) 562-5473 • Telec. Fax (613) 562-5443

Participation Form

If you are willing to participate in this study, please provide the following information and place it in the envelop with my name on it in the coffee room by (Due Date). I will collect them on that day and then contact you to set up an appointment.

Name: _____

Hospital Name:_____

Phone number You wish to be contacted at: _____

Best time to call: _____

Thank you for your participation. I will call you as soon as I get this form.

Riek van den Berg, R.N.

Appendix E

Consent Forms

(please see next two pages)

Université d'Ottawa · University of Ottawa

Faculté des sciences de la santé
École des sciences infirmières

Faculty of Health Sciences
School of Nursing

I, _____, freely agree to participate in the study describing the clinical judgement process used by critical care nurses, conducted by Riek van den Berg, a masters student in the Masters of Science in Nursing program at the University of Ottawa.

This study will explore some of the unique skills that I, as a critical care nurse, use when making clinical judgements. It is essential that this process is described so that the practice of critical care nursing is more clearly understood.

As a participant in this study, I will be asked to talk through several case studies. This will be audiotaped and the tapes will then be transcribed. I will also be asked to complete a brief demographic questionnaire. My involvement in this study will take about an hour.

My name and any information that could identify me will be kept strictly confidential. Any reports or publications resulting from this study will not identify the hospital I work in or my name.

Participation in this study will not present any risk of harm. There will be no individual benefit for participants of this study.

This study may benefit the profession of nursing by increasing our understanding of the process of making clinical judgements used by Critical Care Nurses.

I can withdraw from this study at any time.

If I have any questions or concerns about this research study, I am free to contact the nurse researcher or the research study supervisor at the numbers listed below. I will receive a copy of this consent.

_____	_____
Researcher	Participant
_____	
Date	

Researcher:	Riek van den Berg, 725-2051
Thesis Supervisor:	Dr. Denise Alcock, 562-5423
Chair, Faculty of Health Sciences Human Research Ethics Committee	Dr. Francis D. Reardon, 562-5852

451, ch. Smyth
Ottawa (Ontario) K1H 8M5 Canada

451 Smyth Rd
Ottawa, Ontario K1H 8M5 Canada

(613) 562 5473 • Telec Fax (613) 562 5443

Université d'Ottawa • University of Ottawa

Faculté des sciences de la santé
École des sciences infirmières

Faculty of Health Sciences
School of Nursing

Je, _____ accepte de prendre part à ce projet de recherche qui vise à étudier le processus des jugements cliniques utilisés par les infirmiers(es) des soins critiques. Ce projet est dirigé par Riek van den Berg, étudiante au programme de maîtrise en sciences infirmières de l'Université d'Ottawa.

Cette étude vise à approfondir les connaissances qu'ont les infirmières des soins critiques à résoudre des problèmes d'ordre clinique. Il est important que le processus de jugement clinique soit expliqué afin de mieux comprendre la pratique des soins infirmiers de milieu de soins critiques.

En tant que participant à cette étude on me demandera de discuter de plusieurs études de cas lors d'une entrevue. Durant cette entrevue, la discussion sera enregistrée et sera plus tard transcrite. On ma demandera aussi de fournir quelques données démographiques. Ma participation à cette étude durera environ une heure.

Mon nom, ainsi que toute information fournie lors de cette étude demeureront confidentiels. Toute information publiés résultant de cette étude n'identifiera pas mon, ni l'hôpital pour laquelle Je travaille. Ma participation ne représenté aucun danger et Je n'en retirerai aucun bénéfice.

Par contre, les résultats de cette étude vont bénéficier la profession des soins infirmiers en améliorant notre compréhension du processus des jugements cliniques utilisés par les infirmières des soins critiques.

Je peux me retirer de cette étude en tout temps. Si j'ai des questions, Je peux contacter l'infirmière responsable de cette étude ou son superviseur aux numéros indiqués ci-dessous. J'obtiendrai une copie de ce consentement.

_____ _____

Signature Témoin

Date: _____

Chercheuse principale: Riek van den Berg, 725-2051
Superviseuse de thèse: Dr. Denise Alcock, 562-5423
Chair, Faculty of Health Sciences
Human Research Ethics Committee Dr. Francis D. Reardon, 562-5800-8055

451, ch. Smyth
Ottawa (Ontario) K1H 8M5 Canada

451 Smyth Rd.
Ottawa, Ontario K1H 8M5 Canada

tél. 562-5473 • Téléc. Fax (613) 562-5443

Appendix F

Perceived Relative Stress Tool

I FEEL THAT THIS EXPERIENCE WAS AS STRESSFUL AS DEALING WITH SIMILAR PATIENTS IN MY USUAL WORK.

1	2	3	4	5
LESS STRESSFUL		SAME STRESS		MORE STRESSFUL

Question asked by researcher:

Please tell me how you would compare the stress you felt while working through these case studies with the stress you would feel looking after them in your usual work.

Appendix G

Letters and Certificates of Approval

University of Ottawa, Faculty of Health Sciences

Ottawa Civic Hospital

Ottawa General Hospital

Queensway Carleton Hospital

Riverside Hospital

Université d'Ottawa • University of Ottawa

Faculté des sciences de la santé
Cabinet de la doyenne

Faculty of Health Sciences
Office of the Dean

August 16, 1995

Ms. Riek van den Berg
c/o Professor Denise Alcock
School of Nursing
Faculty of Health Sciences
University of Ottawa
INTRA

SUBJECT: Your project entitled: **"The integration of patient information and nursing knowledge in order to make clinical judgements during situations of urgency in the Intensive Care Unit"**

Dear Ms. van den Berg:

It is my pleasure to inform you that the Faculty of Health Sciences, Human Research Ethics Committee, after study of the documentation provided, concluded that your project met the appropriate standards of ethical acceptability and falls within Category 1A.

I hereby attach a copy of the certificate of clearance granted by the University Human Research Ethics Committee.

This certificate is valid for a period of one year from the time of issuance. I would also like to remind you that, in accordance with the policies of the UHREC, it is your responsibility to notify the Committee of any major changes in this project.

On behalf of the Committee, I wish you success in your project.

Sincerely,

Francis D. Reardon, Chair
Human Research Ethics Committee

451 Smyth Rd
Ottawa, Ontario K1H 8M5 Canada

Université d'Ottawa • University of Ottawa

Faculté des sciences de la santé
Cabinet de la doyenne

Faculty of Health Sciences
Office of the Dean

CERTIFICATION OF INSTITUTIONAL HUMAN RESEARCH ETHICS COMMITTEE FACULTY OF HEALTH SCIENCES

This is to certify that the Institutional Human Research Ethics Review Committee of the Faculty of Health Sciences has examined the research proposal by **Riek van den Berg** from the **School of Nursing** for the project entitled: **"The integration of patient information and nursing knowledge in order to make clinical judgements during situations of urgency in the Intensive Care Unit"** and concludes that, in all respects, in the proposed research protocol meets the appropriate standards of ethical acceptability, at a Category 1A level.

MEMBERS OF THE COMMITTEE

Name (Optional)	Position held	Department of discipline
Victor Boucher	Professor	Audiology and Speech-Pathology Program
François Tremblay	Professor	Physiotherapy Program
Claire-Jehanne Dubouloz	Professor	Occupational Therapy Program
Normand Faulkner	Student	School of Human Kinetics
Fabienne Fortin	Professor	School of Nursing
Sylvie Frigon	Professor	Faculty of Social Sciences
Roch Paquin	Member-at-Large	
Francis Reardon	Chair	Human Research Ethics Committee School of Human Kinetics

SIGNATURE

05.08.16

Date **Committee Chairperson - Francis D. Reardon Ph.D**

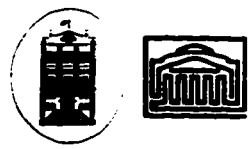
451, rue Smyth
Ottawa, Ontario, K1H 8M5 Canada

451 Smyth Rd
Ottawa, Ontario, K1H 8M5 Canada

tél. / tel. 613-562-5700 • téléc. / fax 613-562-5721

LOEB MEDICAL RESEARCH INSTITUTE
INSTITUT DE RECHERCHE MÉDICALE LOEB

OTTAWA CIVIC HOSPITAL
HÔPITAL CIVIC D'OTTAWA



UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

October 3, 1995

R. van den Berg
University of Ottawa
Faculty of Health Sciences
School of Nursing
451 Smyth Road
Ottawa, Ontario
K1H 8M5

Dear Ms. van den Berg:

Re: Protocol #95-131 **The Integration of Patient Information and Nursing Knowledge in Order to Make Clinical Judgements During Situations of Urgency in the Intensive Care Unit**

I am pleased to inform you that your project (listed above) was reviewed by the Research Ethics Committee and approved. No changes, amendments or addenda may be made in the protocol or the consent form without the Research Ethics Committee review and approval.

Approval is valid for a period of one year ending October 3, 1996. The validation date should be indicated on the bottom of all consent forms and information sheets (see copy attached). Approximately one month prior to that time, a single renewal form should be sent to the Research Administration office.

The new guidelines of the Medical Research Council require a greater involvement of the Research Ethics Committee in studies over the course of their execution. You must maintain as part of your records copies of the signed consent form. As well, you must inform the Committee of adverse events encountered during the study, here or elsewhere, or of significant new information which becomes available after the Committee review, either of which may impinge on the ethics of continuing the study. The REC will review the new information to determine if the protocol should be modified, discontinued, or should continue as originally approved.

Sincerely,

Raphael Saginur, M.D.
Chairman
Research Ethics Committee

Encls.

1053 Carling Avenue, Ottawa, Ontario K1Y 4E9
Tel: (613) 761-4395 Fax: (613) 761-4920

Conseil d'éthique en recherches
737-8930

1845 150 1995

Research Ethics Board
APPROVAL 1996

HÔPITAL GÉNÉRAL D'OTTAWA OTTAWA GENERAL HOSPITAL

Wednesday, 10 January 1996

Ms. Rieka van den Berg
12 Kinnear Street
Ottawa, ON, K1Y 3R4

Dear Ms. van den Berg:

RE: OGH-95-135 The Integration of Patient Cues and Nursing Knowledge in Order to Make Clinical Judgements in the Intensive Care Unit

The Research Ethics Board has reviewed your response to a letter of concerns that you submitted on the above protocol.

I am pleased to inform you that the REB finds these revision to be acceptable with respect to the ethics of research with human subjects and has therefore approved this protocol from January 1996 to January 1997. Enclosed are various forms which you may use throughout your study to inform us of any changes such as amendments, annual reports, toxicities or closure of this study protocol.

The new guidelines of the Medical Research Council require a greater involvement of the REB in studies over the course of their execution. You must maintain, as part of your records, copies of the signed consent form. As well, you must inform the REB of adverse events encountered during the study, here or elsewhere, or of significant new information which becomes available after the REB review, either of which may impinge on the ethics of continuing the study. The REB will review the new information to determine if the protocol would be modified, discontinued, or should continue as originally approved.

Yours sincerely,

G.D. Goss, M.D., F.C.P.(SA), F.R.C.P.C.
Chairman
Research Ethics Board

GG/ram *(SUBMITTED TO REB FOR SIGNATURE JAN 10/96)*

encl (Approval Package)

October 24, 1995

Dr. Denise Alcock
Dean, Faculty of Health Sciences
School of Nursing
University of Ottawa
451 Smyth Road
OTTAWA, Ontario
K1H 8M5

Dear Dr. Alcock:

This letter is to confirm Queensway-Carleton Hospital's support and endorsement for the research to be conducted by Rieck van den Berg on clinical judgement by staff nurses in the Intensive Care Unit at Queensway-Carleton Hospital. The proposal has been reviewed and supported by the Nursing Research Committee of the Patient Services Division. We look forward to Rieck's report in the Spring of 1996.

Sincerely,

Marlene Ghattas
Director of Nursing
Practice, Education & Research

THE RIVERSIDE HOSPITAL
OF OTTAWA
1967 Riverside Drive
Ottawa, Ontario K1H 7W9
(613) 738-7100
Fax (613) 738-8522

November 15, 1995

Ms. Rieka van den Berg
R.N., MScN Candidate
Faculty of Nursing
University of Ottawa
12 Kinnear Street
Ottawa, Ontario
K1Y 3R4

Dear Ms. van den Berg:

I would like to inform you of the decision of the Ethics Committee and the Medical Advisory Committee regarding your research proposal **Clinical Judgements in the ICU**. We are happy to announce that the Committees have approved the conduct of the research in the Nursing Department at the Riverside.

Please ensure that you wear a name tag which may be obtained from the Human Resources Department at all times when you are conducting staff interviews. Further arrangements regarding the initiation of your research should be made through arrangements with Sue Bubb, Nurse Manager, ICU.

Please accept the Committee's best wishes in your endeavours.

Sincerely,

Dr. Mark Dermer
Chair, Ethics Committee

c.c. L. Schumacher, VP - Nursing Services
E. Dunn, VP - Human Resources
S. Stanton, Nursing Director, Critical Care
S. Bubb, Nurse Manager, ICU

Appendix H

Instructions for Raters

Thank you for agreeing to score these data for my research project.

The participants are asked to read the six case studies aloud and to think aloud. So if they think of something, they should say it. They are also given five questions to help stimulate their thinking. These questions are:

1. What is the first thing you would do?
2. What else would you do in this situation?
3. What other information would you want to get?
4. What do you think is going on?
5. What would you do next?

The tapes were then transcribed into the documents you have in the binder today.

Please do not include the parts where the nurse is clearly reading the case material for the first time in the scoring.

Place a check in the appropriate column when the nurse shows evidence of:

- identifying the patient cues
- using the appropriate nursing knowledge
- making the appropriate clinical judgements.

The information about what the nurse thinks is going on is helpful in understanding their other answers.

If you feel that something should be included, please make a note of it for me. As well, if you have any other comments, call me or write them down for me. Your feedback is very important to me.

I would really appreciate it if you could do this within the next week! Many thanks for your help in this important (for me) project.