

THE EXPLORATION OF CRITICAL CARE NURSES' USE OF ACCUMULATED  
KNOWLEDGE AND INFORMATION-SEEKING FOR NON-ROUTINE TASKS

by

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## **ABSTRACT**

The exploration of critical care nurses' use of accumulated knowledge and information-seeking for non-routine tasks

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### **Background**

Nurses complete tasks during patient care to promote the recovery, or to maintain the health, of patients. These tasks can be routine or non-routine to the nurse. Non-routine tasks are characterized by unfamiliarity, requiring nurses to seek additional information from a variety of sources to effectively complete the tasks. Nurses' perception of their problem-solving skills, as characterized by the attributes of personal control, problem-solving confidence, and avoidance-approach style, influences how information is sought.

### **Objectives/Research Questions**

Guided by the information-seeking behaviour model, this study was designed to: (1) examine how the non-routineness of the task affects nurses' information-seeking behaviour and the use of accumulated knowledge; and, (2) explore nurses' perception of their problem-solving abilities.

### **Methods**

An exploratory cross-sectional survey design was used. A random sample of critical care nurses who worked in a hospital setting were selected from the College of Nurses of Ontario (CNO) research participant database. Multiple regression analysis was used to examine the proposed relationships.

### **Results**

Avoidance-approach style and, problem-solving confidence did not have a significant relationship with nurses' information-seeking behaviour. None of the variables explained

use of accumulated knowledge ( $F = 0.902$ ,  $p > 0.05$ ). Previous training ( $p = 0.008$ ), Non-routineness of the task ( $p = 0.018$ ), and Personal control ( $p = 0.040$ ) had a positive relationship with information-seeking behaviour (Adjusted  $R^2 = 0.136$ ).

### **Implications**

The study results provide evidence that problem-solving ability, and in particular the attribute of personal control, influences nurses' information-seeking behaviour during the completion of nursing tasks. They reveal how information is sought from resources, and what specific information resources are necessary to promote access to, and use of, evidence-based information. The results also help direct efforts towards training nurses in issues related to problem-solving and information-seeking by targeting the development of personal control and retrieving evidence-based information.

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## TABLE OF CONTENTS

|  |    |
|--|----|
| <b>ABSTRACT</b> .....  | ii |
| <b>ACKNOWLEDGEMENTS</b> .....  | iv |
| <b>CHAPTER 1: INTRODUCTION</b> .....                                     | 1  |
| 1.1. Problem.....  | 1  |
| 1.2. Purpose.....  | 3  |
| 1.3. Significance.....   | 4  |
| <b>CHAPTER 2: LITERATURE REVIEW</b> .....                                | 5  |
| 2.1. Introduction.....   | 5  |
| 2.2. Information-seeking behaviour and use of accumulated knowledge..... | 5  |
| 2.3. Literature search strategy.....                                     | 6  |
| 2.4. Information-seeking.....  | 7  |
| 2.5. Information behaviour definition.....                               | 7  |
| 2.6. Information need definition.....                                    | 8  |
| 2.7. Information-seeking definition.....                                 | 8  |
| 2.8. Information-seeking models.....                                     | 8  |
| 2.9. Summary.....  | 10 |
| 2.10. Empirical evidence - Information-seeking behaviour.....            | 12 |
| 2.11. Resources.....   | 13 |
| 2.12. Sources.....   | 13 |
| 2.13. Channels.....  | 14 |
| 2.14. Summary.....   | 15 |
| 2.15. Task.....  | 16 |
| 2.16. Task complexity definition.....                                    | 17 |
| 2.17. Non-routineness of the task.....                                   | 17 |
| 2.18. <i>a Priori</i> determinability of the task.....                   | 18 |
| 2.19. Task Categorization.....   | 19 |
| 2.20. Summary.....   | 20 |
| 2.21. Problem-solving.....   | 20 |
| 2.22. Problem Formation.....   | 21 |
| 2.23. Perception of problem-solving abilities.....                       | 21 |

|                                     |   |    |
|-------------------------------------|---|----|
| 2.2.1.                              | <i>Personal Control</i> .....   | 22 |
| 2.2.2.                              | <i>Avoidance-Approach style</i> .....                                       | 22 |
| 2.2.3.                              | <i>Problem-solving confidence</i> .....                                     | 23 |
| 2.24.                               | Summary.....  | 23 |
| 2.25.                               | Individual and contextual variables.....                                    | 23 |
| 2.2.4.                              | <i>Nurse characteristics</i> .....  | 25 |
| 2.2.5.                              | <i>Context</i> .....  | 25 |
| 2.26.                               | Summary.....  | 27 |
| 2.27.                               | Research Gaps.....  | 27 |
| 2.28.                               | Summary.....  | 27 |
| 2.29.                               | Research Questions.....   | 28 |
| 2.30.                               | Hypotheses.....   | 28 |
| 2.2.6.                              | <i>Hypotheses 1</i> .....   | 28 |
| 2.2.2.1.                            | <i>Evidence for Hypothesis 1</i> .....                                      | 29 |
| 2.2.7.                              | <i>Exploratory Hypothesis 2</i> .....                                       | 29 |
| 2.2.2.2.                            | <i>Evidence for Exploratory Hypothesis 2</i> .....                          | 30 |
| 2.31.                               | Proposed Conceptual Model.....  | 30 |
| <b>CHAPTER 3: METHODOLOGY</b> ..... |   | 32 |
| 3.1.                                | Study design.....   | 32 |
| 3.2.                                | Setting and Sample.....   | 32 |
| 3.3.                                | Inclusion/Exclusion Criteria.....   | 32 |
| 3.4.                                | Estimated sample size .....   | 32 |
| 3.5.                                | Variables and measures.....   | 33 |
| 3.6.                                | Dependent variables.....  | 36 |
| 3.3.1.                              | <i>Information-seeking behaviour and Use of Accumulated knowledge</i> ..... | 36 |
| 3.7.                                | Independent variable.....   | 37 |
| 3.3.2.                              | <i>Non-routineness of the Task</i> .....                                    | 37 |
| 3.8.                                | Moderating variable.....  | 37 |
| 3.3.3.                              | <i>Perception of problem-solving ability</i> .....                          | 37 |
| 3.9.                                | Confounding variables.....  | 39 |

|                                    |  |    |
|------------------------------------|--|----|
| 3.3.4.                             | <i>Nurse characteristics</i> .....                                 | 39 |
| 3.3.5.                             | <i>Context</i> .....   | 39 |
| 3.10.                              | Procedures sampling and for data collection.....                   | 40 |
| 3.11.                              | Ethical Considerations.....  | 40 |
| 3.12.                              | Data analysis Procedure.....                                       | 41 |
| 3.3.6.                             | <i>Data cleaning</i> .....   | 41 |
| 3.3.7.                             | <i>Accuracy</i> .....  | 41 |
| 3.3.8.                             | <i>Missing data</i> .....  | 42 |
| 3.3.9.                             | <i>Normality</i> .....   | 42 |
| 3.3.10.                            | <i>Linearity</i> .....   | 43 |
| 3.3.11.                            | <i>Homoscedasticity</i> .....                                      | 43 |
| 3.3.12.                            | <i>Multicollinearity</i> .....                                     | 43 |
| 3.13.                              | Step 1: Identify Confounding variables to include in analysis..... | 44 |
| 3.14.                              | Step 2: Multiple Regression Analysis.....                          | 45 |
| <b>CHAPTER 4: RESULTS</b> .....    |  | 46 |
| 4.1.                               | Response rate.....   | 46 |
| 4.2.                               | Characteristics of Participants.....                               | 47 |
| 4.3.                               | Descriptive Results for Study Variables.....                       | 49 |
| 4.4.                               | Psychometric Evaluation of Study Instruments.....                  | 49 |
| 4.5.                               | Research Hypotheses.....   | 51 |
| 4.6.                               | Use of Accumulated Knowledge.....                                  | 51 |
| 4.7.                               | Information-seeking behaviour.....                                 | 54 |
| 4.8.                               | Conceptual Model.....  | 57 |
| <b>CHAPTER 5: DISCUSSION</b> ..... |  | 59 |
| 5.1.                               | Limitations of the Study.....                                      | 59 |
| 5.5.1.                             | <i>Potential threats to internal validity</i> .....                | 59 |
| 5.5.2.                             | <i>Potential threats to external validity</i> .....                | 60 |
| 5.2.                               | Key Findings.....  | 61 |
| 5.5.3.                             | <i>Descriptive Findings</i> .....                                  | 61 |
| 5.5.5.1.                           | <i>Description of the Sample</i> .....                             | 61 |
| 5.3.                               | Descriptive Findings of the Dependent variables.....               | 62 |



|  |    |
|--|----|
| 5.5.4. <i>Information-Seeking Behaviour and Use of Accumulated Knowledge</i> ..... | 62 |
| 5.5.5.2. <i>Information-Seeking Behaviour</i> .....                                | 62 |
| 5.5.5.3. <i>Use of Accumulated Knowledge</i> .....                                 | 64 |
| 5.4. Discussion of Findings Related to the Hypotheses.....                         | 65 |
| 5.5.5. <i>Hypothesis 1</i> .....   | 65 |
| 5.5.6. <i>Hypothesis 2</i> .....   | 67 |
| 5.5. Major confounding variables.....  | 68 |
| 5.6. Final Conceptual Model.....   | 71 |
| 5.7. Implications.....   | 71 |
| 5.5.7. <i>Practice</i> .....   | 71 |
| 5.5.8. <i>Education</i> .....  | 72 |
| 5.5.9. <i>Administration</i> .....   | 72 |
| 5.5.10. <i>Research</i> .....  | 73 |
| 5.8. Conclusions.....  | 74 |
| <b>REFERENCES</b> .....  | 76 |
| <b>APPENDICES</b> .....  | 92 |

## LIST OF TABLES

|            |   |     |
|------------|---|-----|
| Table 3.1. | Concept and operational definitions of study variables.....   | 34  |
| Table 4.1. | Employment and demographic information.....   | 48  |
| Table 4.2. | Cronbach’s Alpha and Descriptive Statistics Study variables.....  | 50  |
| Table 4.3. | Use of Accumulated Knowledge with Personal Control.....   | 53  |
| Table 4.4. | Information-seeking behaviour with Personal Control.....  | 55  |
| Table 4.5. | Information-seeking behaviour with the interaction term<br>for Personal Control x Non-routineness of the task.....  | 56  |
| Table I.1. | Use of Accumulated Knowledge with Problem-Solving<br>Confidence.....  | 110 |
| Table I.2. | Use of Accumulated Knowledge with Problem-Solving Confidence x Non-<br>routineness of the task.....                 | 111 |
| Table I.3. | Use of Accumulated Knowledge with Avoidance-<br>approach style.....   | 112 |
| Table I.4. | Use of Accumulated Knowledge with interaction of Avoidance-approach<br>style x Non-routineness of the ask.....      | 113 |
| Table I.5. | Use of Accumulated Knowledge with three domains of Problem-solving<br>abilities x Non-routineness of the ask .....  | 114 |
| Table I.6. | Use of Accumulated Knowledge with Personal Control x Non-routineness<br>of the task.....                            | 115 |
| Table I.7. | Use of Accumulated Knowledge with three domains of Problem-solving<br>abilities x Non-routineness of the task ..... | 116 |
| Table J.1. | Information-seeking behaviour with Problem-Solving<br>Confidence.....   | 118 |
| Table J.2. | Information-seeking behaviour with interaction of<br>Problem-Solving Confidence x Non-routineness of the task.....  | 119 |
| Table J.3. | Information-seeking behaviour with Avoidance-approach<br>style.....   | 120 |
| Table J.4. | Information-seeking behaviour with interaction of Avoidance-approach<br>style x Non-routineness of the task.....    | 121 |

|            |  |     |
|------------|--|-----|
| Table J.5. | Information-seeking behaviour with three domains of Problem-solving abilities.....   | 122 |
| Table J.6. | Information-seeking behaviour with three domains of Problem-solving abilities and three domains of interaction of Problem-solving abilities x Non-routineness of the task..... | 123 |

## LIST OF FIGURES

|             |   |    |
|-------------|---|----|
| Figure 2.1. | Relationship of Independent and Dependent variables ..... | 30 |
| Figure 2.2. | Relationships among the key concepts .....                | 31 |
| Figure 4.1. | Summary of Responses .....                                | 46 |
| Figure 4.2. | Information-seeking behaviour conceptual model.....       | 58 |

## LIST OF APPENDICES

|  |            |
|--|------------|
| <b>Appendix A: Selected critical care nurse information-seeking studies.....</b> | <b>93</b>  |
| <b>Appendix B: Task complexity constructs.....</b>                               | <b>96</b>  |
| <b>Appendix C: Demographic information.....</b>                                  | <b>98</b>  |
| <b>Appendix D: Pre-notification letter.....</b>                                  | <b>101</b> |
| <b>Appendix E: Cover letter, response to questionnaire and consent.....</b>      | <b>102</b> |
| <b>Appendix F: Thank you postcard.....</b>                                       | <b>105</b> |
| <b>Appendix G: Certificate of Participation.....</b>                             | <b>106</b> |
| <b>Appendix H: Correlation Matrix.....</b>                                       | <b>107</b> |
| <b>Appendix I: Use of Accumulated Knowledge Tables .....</b>                     | <b>109</b> |
| <b>Appendix J: Information-Seeking Behaviour Tables.....</b>                     | <b>117</b> |

## CHAPTER 1: INTRODUCTION

The work performed by nurses is multifaceted, with varying levels of complexity. A number of factors have contributed to the increasing complexity of many aspects of nursing care management, such as: advances in medical technology; an aging population with increased numbers of geriatric patients presenting with co-morbid conditions; increasing initial survival rate of patients, with associated greater risks of developing complex secondary complications; and, increased public expectations and demand for improved quality of care (Nursing Task Force, 1999).

Historically, as Henderson (1964) points out, nurses primarily assist the individual, either sick or well, in the performance of those activities contributing to their health or recovery that the individual would perform unaided if the person had the necessary strength, will or knowledge. The role of the nurse, in this context, is to help the patient gain independence as rapidly as possible. As part of this process, nurses help the patient to successfully reach goals identified in a therapeutic plan of care (Henderson, 1964). These goals are achieved by the patient, with the assistance and guidance of nurses, through understanding and completing activities that contribute to their health or recovery.

More recently, the International Council of Nurses (2007) recognized that nurses' work has also been extended to "encompass autonomous and collaborative care of individuals of all ages, families, groups and communities, sick or well, and in all settings" (p.1). In general, nursing includes the promotion of health, prevention of illness, and the care of ill, disabled and dying people. Advocacy for patients and their significant others, promotion of a safe environment inside and outside health care facilities, research, participation in shaping health policy, inpatient and health systems management, and education are also key nursing roles (International Council of Nurses, 2007).

The nurses' role includes many work responsibilities and decisions for patient care. Unfamiliar tasks could present themselves and the nurse will need to seek information to complete the task.

### 1.1. Problem

Nurses have certain responsibilities to complete during an episode of patient care to promote or maintain the health or recovery of the patient. These tasks can be perceived by each individual nurse as being either routine or non-routine (Given & Giwai, 1969). A task is

considered “non-routine” based on the degree to which the task is determined to be unfamiliar to, and perceived to be complex by, the task performer. Similarly, a “routine” task is viewed closer to the opposite end of this range of perception, and thus is considered familiar and “simple” by the task performer (Gill & Hicks, 2006).

The nurse has reliance on information from accumulated knowledge sufficient to complete the routine task. However, if a task is perceived to be non-routine, the nurse will have a need for additional information in order to successfully complete the task. This information can be sought, and is available, through a variety of resources. A few examples of these sources and channels of information include: the internet; journals; colleagues; and, other health care professionals. This study is particularly interested in information sought by critical care nurses from published and informal information resources.

According to Byström and Järvelin (1995), information-seeking is part of the problem-solving process. This process provides the context for establishing or acting on information needs. During the act of resolving a non-routine task, the nurse needs to problem-solve and address requirements for additional information in order to successfully impact positively on patient care. Nurses make task-related decisions that can involve clinical judgment, clinical inference, clinical reasoning, and diagnostic reasoning, in order to make a choice of one particular option from a range of discrete alternatives available to the nurse (Thompson & Dowding, 2002). The range of alternatives may provide multiple options related to any one particular patient care task. Clarifying which choice to make becomes a challenge, especially when the task is considered to be complex by the nurse. This study investigated nurses’ information-seeking behaviour as it relates to their perceived complexity of the task and perceived problem-solving abilities. There are several features that characterize complex tasks as described by Gill and Hicks (2006) and in this study the focus was specifically on non-routine tasks. It can be contended that the relationship between non-routine tasks and nurse’s information-seeking actions is influenced by the individual nurse’s perception of her or his problem-solving abilities.

In this study, information-seeking is defined as a search for resources of practice knowledge to satisfy a perceived information need for a patient care task (Krikelas, 1983). Information-seeking is embedded in a larger process of problem-solving that provides the context for establishing information needs. If the problem-solving process identifies that information is needed, then information-seeking behaviour is implemented. An individual’s perception of their problem-solving abilities can influence how the nurse identifies task

problems as being routine or non-routine, and also how to proceed with resolving non-routine issues.

Effective problem-solvers consider themselves to have high confidence levels, to have high personal control, and be able to approach problems in a positive manner (Heppner, Witty & Dixon, 2004). They are more aware of their environment and may efficiently use appropriate sources and channels to resolve a task problem. Ineffective problem-solvers tend to avoid trying to solve task problems and make less use of resource aids (Heppner, Witty & Dixon, 2004). For nurses, information-seeking is an important component of solving problems in carrying out patient care. The successful completion of complex, or non-routine tasks requires the nurse to problem-solve and perform information-seeking activities.

This study will examine task actions of critical care Registered Nurses (RNs) who work in Ontario hospitals. Critical care units are complex environments where decisions are often made by nurses in demanding and time-sensitive situations because any patient's health status can decline rapidly. Also, patient care is becoming more complex as patients age and develop comorbid factors. Advances in health care, such as highly evolved interventional and patient monitoring equipment, as well as the availability of electronic patient record information including online documentation, orders, and diagnostic results, have contributed to the complexity of tasks for patient care seen in critical care environments (Currey & Worrall-Carter, 2001). Critical care nurses engage in both routine and non-routine tasks during the performance of patient care. These nurses may have high information needs, especially during non-routine tasks, and need to seek further information, using evidence-based resources, to make decisions and resolve problems.

## **1.2. Purpose**

The purpose of the study was to examine: 1) the direct relationship between nurses' information-seeking behaviour and use of accumulated knowledge, and the non-routineness of tasks; and, 2) the extent to which nurses' perception of their problem-solving abilities when completing patient care tasks in the critical care hospital setting, moderate the relationship between information-seeking behaviour and use of accumulated knowledge, and non-routineness of tasks. The research question for the study is two fold: (1) How does the non-routineness of the task affect nurses' information-seeking behaviour and use of accumulated knowledge? Specifically, does the non-routineness of the task positively or negatively affect nurse's information-seeking behaviour and use of accumulated knowledge?; (2) How does the nurses' perception of their problem-solving ability, as exhibited by their



problem-solving confidence, personal control and avoidance-approach style in problem-solving, affect the relationship between the non-routineness of the task and the nurses' information-seeking behaviour and use of accumulated knowledge? Specifically, how does the perception of the nurses' own problem-solving abilities (i.e., problem-solving confidence, personal control, and avoidance-approach style) strengthen or attenuate the relationship between the non-routineness of the task and information-seeking behaviour and use of accumulated knowledge? Context (i.e. the environment in which nurses perform tasks to provide care) and nurse characteristics are confounding variables for this study.

The key concepts of this study includes: information-seeking behaviour; the use of accumulated knowledge; the non-routineness of the task; and, the nurse's perception of their problem-solving ability.

### **1.3. Significance**

This research is significant because it provides insight into the critical care nurses' perception of their problem-solving abilities, especially as it relates to published and informal information sought during the performance of a non-routine task. For example, a non-routine task could be the administration of an unfamiliar medication to a critically ill patient. If the critical care nurse cannot complete this task in an appropriate amount of time, then negative consequences could result for the patient. Efficient and effective information-seeking, as part of the problem-solving process, positively impacts the completion of non-routine tasks. Furthermore, this research provides insight on how information is sought from resources. It may assist to inform educators and employers on what information resources are necessary to promote the access to, and use of, evidence-based information in a critical care setting. Also, the results of this study could assist in directing efforts towards training nurses in problem-solving and information-seeking, as well as encourage the provision of appropriate resources to nurses at the point of care, in a user-friendly format. It may inform educators and employers on the effects of context, nurse characteristics, and the nurses' perception of their problem-solving abilities, during a non-routine task. It is important that nurses use evidence-based information to guide practice so that quality patient care is given.

## CHAPTER 2: LITERATURE REVIEW

### 2.1. Introduction

Within the hospital setting, access to evidence-based information resources is often a challenging prospect for nurses to support the performance of non-routine tasks on their nursing units. Resources have become scarcer, and the growth of nurses' information needs has multiplied due to increases in new technology and products aimed at assisting in the care management of patients. In the past, many nurses have not used information resources significantly, such as electronic guidelines, instead relying on paper charts that provided isolated facts about patient specific information. This has resulted in a knowledge gap related to how information-users seek information as part of the problem-solving process aimed at successfully completing patient care tasks (Pringle & Nagle, 2009). Well-integrated, easily accessible and interpreted information is required to assist nurses during patient care tasks. An example of this type of resource is internet web access online functionality. Nurses need to recognize and act to fulfill information needs when needs arise to provide appropriate, effective, and efficient patient care. This expectation is further compounded by the expanding growth of knowledge and how information may be accessed from many different types of resources (Pringle & Nagle, 2009).

The individual's choice of problem-solving strategy influences how information is sought from resources for a non-routine task (Gill & Hicks, 2006). While clinical judgment and experience are always involved in task-related decision-making, information-seeking behaviour, as part of the problem-solving process, plays an important role as multiple options arise on how best to deal with a complex, non-routine task.

### 2.2. Information-seeking behaviour and use of accumulated knowledge

The main concepts of this study are information-seeking behaviour and use of accumulated knowledge, and how these are influenced by the non-routineness of the task and the individuals' perception of their problem-solving abilities.

An integrative review of research literature was conducted. The literature review commenced with the information-seeking behaviour concept because it is central to the purpose of this study. Byström and Järvelin's *Information-seeking model* (1995) was used as an organizing framework for the remainder of the review. This model shows that an individual's information need analysis is based upon information-seeking behaviours, use of accumulated knowledge, task complexity, problem-solving and individual/contextual factors.

A review of the literature relevant to each of these concepts is presented. Information behaviour, information need and use of accumulated knowledge are discussed prior to the introduction of key information-seeking models. Information-seeking resources for nurses are expressed in terms of sources and channels. The review also focused on literature that has explored task routineness in relation to information seeking behaviour. In this study task routineness is conceptualized as one dimension of task complexity, and is defined as: “the degree to which the task is unfamiliar to the task performer” (Gill & Hicks, 2006, p.8-10). More will be discussed about task routineness in the literature review that follows. *a Priori* determinability of the task and categorization of tasks were addressed prior to a discussion of problem-solving and problem formation. Perception of problem-solving abilities including the domains of personal control, avoidance-approach style and problem-solving confidence were explored. Finally, individual and contextual variables were considered for their impact on nurses’ information-seeking behaviours and use of accumulated knowledge. Research gaps in the literature were discussed followed by the study’s research questions.

### **2.3. Literature Search Strategy**

The purpose of the literature search is to locate resources that discuss nurses’, more specifically critical care nurses’, information-seeking behaviours. The following databases were searched: *Medline*, *OVID*, *ISI Web of Knowledge*, *PsycInfo*, and *Google Scholar* search engines, as well as information sciences literature. Reference lists of all full text articles were reviewed to identify potentially relevant articles that may not have been captured in electronic databases. Articles that were not accessible electronically were retrieved manually. As the purpose of this study is to explore information-seeking practices of critical care nurses from resources during patient care, the key search terms employed were reflective of the concept of information-seeking behaviour, and included: information, information behaviour, nursing, information-seeking, information needs, information tasks, evidence, evidence-based, and research evidence. Further, MeSH headings were used to describe other synonymous or similar terms such as, information retrieving or evidence-informed, applied in the literature. In order to refine the search, boolean operators of AND/OR were used to combine the key search terms for information-seeking behaviour. A review of the titles and available abstracts of search identified sources was completed to determine if the full article should be retrieved for further evaluation.

Once research literature was located and reviewed, the following information was extracted from peer reviewed publications: (a) the study design; (b) the setting, sample, and

response rate; (c) independent and dependent variables, measures of these variables, and psychometric properties of measures including alpha coefficient; and, (d) the study results. The literature search revealed 104 peer-reviewed papers related to nurses' information-seeking. Of the 104 reviewed, 20 were theoretical papers, nine literature reviews, three thesis dissertations, and 72 empirical studies. Appendix A highlights the studies that met the selection criteria focusing on critical care nurse information-seeking. Further, the preliminary review of critical care nurse information-seeking has been reported in the literature by Newman and Doran (2012) for this study.

#### **2.4. Information-Seeking**

Information-seeking is embedded in a larger process of problem-solving that provides the context for establishing or acting on information. Non-routine tasks require nurses to problem-solve and seek information resources to successfully complete this portion of patient care. The non-routineness of the task is also likely to be influenced by the individual nurses' experience of previously performing the task, and by the knowledge that eventually leads individuals to improve the ways they learn, or meta-knowledge (Gill & Hicks, 2006). Meta-knowledge consists of knowledge about knowledge that imparts approaches to problem-solving strategies, such as reasoning (Gill & Hicks, 2006). Meta-knowledge is the knowledge an individual needs but they do not possess so the individual gathers pertinent information with regards to their task. Information-seeking behaviour is an essential concept for information behaviour in the literature for information sciences and organizational behaviour. In nursing, the concept of information-seeking behaviour is related to the concept of evidence-based or research-evidence seeking.

#### **2.5. Information behaviour definition**

Information-seeking behaviour describes how nurses identify information needs and then carry out the process of information-seeking. Nurses' action to satisfy their perceived information needs in order to effectively perform a task is information-seeking.

This study considers information as the knowledge gained as a result of the process of identifying and choosing among alternative resources (Rouse & Rouse, 1984). The study examined how this information is sought to complete a critical care nursing task related to patient care. According to Case (2007), "*information behaviour* encompasses information-seeking as well as the totality of other *unintentional or passive* behaviours (such as previewing or encountering information), as well as purposive behaviours that do not involve

seeking, such as actively *avoiding* information” (p.5). Critical care nurses may not pursue information needs during patient care due to lack of motivation, time or resources, or they may not be actively motivated to seek any evidence (McKibbon, 1996).

## **2.6. Information need definition**

Information need is defined in this study as recognition that the nurse’s knowledge is inadequate to perform a task (Case, 2007). It should be noted that the actual use of information falls outside the scope of this study. The primary focus of this study is how nurses perceive their problem-solving abilities, during a non-routine task, to seek information that will assist in meeting their information need, resulting in the successful completion of the patient care task.

## **2.7. Information-seeking definition**

Information-seeking covers a variety of behaviours motivated by the recognition of missing information, or information needs (Case, 2007). This study uses the definition of information-seeking as a search for resources of practice knowledge to satisfy a perceived information need for a patient care task (Krikelas, 1983). This definition was selected because it considers an individual’s perception of the importance of their information need. If the information need is perceived to be important to nurses, then they will choose to seek information during patient care.

Information-seeking models guided the conceptualization of nurses’ information-seeking behaviour, use of accumulated knowledge by nurses, factors influencing the non-routineness of the task, and the perception of their problem-solving ability.

## **2.8. Information-Seeking Models**

Some of the information-seeking models found in the information sciences research literature include: *Sense-making theory* (Dervin, 1983); *Wilson’s model of information behaviour* (1996); *A model of the information-seeking of professionals* (Leckie, Pettigrew & Sylvain, 1996) and *Information-seeking model* (Byström & Järvelin, 1995).

*Sense-making theory* (Dervin, 1983) reveals the nature of a problematic situation, namely the extent to which information serves to bridge a gap to a problem, and the nature of the outcomes from the use of information. Individuals generally seek information when they encounter a problem of some kind that they see as a barrier to their awareness and understanding of the patient care task at hand. The individual will seek information,

methods, and new approaches to handle problems to help them fulfill their information needs through the process of creating situational awareness. Dervin proposes that when the individuals are aware of what is happening around them, they are better able to understand how information will impact their goals and objectives, as well as improve their understanding in situations of high complexity.

*Wilson's (1996) Model of information behaviour* argues that the context in which the person has information needs is important. The factors that are proposed to influence information behaviour in this model include: psychological; demographic; role-related or interpersonal; environmental; and, source characteristics, which can be supportive or preventive of information-seeking. Information behaviours in this model consist of passive attention; passive search; active search; and, ongoing search. In order to satisfy the information need, a feedback loop is required that includes: an active search, information processing, and information use. Three theoretical concepts are presented as activating mechanisms of information behaviour in this model: stress/coping theory, based on the concept that some needs do not invoke information-seeking behaviour; risk/reward theory, focusing on sources of information used; and social learning theory, such as self-efficacy.

*A model of the information-seeking of professionals* (Leckie, Pettigrew, & Sylvain, 1996) proposes that “roles and related tasks undertaken by professionals in the course of daily practice prompt particular information needs, which in turn give rise to an information-seeking process” (p.180). In this model, work roles and tasks are thought to be the prime motivators for seeking information as a professional. Information needs can be influenced by situational or environmental factors, such as: context, frequency of information need, predictability, importance, and complexity of the need situation. Furthermore, where and when professionals seek information depends on factors including experience, personal knowledge, time constraints, trustworthiness of source, accessibility, and costs. Information needs create an awareness of information sources, and can motivate an individual to examine those sources. If the need is not satisfied, then the authors propose that a feedback loop comes into play, indicating that information-seeking may continue until the need has been met. This feedback loop includes sources, awareness, and information sought. Context, the environment in which nurses perform tasks to provide care, can influence an individual's personal style of seeking information from the psychological standpoint. Subjective reasons become involved in influencing information-seeking as well, such as familiarity with accessing evidence-based resources using an electronic device; or situational factors, such as the amount of time available to seek information (Byström & Järvelin, 1995). The authors

argue that routine tasks are habitual and are often not perceived as task problems by the individual because they are familiar. The inputs, processes, and outcomes are *a priori* known, through pre-conceived ideas about knowledge. The resolution to these routine tasks is assumed, usually without an appropriate empirical search. Non-routine tasks cannot be considered *a priori* known (Byström & Järvelin, 1995).

Byström and Järvelin's *Information-seeking model* (1995), however, focuses on information needs in the context of task complexity and posits that if the individual's information needs are satisfied, then the task can be completed successfully. Similarly, if the information needs cannot be satisfied, then the task cannot be completed; or, in the event that sufficient information does not exist to complete the task, then the task must be reformulated. When individuals experience gaps in knowledge while performing a task, then they need additional information in order to complete the task, and must seek out resources to satisfy the gap in knowledge. The authors point out that, if further information is required, an individual may initiate new information-seeking processes, or they may interrupt the process, or choose not to proceed (Byström & Järvelin, 1995). The individual's choice of action during a task depends on: their information needs; the perceived accessibility of information channels related to cognitive, economic, or physical limitations; sources of information; and, their personal information-seeking style. Those individuals who are more successful in making choices during their information-seeking actions will seek information more often to complete a task. The individual's perception to solve a problem with motive includes gathering information. The individual's information need analysis is shaped by personality factors such as attitude towards seeking information, motivation, and mood.

## **2.9. Summary**

Since Byström and Järvelin's *Information-seeking model* (1995) is well-tested and widely accepted in the information-sciences community, this conceptual model was selected to guide this study. This conceptual model encompasses the important aspects of Dervin's, Wilson's, and Leckie et al.'s conceptualizations. These aspects are: seeking information when an information need exists; the context of information need; and, work tasks as motivators to professionals seeking information. Specifically, Byström and Järvelin's *Information-seeking model* integrates separate parts of knowledge through systematization of organizational research integrated with information-seeking research for task complexity (Järvelin & Wilson, 2003). Non-routineness of the task, one feature of task complexity, is one of the major concepts in this study's conceptual model.

Although, the Bystrom and Jarvelin's model has not been tested with critical care nurses, it has guided Sintchenko and Coiera's study (2006) for critical care medicine antibiotic prescribing in ICU. Sintchenko and Coiera (2006) found decision complexity affects task performance and the extent/type of decision support used by individuals in decision-making. They studied the relationship between decision complexity and information-seeking. Also, how the adoption of decision support systems is related to complexity of decision process variables. Confidence in diagnosis and prescribing decision and use of information available was examined too. Antibiotic prescribing (start, stop or modify antibiotic therapy) in critical care is a complex, cognitively demanding task, made under time pressure. A web-based experiment was conducted with 40 board-certified specialist intensive care (ICP) and infectious disease (IDP) physicians working full-time in Australian tertiary referral hospitals to explore the impact of decision complexity of DSS utilization, comparing utilization of antibiotic guidelines and an interactive probability calculator for ventilator associated pneumonia (VAP) plus laboratory data. Decision support was found to be used more often for less complex decisions. Prescribing decisions of higher complexity were associated with a lower frequency of DSS use, but required the use of the more cognitively demanding situation assessment tool for infection risk along with pathology data. Decision complexity seems to impact on the extent and type of information on support used by individuals when decision-making.

Byström and Järvelin's *Information-seeking model* was developed from Järvelin's (1986) framework for the analysis of work tasks, their change and information requirements. This framework was more general and it was not an information-seeking model. Järvelin's (1986) framework led to the empirical investigations in information and retrieval and proposed conceptual developments for task analysis. Task categorization found in Byström and Järvelin's *Information-seeking model* (1995) was based on Anon (1974) *a priori* prescribability of tasks (i.e., outcome process and necessary inputs). Routine tasks are completely prescribable at the outset by individuals working in the context where as for non-routine tasks; even the type of result is unknown in the beginning of the process, the process itself or its information requirements.

In particular, for this study, Byström and Järvelin's (1995) task categorization will be adopted as this conceptualization addresses the individuals' perception of their problem-solving abilities and the relationship between the non-routineness of a task and individual information-seeking and use of accumulated knowledge. This conceptualization was selected because this model is based on *a priori* determinability of a specific task which can be



categorized on a continuum from routine to non-routine. *a priori* determinability will be discussed later. Task categorization, also discussed later in more detail, is a broad enough concept to be used for the analysis of any kind of task (Järvelin & Wilson, 2003). Byström and Järvelin's research focused on administrative workers in developing their *Information-seeking model*; however, further testing of this model among nurses will provide an important contribution to the literature as it has not been previously used with this population.

## **2.10. Empirical Evidence – Information-seeking behaviour**

Information-seeking behaviour is a search for resources of practice knowledge to satisfy a perceived information need for a patient care task (Krikelas, 1983). The active process of the information-seeking behaviour is important since it demonstrates that nurses need to put forth a conscious effort in order to acquire information for a non-routine task. If an individual chooses to remain passive, then they will pass up the information (Case, 2007).

As it relates to information-seeking, nurses are challenged by competing priorities, time pressures, limited information resources, and lack of convenient access to resources (Spenceley et al., 2008). Additionally, literature indicates that critical care nurses also experience barriers to information-seeking in both their paper-based and computerized reporting systems, including: equipment failure; unavailability of technicians; inadequate staffing; social protocols, including peer pressure; and mistakes made while using multiple complex electronic systems (McKnight, 2006).

French (2006) found that tasks that only have a visible, practical solution are followed up by nurses. Front-line nurses are task-driven, with heavy workloads. They generally offer limited attention to, or acknowledge recognition of, potential information needs and knowledge gaps (MacIntosh-Murray & Choo, 2005). As the actual information-seeking action takes time and focus away from patient care, many nurses feel that it is ethically wrong to seek and analyze information from resources, while at work (McKnight, 2006; McKnight & Peet, 2000).

When nurses do seek information, it is generally accessed through numerous channels, such as colleagues, as well as from a variety of sources, such as internet guidelines. Critical care nurses tended to seek information from people, the patient's chart, and computer systems. As McKnight (2006) found, the information critical care nurses used was patient-specific, using social networking and available factual resources and on occasion, knowledge-based information was sought. The nurses' decision to pursue patient care related

questions was based on their perception of how important the answer would be to the care of the patient.

### **2.11. Resources**

As noted previously, information resources, such as sources and channels, are sought by nurses to satisfy perceived information needs to complete a task for patient care (Krikelas, 1983). It is important to discuss practice knowledge resources sought by nurses, specifically the sources and channels, recognizing their preferred information resources and the challenges they encounter in retrieving information. Most importantly, to provide quality patient care, nurses need to have accessible resources so they have the capacity to seek information on evidence-based practices at work. A source should contain relevant information, whereas a channel should guide the nurse to pertinent sources. However, Byström and Järvelin (1995) state that there is no absolute difference between channels and sources since a channel may turn into a source, and vice-versa. Below, nurses' sources and channels will be distinguished; however the main point of the discussion is to highlight nurses' information-seeking practice knowledge resources.

### **2.12. Sources**

Nurses require evidence-based information sources that are accessible from their unit, or work location (Leckie et al., 1996). Information-seeking can be limited by the lack of: (1) resources, whether paper or electronic, (2) trust in a source, (3) quick accessibility, or (4) convenient for nurses (Spenceley et al., 2008). Most staff nurses are required to complete their tasks in defined workspaces during point-of-care activities, with inadequate information resources that are often of limited applicability due to resources being outdated or difficult to find for use. Spenceley et al. (2008) found that nurses' information-seeking is driven by urgent information needs. Gorman, Yao and Seshadri (2004) found that clinicians usually consulted one or, at most, two information sources to find answers to their questions, and only for a period of ten to fifteen minutes. Also, novice nursing students infrequently used more than one information-seeking resource to obtain information (Borycki, 2009). Therefore, it is important for nurses to have evidence-based information accessible on their work units so that they can seek information effectively and efficiently, especially for the purpose of completing non-routine patient care tasks.

Nurses mostly use information and library services for pursued schooling course work and formal research rather than for current patient care issues (Urquhart & Davies, 1997). It

has also been reported that nurses tend to use the source of information that is most immediately accessible to them during work. This often includes outdated guidelines, even though they realize that this source might not provide the most complete answer (Marshall, West & Aitken, 2011; Urquhart & Crane, 1994).

Ease with technology also plays a role. For example, Tannery et al. (2007) found that after one year of access to a library's electronic resources, 20% of nurses chose this option over print resources that were more dated. There are many new technologies through which knowledge can be translated now. For example, smart phones and personal digital assistants could be used by nurses with social media platforms to gain knowledge. Although electronic devices and resources are now more readily available for nurses in their work environment, this does not guarantee a change in their information-seeking behaviour. A possible explanation is that nurses who work in a culture that supports technology and provides training to assist their information-seeking behaviours are more likely to adopt changes related to evidence-based practices. Adaptations to nurses' change in information-seeking behaviours can occur immediately, gradually or never. There will also be variations to nurses' adaptation to change their information-seeking behaviour due to their individual characteristics, such as experience with technology or their motivation.

### **2.13. Channels**

Nurses may have several sources of information to use during their practice; however channels, usually in the form of colleagues, are currently the most sought-after type of information resource by nurses (Cranley et al., 2009; Spenceley et al., 2008; Kosteniuk et al., 2008; Doran et al., 2007; Tan et al., 2006; Dee & Stanley, 2005; Estabrooks et al., 2005; Pravikoff, Tanner & Pierce, 2005; McKnight, 2004; Thompson et al., 2005; Pravikoff, Pierce & Tanner, 2003; Cogdill, 2003; Urquhart & Crane, 1994). This implies that nurses perceive that the easiest and most efficient access to information, when completing nursing tasks, is through channels, such as colleagues. Due to accessibility and convenience, local resources are more often sought by nurses (Spenceley et al., 2008). Further, nurses prefer colleagues as their primary information resource since they are familiar, are perceived to be reliable, can give precise information, are accessible, and can provide immediate answers that are relevant and applicable to the setting (Corcoran-Perry & Graves, 1990). However, it should be noted that information provided by colleagues might not always be accurate. Regardless, nurses still trust information from colleagues, finding this information more valid than others, and "in their eyes" more questionable, resources (Spenceley et al., 2008).

Similarly, Thompson et al. (2004) found that nurses sought information from accessible human channels of information such as a Clinical Nurse Specialist (CNS). CNSs are able to contextualize and summarize knowledge in a timely manner for nurses, and they are recognizable on the unit. As mentioned previously, some nurses feel that the completion of patient care tasks is a priority and searching for information is not a worthy use of their time. Nurses seek information from a CNS because they are easily accessible at the point-of-care, are seen to possess knowledge, and are perceived as useful information sources because they can directly answer questions posed by nurses. Nurses in the CNS position are perceived to be authoritative in their knowledge, and trustworthy. CNS provides supportive information in an unchallenging manner, without the risk of criticism in the staff nurses perception (Thompson et al., 2004). CNS is sought for quick access to answers since nurses are conscious of the time that is needed to give patient care, rather than searching for information (Thompson et al., 2004). Profetto-McGrath et al. (2007) found that CNSs use research literature as a primary source of evidence for their nursing practice, and that this information is used in their decision-making processes towards patient care. In this manner, the CNS is perceived by staff nurses to be able to translate their up-to-date knowledge to staff nurses whose main priority is to complete patient care tasks in an effective and timely manner. Nurses developed a trust for the specific channel exemplified by the CNS.

It is interesting to note that nurses are most likely to seek information for medication practices. As shown in the literature, the top priority for nurses' information-seeking is related to medication administration and management during patient care (Doran et al., 2007; Secco et al., 2006; Lange, 1993). Medication administration tasks can occupy up to one-third of the nurses' time; therefore, it is a complex and time-consuming process (Pepper, 1995). Medication administration and management tasks are important to patient safety, as well as being part of the care plan. Therefore, nurses will dedicate time to seek out information, especially for non-routine medication administration tasks, to prevent errors (Wakefield et al., 1999) and risk patient safety.

#### **2.14. Summary**

Nurses have information needs during the performance of non-routine patient care tasks. They will seek information through resources (sources and channels) to find evidence to complete those tasks. The degree of effort to find evidence-based information, however, depends on the nurses' perceived information need priorities. It has been found that, for routine task questions, nurses usually seek information from a single source, but for non-

routine task questions they would often use multiple sources (Blyth & Royle, 1993; Gorman et al., 2004).

Furthermore, patient care tasks can have varying levels of complexity in terms of their non-routineness. The following discussion will address the non-routineness of the task, and its influence on the nurses' information-seeking behaviour and use of accumulated knowledge. Definitions of task, task complexity and the non-routineness of the task will be reviewed.

### **2.15. Task**

A nurse's job consists of tasks, which consist of levels of progressively smaller subtasks (Byström & Järvelin, 1995). Gill and Hicks (2006) defined task based on Hackman's work (1969): "a task is a set of assigned a) goals to be achieved, b) instructions to be performed, or c) a mix of the two" (p.3). This definition will be used in this current study.

Tasks require specific nursing knowledge, skill, and judgment. In this way, the nurse needs to be able to understand the task, perform the patient care task, and initiate problem-solving required for the task during patient care. Nursing knowledge is what each nurse possesses, through basic nursing education and continuing learning opportunities relevant to a specific professional practice (CNO, 2002). Nurses have skills that give them the capacity and ability to perform the activities needed to complete each task. "A skill is a special ability in a task acquired by training" (Collins English Dictionary & Thesaurus, 2000a). Judgment is "the faculty of being able to make critical distinctions and achieve a balanced viewpoint" related to the task situation (Collins English Dictionary & Thesaurus, 2000b). Nursing judgment "is the conclusion or enlightened opinion at which a nurse arrives following a process of observation, reflection and analysis of observable or available information or data" (Phaneuf, 2008, p.1). As an example, a nurse has accumulated knowledge to understand the signs of a patient's hypoglycemic response when the patient presents with nausea, diaphoresis, shakiness, feeling faint and extreme apprehension. Consider that the nurse might complete the task of patient assessment, perform the skilled task of taking a blood glucose measurement on the patient, and make a patient care judgment based upon a low blood glucose test result. A nurse with the knowledge, skill, and judgment to care for a patient with hypoglycemia would then be in position to give a form of glucose, such as fruit juice, sugar, honey, or milk, or a glucose-elevating medication to assist the patient through this episode requiring care. The nurse's practices related to the identification and management of hypoglycemia, such as amount of glucose to be administered, are informed by up-to-date

evidence found in the literature. Continuous reassessment would also occur until the patient's blood glucose level returns to normal. The patient's plan of care, including medications, level of activity, and diet, would be reviewed by the nurse to follow-up on changes required, as well as initiating additional patient education related to diabetes.

Moreover, the complexity of a task should be considered individually for each nurse because nurses "may interpret the same objective task differently as in regards to its non-routineness, and the task always forms the basis for interpreting information needs and the choice of actions for satisfying them" (Byström & Järvelin, 1995, p.193). Therefore, tasks can be analyzed for their level of complexity in terms of the non-routineness of the task. Tasks that are complex to the nurse, in this study, are considered to be non-routine.

## **2.16. Task Complexity Definition**

Gill and Hicks (2006) indicate that 13 task complexity constructs exist in the literature (Appendix B). In this study, task complexity, based on non-routineness of the task, will be defined as: "the degree to which the task is unfamiliar to the task performer" (Gill & Hicks, 2006, p.8-10). This construct was chosen because the nurses' experience performing the task, and their *a priori* knowledge, influence how they problem solve. A routine task is typically viewed as a simple task to the individual and can be viewed as a familiar task since the nurse has accumulated knowledge that is relevant to the task. The nurse has preconceived knowledge about the task; therefore, no problem-solving is required by the nurse to perform the task. However, if the task is non-routine and therefore unfamiliar, the nurse would not have any preconceived knowledge about the task. Consequently, the nurse would have information needs.

## **2.17. Non-routineness of the Task**

One dimension of task complexity, specifically non-routineness of the task, is of interest in this study. Gill and Hicks (2006) explained that the non-routineness of the task is the degree to which the task is unfamiliar and complex to the task performer. The perception of non-routineness of the task should diminish as knowledge accumulates, such that the task becomes more routine to the individual as more knowledge becomes available. As the task becomes routine, the individual does not have a need for information to perform the task since they have preconceived knowledge to complete it. It is a lack of information that prompts information-seeking.

The individuals' response to non-routine tasks is influenced by perception of their problem-solving skills and abilities to make choices (Gill & Hicks, 2006). Therefore, problem-solving appraisal, which is the individual's perception of their problem-solving skills, can influence the nurse's choice of strategy when seeking information to complete a non-routine task. The familiarity with the task increases as knowledge accumulates (Gill & Hicks, 2006). Consequently, as the individual gains experience performing the task, the task becomes progressively more routine and the nurse can rely on personal experience and training to complete the task, rather than seeking information from external resources such as published information.

The influence of external demands, such as context and meta-knowledge, may lead to the adoption of strategies that change the degree of task structure. As previously mentioned, meta-knowledge consists of knowledge about knowledge that provides access to a variety of search intensive, general problem-solving strategies, such as reasoning by analogy, and decomposition (Gill & Hicks, 2006). To conserve cognitive resources when external demands are high, a nurse might choose to use the first acceptable alternative presented by a task problem. For example, a nurse seeking information may turn to the most available resource, such as a colleague, who depending on his/her expertise, might not provide the most effective or accurate information for the task. Alternatively, when external task demands are low, or if the task performer's need for cognitive stimulation is high, then they might choose to try a new approach to performing a familiar task (Gill & Hicks, 2006). This implies that as nurses use resources, they will in turn learn the knowledge to perform the task, thereby no longer having information needs for this task. The nurse will develop a preconceived knowledge of the task, thus transforming the non-routine task to a routine task.

### **2.18. *a Priori* determinability of the task**

Problem-formulation and problem-solving are distinct steps that occur during the process of task performance (Byström & Järvelin, 1995). Problem-formulation identifies the problem to be solved, as well as the information requirements of the task.

Additionally, Roberts (2004) found nurses' information-seeking activities to be one set of the key skills in the problem-solving process. Tasks that nurses' encounter, as described in this study, may be simple, or routine; or they may be complex, or non-routine. In non-routine tasks, nurses will need to fulfill their information needs using problem-solving techniques that employ information-seeking. The nurses already have reliance on information from accumulated knowledge, through personal experience or training, to

perform routine tasks, and on which to base problem-solving of complex tasks. Therefore, problem-solving is the collection and presentation of information sought to fulfill information needs to complete the task (Byström & Järvelin, 1995). For example, in routine tasks there is no problem-formulation because the inputs, processes, and outcomes are *a priori* known; however, these issues for non-routine tasks cannot be determined and are therefore *a priori* unknown (Byström & Järvelin, 1995). *a Priori* is a term derived from Latin literally meaning “from the former”. It can be defined as: 1) deductive, relating to or derived by reasoning from self-evident propositions, or presupposed by experience; and, 2) being without examination or analysis, presumptive, or formed or conceived beforehand (Merriam-Webster’s Online Dictionary, 2008). Therefore, the solution to routine tasks already exists in the individual’s mind prior to, and independent of, the specific task. Routine, or simple, tasks are processed using preconceived ideas; such that, the nurse relies on information from accumulated knowledge to complete a task. Task categorization is based on the individual’s familiarity of that task so a task may be complex to one individual but routine to another.

### 2.19. Task Categorization

Byström and Järvelin (1995) propose five task categories that are based on *a priori* determinability of a specific task. Tasks can be categorized into five different types based on the information-seeking behaviour exhibited and the decision-making associated with completing a task:

- 1) *a Priori* completely determinable, or known, so that, in principle, the task could be automated and is familiar. This is a routine task since knowledge has been previously accumulated to perform the task.
- 2) Tasks are almost completely *a priori* determinable, however part of the process, and information needed, is *a priori* indeterminable.
- 3) Structured tasks that have both *a priori* determinable and *a priori* indeterminable information requirements.
- 4) *a Priori* known, however permanent procedures for performing the tasks have not yet emerged. Therefore, the process is largely indeterminable, and so are the tasks’ information requirements.
- 5) Unexpected, unfamiliar, new, and unstructured tasks – where neither the result, nor the process, nor the information requirements can be characterized in advance. This is a non-routine task – *a priori* unknown or indeterminable.



Thus, if a task is considered to be *a priori* determinable, then it is routine, or simple, in nature. The nurse knows the solution and processes preconceived ideas and accumulated knowledge to perform the task. Conversely, if the task is *a priori* indeterminable, then it is considered non-routine, or complex. The nurse does not have preconceived ideas about performing the task and she/he will have an information need. The type of *a priori* determinability of the task has a direct relationship with the nurses' information-seeking behaviour.

Nursing care is comprised of routine tasks and non-routine tasks. Additional information needs required for the successful completion of a task are discovered during the performance of non-routine, or complex, tasks. Information-seeking and problem-solving processes are engaged to complete complex tasks. In order to meet their information needs, nurses have to access resources. Nurses' information-seeking behaviours depend on how important the nurse perceives the information need to be, and how willing they are to seek the information from resources, such as published (formal) and informal information.

## **2.20. Summary**

Routine tasks are situations in which a nurse typically has a ready response, and these tasks are so familiar that they are not thought of as problems, and are hardly noticed. The nurse has previously learned knowledge, or readily available information, that assists in the performance of the simple task. In other cases, nurses may have limited knowledge about a task, which then prompts them to seek information to help them perform the non-routine task. Non-routine tasks require individuals to seek new information through their resources to resolve questions about the task. At the central area of the continuum, tasks can have components that are both routine and non-routine. The degree to which the tasks are comprised of varying levels of routine and non-routine aspects rise and fall along the length of this continuum. Therefore, in these compound types of tasks, parts of the solution, and means to the solution are routine and simple, while some new information-seeking will be needed to resolve the more complex, non-routine, components (Heppner & Krauskopf, 1987).

## **2.21. Problem-solving**

Nurses must problem-solve to make a choice of strategy for patient care during non-routine tasks. A problem is a puzzle, or question, set for solution (Collins English Dictionary & Thesaurus, 2000c). A problem is a situation which makes it difficult for a nurse to achieve a desired goal, perform a task, objective or purpose. The following discusses problem-

solving in general, and then examines more specifically nurses' perception of their problem-solving abilities.

## **2.22. Problem Formation**

Information-seeking is of key importance in the initial phase of problem-solving (Elstein & Bordage, 1988). Information-seeking initiates the process of problem resolution. The most common difficulty in problem-solving is not the lack of information, but poor information acquisition and utilization (Roberts, 2004). There are increasing amounts of information available, however individuals need to know how to search for evidence-based resources and make use of these resources appropriately. Problem-solving can refer to successful and unsuccessful activities, or conscious and unconscious activities, aimed at approaching or avoiding a problem (Heppner & Krauskopf, 1987). Therefore, problem-solving implies that a problem does exist such that a nurse would be required to meet information needs to perform the non-routine task. Problem-solving is a complex process that focuses on analyzing a difficult situation and always includes a decision-making step (Becker & Fendler, 1990; Craven & Hirnle, 2000). Problem-solving involves obtaining information when there is a gap between what is occurring and what should be occurring (Altun, 2003). A problem might be solved immediately, or might involve many decisions, have multiple possible solutions, and be so ambiguous as to impede evaluation (Heppner & Krauskopf, 1987). An individual's perception of their problem-solving abilities can influence how routine and non-routine tasks are resolved. One aspect of the problem-solving process includes information-seeking and this is important because, without the nurse gathering sufficient information, they cannot develop an effective plan of care for patient-care related tasks (Roberts, 2004). The domains of personal control, problem-solving confidence and avoidance-approach style can be assessed for nurses' perception of their problem-solving abilities (Heppner et al., 2004).

## **2.23. Perception of problem-solving abilities**

The individual's perception of their problem-solving abilities is made up of three factors: personal control; avoidance-approach style; and, problem-solving confidence (Heppner, 1986).

### **2.2.1. Personal Control.**

Personal control, in this context, is defined as the extent to which individuals believe that they are able to direct their emotions and behaviours while solving problems (Heppner, 1986). Individuals who have high personal control reported fewer dysfunctional thoughts and irrational beliefs, such as negative thoughts regarding performance, related to their perceptions of their problem-solving abilities (Heppner & Krieshok, 1983). It was also noted by Larson et al. (1995) that fewer negative self-statements and debilitating cognitions, such as the individual stating they cannot do the task, were reported by people who felt in personal control; whereas, other studies found that there were fewer task-inhibiting self-statements, such as the individual stating they can do the task during difficult interpersonal encounters (Mayo & Tanaka-Matsumi, 1996; Heppner, Witty & Dixon, 2004). It was also determined by Chang and Gaskill (1991) that nursing students' perception of their problem-solving abilities for personal control in relation to their course success improved when compared before and after the course.

### **2.2.2. Avoidance-Approach style.**

The avoidance-approach style for problem-solving takes into account individuals' active approach, or avoidance, to solve a problem (Heppner, 1986). Avoidance-approach style is defined as the general tendency of individuals to approach or avoid problem-solving activities. Effective problem-solvers reported that they were more motivated to solve problems, persist longer, and delay gratification longer in struggling with problems than ineffective problem-solvers (Heppner et al., 2004). Therefore, successful problem-solvers actively approach a task. Altun (2003) found that nursing and midwife students who stated that they would either avoid a problem, or let time handle it, or do the first thing that came to their minds considered themselves less successful in problem-solving. Moreover, Chang and Gaskill (1991) found that nursing students were more likely to approach, rather than avoid, problems after, as compared to before, completing their program. However, MacIntosh-Murray and Choo (2005) found that nurses were afraid, or unwilling, to ask questions, or admit that they might need help with a task, because if they did, they might be seen as incompetent. Under these circumstances, information needs and information-seeking may be suppressed or avoided altogether.

### **2.2.3. Problem-solving confidence.**

The degree of confidence in problem-solving skill is another domain of problem-solving (Heppner, 1986). Degree of confidence is defined as the self-assurance shown while engaging in problem-solving activities (Heppner, 1986). Effective problem-solvers with high problem-solving confidence expect themselves to be successful in problem-solving (Heppner et al., 1982; Heppner et al., 2004). In contrast, ineffective problem-solvers are less able to respond to problems, and also respond less effectively to their environment (Heppner et al., 2004). As well, ineffective problem-solvers tend to be unaware of resources that can help with the problem, use these resources less frequently, and are less satisfied with resources or training opportunities (Heppner & Krieshok, 1983; Neal & Heppner, 1986; Tracey, Sherry, & Keitel, 1986; Heppner et al., 2004). Confidence in problem-solving for nursing students improved significantly ( $P < 0.01$ ) after completion of their nursing program (Chang & Gaskill, 1991). Therefore, information and knowledge gained through their course improved their confidence in problem-solving. Likewise, Altun (2003) found that nursing and midwife students who acted decisively in problem-solving considered themselves successful problem-solvers; whereas, those not acting decisively considered themselves unsuccessful problem-solvers. It was found that a confident student, who considers him/herself a successful problem-solver, was able to act decisively to problem-solve.

### **2.24. Summary**

There is a difference in individuals' perception of their problem-solving ability between people who perceive themselves as effective problem-solvers, with high confidence, high personal control, and a positive attitude toward approaching problems, and those who perceive themselves as ineffective problem solvers, with low confidence, low personal control, and avoidance behaviour related to problem-solving. Effective problem-solvers are aware of their environment and use appropriate sources and channels for their information needs; whereas, ineffective problem-solvers tend to avoid trying to solve problems and make less use of resources that can assist the problem-solver (Heppner et al., 2004).

### **2.25. Individual and contextual variables**

In this next section of the literature review, individual and contextual variables that can influence one or more of the primary study variables will be discussed, specifically: (1) nurse characteristics, and (2) the context (or work environment). With regard to task routineness and information seeking, these individual and contextual variables can act as

confounding variables. Confounding variables are those factors that have an effect on the dependent variables, information-seeking and use of accumulated knowledge, which cannot be distinguished from the effect of the independent variable, the non-routineness of the task. These variables need to be considered because they can potentially threaten the internal validity of the study, and can lead to erroneous conclusions. A confounding factor can either conceal the relationship, therefore making it appear as if there is no relationship when really there is a relationship, or the confounder can make it seem that there is a relationship when in fact there is no relationship.

The nature of nurses' work is highly contextual (Spenceley et al., 2008; Estabrooks et al., 2005). Structural and cultural attributes of the context, in this case the work setting, and the individual nurse characteristics, influence how nurses seek information in their practice (Spenceley et al., 2008). Bucknall (2000) indicates context influences decision-making by critical care nurses through geographical location (ie., rural vs. private urban), physical layout of CCU and unit structure. Therefore, critical care is a unique context and specific contextual factors can influence critical care nurses decision-making (Bucknall, 2003). Bucknall (2003) found that hierarchical systems existed that provided decision making support for less experienced staff, who passed information and provisional decisions on to more experienced staff until someone made a decision. Also, Bucknall (2003) found that all clinical decisions were strongly directly influenced by the context in which the decision was made. There are three key environmental influences identified: (1) the patient situation or health status, (2) resource availability and (3) interpersonal relationships. Time and risk guided all clinical decisions by critical care nurses. Nurses established the state of the situation, the time constraints on decisions and the level of risk involved for both patient and nurse.

For the purposes of this study, the McCormack and McCarthy (2007) definition of context is used. Context is defined as the environment in which nurses perform tasks to provide care. The setting of critical care units in Ontario hospitals was chosen to provide maximum variation in non-routineness of the tasks. A province-wide survey of multiple critical care units provided the data.

The nurse characteristics and the context factors were identified through the literature review (Spenceley et al., 2008). These factors were found to facilitate nurses' information-seeking behaviour.

#### **2.2.4. Nurse Characteristics.**

Nurses' information-seeking behaviour is influenced by nurses' personal attributes; primarily age, level of education, and years of nursing experience (Spenceley et al., 2008). The characteristics of a nurse impact how information needs are identified and sought for patient care. For example, Hall et al. (2003) noted that nurses who lacked knowledge and are information-seeking can be identified by other nurses as having inexperience and uncertainty. They found more frequent information-seeking activity by nurses assuming new roles; however, nurses had the expectation that such activity would diminish as they gained experience in the role. Thus, with time the likelihood that nurses will seek information when they have an information need decreases. Although Corcoran-Perry and Graves (1990) indicate that practitioners' characteristics are proposed to influence information behaviour, their informal examination of cardiovascular nurses' educational and experiential background did not have a relationship with cardiovascular nurses' information behaviours. Spenceley et al. (2008) found that when Advanced Practice Nurses (APNs) with higher levels of education, such as graduate degrees, sought evidence-based information, they used journals as one of their top sources of information, along with colleagues. The level of education achieved influences resources used for information-seeking due to the information-seeking training opportunities. Nurses without these educational opportunities may not have the chance to learn information researching skills. As noted previously, the majority of RNs were found to use colleagues as their primary source of information.

Spenceley et al. (2008) also noted that nurses' characteristics such as experience can impact how information is sought to complete patient care tasks. The specific nurse characteristics investigated in this study are: professional designation, primary role, length of work as a critical care nurse and nurse in general, gender, year of birth, formal education completed, and current employment status. Demographic variables are typical background variables that are often inter-related (The International Development Research Centre, 2010).

#### **2.2.5. Context.**

The context, in this study, involves critical care units in Ontario hospitals. "Critical care nurses are highly knowledgeable and skilled health care professionals that work in a critical care unit in collaboration with members of the health care team to provide optimum holistic care" (Critical Care Secretariat, 2007, p.4). Critical care nurses are responsible for providing care to patients who are experiencing, or are at risk of experiencing, life-

threatening conditions. Patients typically seen in a critical care hospital setting include those who have had major invasive surgery, major trauma, or patients with multiple organ failure (Futures in Nursing, 2010). Critical care nurses must assess and monitor patients closely in order to identify subtle changes in the patient's condition that may require immediate intervention. Patients who are admitted to a critical care unit tend to be medically unstable, requiring constant cardiac and respiratory monitoring and continual adjustment of treatment, such as the titration and dosing of multiple intravenous medications, and changes in ventilator support (Futures in Nursing, 2010). Critical care nurses must be able to seek, interpret, integrate, and respond to the presentation of patients' health through clinical information to make decisions for patient care (Futures in Nursing, 2010).

Critical care nurses' information-seeking behaviour can be described as a "vigilant surveillance" (McKnight, 2006, p.149). Critical care nurses browse or scan the environment, by monitoring, encountering, and being aware of new information. Critical care is a specialty area in the hospital that frequently implements experimental or new treatments due to the acute, life-threatening nature of its patients. RNs are constantly faced with unfamiliar, non-routine tasks, where information needs develop that are related to performing these unfamiliar tasks. McKnight (2006) noted that critical care nurses' on-duty information-seeking behaviour in this "information ecology" (p.146) can literally be a matter of life and death.

The context in which a nurse works impacts how information is sought for patient care tasks. This context influences nurses' information-seeking behaviour through the availability of administrative support, organizational context, and training opportunities (Spenceley et al., 2008). For example, several studies indicated that resources considered facilitative of information-seeking in the organizational context were: time to engage in information-seeking; the availability of up-to-date resource materials; and, the existence of administrative and research support (Spenceley et al., 2008). Professional development and collegial interaction around nursing practice were also noted as being important and facilitative of nurses' information-seeking. Other enablers were identified: training related to information access, and the positive influences of workplace cultural factors on information-seeking. The most significant factors included: the importance of a positive climate for learning and growth; the involvement of nurses in designing new information sources and in deciding how information sources would be incorporated into their practice setting; and, the direct involvement of nursing leaders in the information-seeking process (Spenceley et al.,

2008). The critical care context was chosen for this study because of the above points, as well as being a complex work setting with high acuity patients.

### **2.26. Summary**

As noted above a confounding variable can either conceal the relationship, or make it seem that there is a relationship when in fact there is no relationship. Therefore, it is important to control for the potential confounding influences of context and nurse personal characteristics in this study.

### **2.27. Research Gaps**

Research gaps exist in the literature with respect to how the non-routineness of the task affects nurses' information-seeking behaviour. Studies investigating non-routineness of the task in the organizational behaviour literature have focused on activities of administrative workers. However, there is no investigation of the relationships between information-seeking behaviours and use of accumulated knowledge for nurses. A few studies have explored student nurses' and nurses' perception of their problem-solving abilities but they have not examined the effects of problem-solving abilities on the relationship between the non-routineness of the task and information-seeking behaviour and use of accumulated knowledge. This study contributes to the nursing literature by exploring how the non-routineness of the task affects nurses' information-seeking behaviour from published and informal information, as well as use of accumulated knowledge, and how nurses' perception of their problem-solving ability affects these relationships in the Ontario critical care hospital setting. Nursing literature indicates that nurses generally seek colleagues for information; however, this study is specifically interested in information sought in the context of a critical care nurse having information needs for a non-routine task.

### **2.28. Summary**

A number of factors have increased the complexity of nursing care, such as advances in health care technology. In order to be successfully completed by nurses, all tasks require: specific knowledge to understand and plan care; skill to perform care related activities; and judgment, such as coming to a conclusion or an enlightened opinion.

When nurses perceive that they have positive problem-solving abilities, they view that they can effectively problem-solve to complete their patient care tasks. In doing so, they are more likely to pursue information and use the best available evidence to inform their



decisions about nursing tasks if they have a non-routine task. The context in which a nurse works provides resources that are channels, such as colleagues and sources, often in the form of the published information that can be used to guide practice. An important component of the conceptual model is the non-routineness of the task, such that as nurses engage in non-routine patient care tasks they will experience an information need. If the task is routine and predictable, nurses can draw upon knowledge acquired from training, conferences, policy/protocols and reports or personal experience to guide nursing tasks. However, if the task is non-routine, nurses need to seek new information to guide patient care task decisions. The proposed conceptual model includes the synthesized proposed relationships among the concepts from the literature review that was inductively derived: (1) information-seeking behaviour, (2) use of accumulated knowledge, (3) non-routineness of the task, and (4) perception of nurses' problem-solving ability. Context and the nurse characteristics confound the relationships of interest and will be controlled statistically by the linear regression model. The proposed study provides insight into the critical care nurses' perception of their problem-solving abilities and their information-seeking during a non-routine task, so that efficient, more accessible and evidence-based information-seeking can be promoted for critical care nurses. Figure 2.1. and 2.2. represent the proposed conceptual model and these figures show the proposed relationships among key variables.

## **2.29. Research Questions**

(1) How does non-routineness of the task affect nurses' information-seeking behaviour and use of accumulated knowledge?

(2) How does the nurses' perception of their problem-solving ability (i.e., problem-solving confidence, personal control, and avoidance-approach style), context, and personal characteristics affect the relationship between non-routineness of the task and the nurses' information-seeking behaviour and use of accumulated knowledge?

## **2.30. Hypotheses**

### **2.2.6. Hypothesis 1.**

- a) Non-routineness of the task has a negative relationship with the use of accumulated knowledge. Accumulated knowledge is acquired through personal experience and training, conferences, policy/protocols and reports.

- b) Non-routineness of the task has a positive relationship with information-seeking behaviour (published information and informal information).

### **2.2.2.1. Evidence for Hypothesis 1.**

Routine tasks are situations in which a nurse typically has a ready response because these tasks are so familiar that they are not thought of as problems and are hardly noticed (Byström & Järvelin, 1995). Therefore, nurses use accumulated knowledge such as personal experience and knowledge acquired from training, conferences, policy/protocols and reports to complete the task. The nurse has previously learned knowledge or readily available information that helps her/him to resolve the simple familiar task, thereby completing the task easily. At the other end of the continuum, non-routine tasks are complex and require individuals to seek new information through resources, such as published or informal information, to answer questions about the task. At the center of this continuum, tasks have both routine and non-routine features. Therefore, in these types of tasks, parts of the solution, and means to the solution, are routine and simple, whereas some new information is needed to resolve the more complex and non-routine components (Heppner & Krauskopf, 1987). For routine questions about the task, nurses usually seek information from a single source, but for non-routine questions related to the task they would often use multiple sources (Blythe & Royle, 1993).

### **2.2.7. Exploratory Hypothesis 2.**

- a) Nurses' perception of high problem-solving abilities (i.e. high confidence, high personal control, and a positive attitude on approaching problems) attenuates the negative relationship between the non-routineness of the task and information sought from accumulated knowledge.
- b) Nurses' perception of high problem-solving abilities (i.e. high confidence, high personal control, and a positive attitude on approaching problems) strengthens the positive relationship between the non-routineness of the task and information-seeking behaviour.
- c) Nurses' perception of low problem-solving abilities (i.e. low confidence, low personal control, and a negative attitude on approaching problems) strengthens the negative

relationship between the non-routineness of the task and information sought from accumulated knowledge.

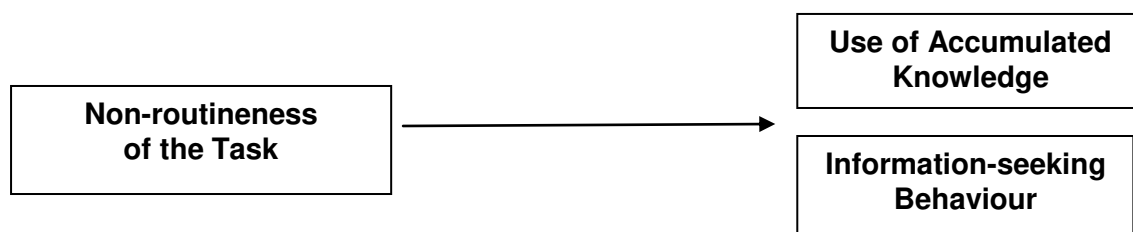
- d) Nurses' perception of low problem-solving abilities (i.e. low confidence, low personal control, and a negative attitude on approaching problems) attenuates the positive relationship between the non-routineness of the task and information-seeking behaviour.

#### ***2.2.2.2. Evidence for Exploratory Hypothesis 2.***

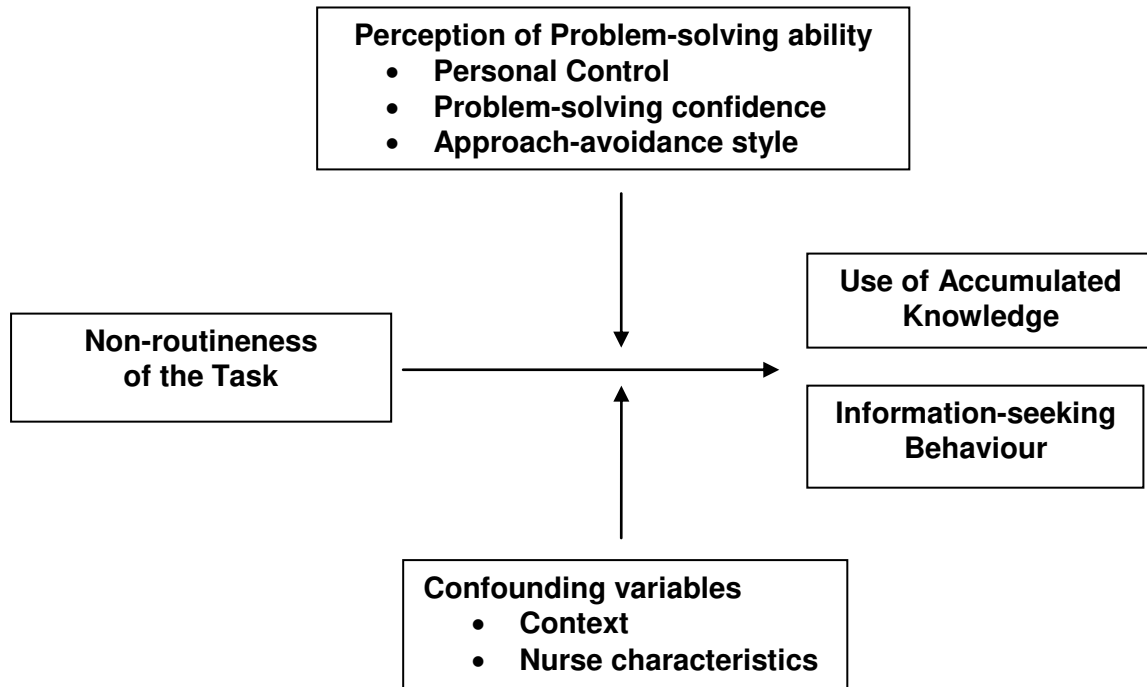
This is an exploratory hypothesis that is derived theoretically and from emerging empirical evidence. The problem-solver's choice of strategy influences how information is sought for a non-routine task (Gill & Hicks, 1996). As the task becomes more routine and the nurse can rely on accumulated knowledge, such as their personal experience, rather than seeking information from resources such as published information, to complete the task. There is a difference in nurse's perception of their problem-solving abilities between people who perceive themselves as effective problem-solvers, such that they have high confidence, high personal control, and a positive attitude on approaching problems, and those who perceive themselves as ineffective, such that they lack confidence, personal control, and avoid problems. Effective problem-solvers are aware of their environment and efficiently use appropriate sources and channels, while ineffective problem-solvers tend to avoid trying to solve problems and make less use of helpful resources (Heppner et al., 2004).

### **2.31. Proposed Conceptual Model**

**Figure 2.1.** Relationship of Independent and Dependent variables



**Figure 2.2.** Relationships among the key concepts



## CHAPTER 3: METHODOLOGY

This chapter details the methods applied in the study. The study design, setting, sample eligibility criteria, sample size, variables and measures, and data collection will be explained.

### 3.1. Study Design

This exploratory cross-sectional study was designed to examine: (1) whether *non-routineness of the task* positively affects critical care Registered Nurses' *information-seeking behaviour* and *use of accumulated knowledge*; and, (2) if *perception of problem-solving ability* moderates this relationship. Data were collected at one point in time with a questionnaire that was mailed to the homes of eligible Registered Nurses in Ontario. The time required to complete questionnaire was approximately 20-25 minutes. Dillman Smyth and Melani Christian's (2009) design method was applied to increase the response rate.

### 3.2. Sample and Setting

The sample for this study was drawn from a population of critical care nurses working in hospitals in Ontario, Canada. The list of names and contact information of potentially eligible nurses was provided by the College of Nurses of Ontario (CNO). The sample was randomly selected from the CNO research participant database.

### 3.3. Inclusion/Exclusion Criteria

The specific eligibility criteria were: current registration as RN or RN EC; work in a critical care hospital setting, including Coronary, Medical/Surgical, Neonatal, Paediatric, Burn, Trauma, or Emergency; and, consent to have the College of Nurses of Ontario (CNO) release their names and contact information for research purposes. Sixty-three percent (5309 out of 8451) of Ontario critical care RNs released their names through the CNO (2009) database.

### 3.4. Estimated Sample Size

To determine the required sample size, the calculation was guided by the recommendation of five cases per predictor to achieve stable parameter estimates (Norman & Streiner, 2008; Kleinbaum, Kupper, & Muller, 1988). Frazier, Tix and Barron (2004) indicate that the sample size should be estimated before data collection by reviewing the pertinent literature with similar studies, however this could not be found because of a lack of

prior studies that examined the relationships proposed in this study. By default, the most parsimonious recommendation of five cases per variable was chosen to guide the sample size estimation since this was an exploratory study (Norman & Streiner, 2008). The variables included confounding, dependent, independent, and moderating variables. There were 17 specific variables of interest; some of the variables represented different dimensions of the underlying construct (See Table 3.1.). Frazier, Tix and Barron (2004) suggest doubling the sample size and/or including additional significant predictors of the outcome variable in the model as covariates to increase statistical power in analyses involving moderators. Consequently, a sample size of at least 170 nurses was required (e.g. 17 variables multiplied by 5 and then doubled = 170). Moreover, a sample size that is larger than the minimum estimated sample size is recommended to address the potential for non-normal or incomplete data. Polit and Hungler (1999) indicate that a 60% or lower response rate is commonly reported in survey research. Robson (2002) observed that a response rate around 40% is not unusual for postal surveys and especially those targeting healthcare professionals. For example, Gerrish et al.'s (2007) study had a response rate of 42%. This study anticipated a 40% response rate so the survey questionnaire was mailed to 425 RNs. Recruitment of more participants to accrue the required sample size within the allotted time for data collection was necessary, so seventy five more questionnaires were sent to critical care nurses' addresses provided by CNO, increasing the total number of questionnaires sent out to 500.

### **3.5. Variables and Measures**

The study variables, conceptual definition, and operational definition are summarized in Table 3.1. A discussion of the approach to measurement for each variable is presented next.

Table 3.1.

*Concept and Operational definitions*

| Concept                               | Definition  | Operational Definition  |
|---------------------------------------|---|---|
| Information-seeking behaviour         | A search for resources of practice knowledge to satisfy a perceived information need for a patient care task (Krikelas, 1983).            | Developing evidence-based practice questionnaire-- (1) published information, & (2) informal information (Gerrish et al., 2007).  |
| Use of Accumulated knowledge          | Preconceived ideas regarding task performance that are <i>a priori</i> determinable and previously accumulated (i.e. through experience). | Developing evidence-based practice questionnaire-- (1) personal experience & (2) training, conferences, policy/protocols & reports (Gerrish et al., 2007).  |
| Non-routineness of the task           | Degree to which the task is unfamiliar and complex to the task performer (Gill & Hicks, 2006).  | Task Characteristics -- non-routineness (Karimi, Somers & Gupta, 2004)  |
| Perception of problem-solving ability | Perception of personal control; avoidance-approach style; and, problem-solving confidence (Heppner, 1986).                                | Problem solving inventory— (1) Personal control: extent to which individuals believe that they are able to direct their emotions and behaviours while solving problems; (2) avoidance-approach style: general tendency of individuals to approach or avoid problem-solving activities; (3) problem-solving confidence: self-assurance shown while engaging in problem-solving activities (Heppner, 1986). |

| Concept               | Definition  | Operational Definition   |
|-----------------------|---|--|
| Context               | The environment in which nurses perform tasks to provide care.                                  | <p>(1)Context Assessment Index – Context (McCormack et al., 2007).</p> <p>(2) Supportive supervision questionnaire – Supervisor Support (Oldham &amp; Cummings, 1996). (3) Received training (Spenceley et al., 2008)</p> <p>(4) type of critical care unit (e.g. CCU), (5) geographic location (rural vs. urban); and (6&amp;7) length of work on unit/ organization (years and months)</p>   |
| Nurse Characteristics | Nurse attributes that influence information-seeking behaviour and use of accumulated knowledge. | <p>(1) Professional designation (RN, RN EC), (2) Primary role (staff nurse, clinical resource nurse /educator/ Advanced practice nurse), (3) how long worked as critical care nurse (years and months) , (4) how long worked as a nurse (years and months); (5) gender (male and female), (6) year of birth (year), (7) completed education (diploma/certification, bachelors degree, masters degree and PhD/DN), and (8) current employment status (Full-time, part-time and casual).</p> |



### 3.6. Dependent variables

#### 3.3.1. Information-seeking behaviour and use of accumulated knowledge.

Gerrish et al. (2008) generated the *Developing Evidence-Based Practice (DEBP) Questionnaire* based on a Canadian version of the measure originally developed by Estabrooks (1998). Only the first subscale, *Sources of knowledge used in practice*, of the *DEBP Questionnaire* was used in this study. This subscale measured *information-seeking behaviour* (i.e., published and informal information accessed by nurses in their practice) and *use of accumulated knowledge*. As noted in Table 3.1., *information-seeking behaviour* was operationalized through published information, and informal information. *Use of accumulated knowledge* reflects knowledge gained through personal experience and training, conferences, policy/protocols and reports. The subscale contains 18 items; each item is scored on a 5-point Likert scale ranging from 1 (never) to 5 (always) (Gerrish et al., 2008). Some items are worded negatively, and these items were reverse coded prior to computing total scores. These items are two sets within the same subscale and measure the concept of *information-seeking behaviour* (9 items total). Published information has 6 items that showed acceptable internal consistency reliability (Cronbach's  $\alpha=0.82$ ), and informal information has 3 items, that had  $\alpha < 0.7$  (Cronbach's  $\alpha=0.689$ ) (Gerrish et al., 2007). Two factors measure the concept of *Use of accumulated knowledge* (9 items total): Personal experience has 6 items with  $\alpha = 0.716$  while training, conferences, policy/protocols and reports has 3 items with  $\alpha = 0.731$ . Values where  $\alpha > 0.7$  are generally regarded as indicating acceptable reliability of the scale (Nunnally, 1994) however the reliability values may be low due to the small number of items or low variability in responses to items (Gerrish et al., 2007). The *DEBP Questionnaire* has been used in other nursing studies (e.g. Mills, Field & Cant, 2009) and demonstrated reliability. To validate the *DEBP Questionnaire*, the study results for items were matched with Estabrook's items and were compared with the findings she reported (1998). Concurrent validity was evidenced by the correlation between the rank-orders of the means for the items in the two studies and it yielded a value of Spearman's  $\rho = 0.897$ , which was significant at the  $p < 0.1$  level (one tail). Tests of the difference between means in the two studies showed non-significance at the 0.01 level using  $t$  (two-tailed for degrees of freedom of around 590) (Gerrish et al., 2007). For example, the British and Canadian samples responded similarly to a question that had its wording changed (i.e. the word 'physician' versus the word 'doctor' was changed in the questionnaire, having the same meaning).

### 3.7. Independent variable

#### 3.3.2. Non-routineness of the task.

Task routineness is the familiarity of the task by the task performer. Familiar tasks are classified as routine tasks. Unfamiliar tasks are classified as non-routine tasks. Karimi, Somers and Gupta (2004) adapted three items measuring task non-routineness from a scale developed by Goodhue (1995), in order to examine the impact of task characteristics on users' satisfaction with data in information systems. There were four items in the measurement of non-routineness, drawing from the original work by Goodhue. The fourth item was added because it measures, "Frequently, in the mindset of using information to address some issue, I may decide to restate the problem and access slightly different information than I had at first planned". The fourth item representing the task characteristic of non-routineness developed by Goodhue was not retained in Karimi et al.'s study. This study used Karimi et al.'s measurement for non-routineness because the fourth item did not capture the dimension of task non-routineness and information-seeking behaviour. In this study, the participants were asked to indicate the extent to which they agree or disagree with the items' content in the context of how they seek information. An example of a query item is, "I frequently deal with ad hoc, non-routine problems" (Karimi et al., 2004, p.190). A 7-point Likert scale ranging from 1, *strongly disagree*, to 7, *strongly agree*, was used. The 3 items were internally consistent ( $\alpha = 0.84$ ). Furthermore, Goodhue previously conducted a confirmatory factor analysis to assess the construct validity of the items and found that they capture a single dimension of task non-routineness (Perrow, 1967; Daft & MacIntosh, 1981).

### 3.8. Moderating variable

#### 3.3.3. Perception of problem-solving ability.

Heppner (1986) developed the *Problem Solving Inventory (PSI)* to measure an individuals' perception of their problem-solving skills along three dimensions: *problem-solving confidence*, *avoidance-approach style*, and *personal control*. The PSI consists of: (1) 11 items measuring *problem-solving confidence (PSC)*, which had good internal consistency reliability (Cronbach's  $\alpha = 0.78$ ); (2) 16 items measuring *avoidance-approach style (AS)*, which had excellent internal consistency reliability (Cronbach's  $\alpha = 0.90$ ); and, 5 items measuring *personal control (PC)*, which had a Cronbach's  $\alpha = 0.74$ . The PSI uses a six point Likert-type scale ranging from 1, *Strongly Disagree*, to 6, *Strongly Agree* (Heppner, 1986).

This questionnaire contains three filler items that are not scored and they do not have any proposed relationship with the concepts being measured. Filler questions are not part of the research question, but aid in the flow of the questionnaire. Scoring the PSI is done by summing the responses to each item (1-6) for each of the three domains. Some items are worded negatively, and the scoring of these items was reversed. "Low scores indicate behaviours and attitudes typically associated with successful problem-solving" (Heppner & Petersen, 1982). A high summed score indicates that the individual is unsuccessful with problem-solving ability domain (i.e., if score = 110 then they have lower problem-solving ability and if score = 28 then they have higher problem-solving ability). Some examples of the query items are: (1) "When I am confronted with a complex problem, I do not bother to develop a strategy to collect information so I can define exactly what the problem is"; (2) "Many problems I face are too complex for me to solve"; and, (3) "I trust my ability to solve new and difficult problems" (Heppner, 1986).

The PSI showed acceptable internal consistency reliability across a number of populations and cultures (Heppner, 1988; Heppner & Lee, 2002). The total PSI demonstrated test-retest reliability; the PSI scores were correlated 0.80 over 2 weeks, 0.81 over 3 weeks as well as 4 months, and 0.60 over 2 years across samples of Caucasian college students, Black college students, and French Canadian adults (Heppner, 1988). Heppner et al. (2004) found that, across studies, the total PSI obtained an average alpha coefficient in the high 0.80s, whereas two of the factors (PSC and AS) had an average alpha coefficient in the low to mid-0.80s, and the third factor (PC) had an average alpha coefficient in the low 0.70s. These results suggest that the PSI subscales are internally consistent across different cultural groups (Heppner & Wang, 2003). The Cronbach's alpha coefficient ranged from 0.72 to 0.85 for the subscales and 0.90 for the total inventory (National Network for Childcare, 1998).

Concurrent, discriminate, and construct validity have been assessed in various studies. Significant correlations were found between the factors and the total PSI (National Network for Childcare, 1998). Factor analysis revealed three distinct constructs: *Problem-solving confidence*, *Avoidance-approach style*, and *Personal control*. Reliability estimates of the 32 items revealed that the constructs were internally consistent and stable over time. The test-retest reliability coefficients over a 2-week period were 0.99 and 0.93 (n=53) (Heppner & Petersen, 1982).

### 3.9. Confounding Variables

#### 3.3.4. Nurse Characteristics.

The nurse characteristics were captured through standard demographic questions, related to: *professional designation; primary role; how long worked as a critical care nurse, and as a nurse; gender; year of birth; highest level of completed education; current employment status; and, hours worked in a typical week* (See Appendix C). For example, participants were asked to give their year of birth so their age could be calculated; indicate their highest level of education, such as Diploma/certificate, Bachelors degree, Masters Degree or PhD, DN; and report the number of years of critical care nursing experience.

#### 3.3.5. Context.

The *context* characteristics are operationalized by: (1) *received training* opportunities for information-seeking skills, (2) *administrative support* for seeking information for patient care tasks, and (3) *context* of critical care settings as perceived by nurses (Spenceley et al., 2008). Standard demographic questions, were used to assess *how long nurses worked on their respective unit, how long nurses worked in the respective organization, type of critical care unit, and geographic location* (rural vs. urban) (See Appendix C).

Nurses' access to training for information-seeking was captured by asking if the nurse has *received training* to seek information (e.g. library skills, research skills, computer skills).

*Administrative support* for information-seeking activities was measured with the *Supportive supervision questionnaire* (Oldham & Cummings, 1996). Participants were asked to rate their level of agreement with items regarding supervisor support for information-seeking at the point-of-care for non-routine patient care tasks. The scale consists of 8 items and an example question is: "My supervisor encourages me to develop new skills". Items are rated on a 7-point Likert-type scale that ranges from 1 to 7, with 1 being *strongly disagree* and 7 being *strongly agree*. *Administrative support* questionnaire has good internal consistency reliability (Cronbach's  $\alpha = 0.86$ ) (Oldham & Cummings, 1996). It has been used with health care professionals and has shown construct validity (West, 1989).

McCormack et al.'s (2007) *Context Assessment Index* (CAI) was used to measure workplace *context*. Sixteen items reflecting the factor of *context* were chosen. The items are scored on a 5-point Likert scale ranging from 1 *strongly disagree* to 5 *strongly agree*. Some items are worded negatively and scoring of these items was reversed. Some examples of items are: "Personal and professional boundaries between Healthcare Professionals are

maintained” and “Clinical nurse leaders create an environment conducive to the development and sharing of ideas”. The reliability coefficients ranged between Cronbach alpha values of 0.78 and 0.91 in previous studies (McCormack et al., 2007).

### **3.10. Procedure for sampling and data collection**

A random sample of nurses was selected from the list of RNs identified in the CNO database as working in critical care setting. They had consented to release their name for research purposes. CNO members are asked if they would like to participate in nursing research when they renew their annual registration. A method adapted from Dillman, Smyth and Melani Christian (2009) was used to increase response rate. First, a brief pre-notification letter (Appendix D) was sent to nurses five days prior to mailing the packages. The letter notes that a questionnaire for an important survey is to arrive in a few days and that the person’s response would be greatly appreciated. Secondly, a package was mailed out which included a detailed cover letter explaining the study, why a response is important, the questionnaire (Appendix E), and a prepaid postage return envelope. Thirdly, a thank you postcard (Appendix F) was sent one week after the questionnaire was mailed. This postcard expressed appreciation for responding and indicated that if the completed questionnaire had not yet been mailed it is hoped to be returned soon. Finally, a replacement questionnaire was sent to non-respondents two to four weeks after the mailing of the postcard. It indicated that the person’s completed questionnaire had not yet been received and encouraged the recipient to respond (Dillman et al., 2009). Furthermore, a final contact was made to the sample population through another thank you postcard mailing (Appendix F) sent one to two weeks after the second questionnaire was mailed out.

### **3.11. Ethical Considerations**

Ethical approval was obtained from the *University of Toronto Research Ethics Board*. Measures were taken to protect the rights of human subjects. No risks associated with participation were anticipated. Participants were informed in the Cover letter (Appendix E) that participation was voluntary and that they could withdraw from the study at any time with no consequence. At no time was the questionnaire data linked to the identity of individual participants. Participants who completed the questionnaire chose one charity from three selected charities so that a two dollar donation was made in compensation of their time to complete the questionnaire. This research investigated nurses’ information-seeking behaviour during a non-routine task and, although nurses who participated in this study may not directly

benefit from their participation, the results could impact on future nursing practice for searching for evidence-based information at the point of care. Nurses were able to include study participation as a component of their quality assurance/reflective practice commitment with the CNO. A certificate of participation was sent to all respondents (Appendix G).

During the study, completed, coded questionnaires were stored in a secure location at the *University of Toronto* where they continue to be kept separate from consents and code sheets so that participants' names cannot be linked to their responses. Participants gave their consent by completing the consent form, as well as completing and returning the questionnaire (Appendix E). All data and consent forms will be stored for seven years following completion of data analysis. At that time, all hard copies of completed questionnaires will be shredded according to the secure process in place at the *Lawrence S. Bloomberg Faculty of Nursing, University of Toronto*. Data have been de-identified (i.e. use of code numbers) throughout the study and will remain de-identified. It will remain stored on a USB key in a locked filing cabinet under the control of the Principal Investigator after the end of the study.

### **3.12. Data Analysis Procedure**

Data were analyzed using the *Statistical package for the social sciences* (SPSS) version 19.0 computer program. Data were double checked by the Principal Investigator, as well as a research assistant, for accuracy and missing data. Below is a discussion of the procedure for data cleaning and approach to handling missing data.

#### **3.3.6. Data cleaning.**

Data were reviewed for accuracy, missing values, outliers, normality, linearity, homoscedasticity, and multicollinearity. Appropriate strategies were applied to handle these problems, if present, prior to analyzing the data.

#### **3.3.7. Accuracy.**

Data entry was checked for accuracy and errors since data entry errors can cause extreme values which could influence the results (i.e. skewed inappropriate distribution or low threshold). Two individuals (Principal Investigator and research assistant) independently reviewed the data for errors. Descriptive statistics and graphical representation of the variables were performed, including: means, standard deviations, frequency distributions, and out-of-range entries.

### 3.3.8. Missing Data.

Missing data represent non-responses to some items in a questionnaire (McKnight, McKnight, Sidani & Figueredo, 2007). A large amount of missing data can impact the study's statistical power, generalizability of findings and statistical inference.

The literature does not indicate that there is a standardized method to manage missing data. Tabachnick and Fidell (2007) indicate that if a few data points, 5% or less, are missing in a random pattern from a large data set, then the problems generated by this missing data are not serious. However, a large amount of non-random missing data can cause bias to standard errors and parameter estimates. The SPSS Missing Value Analysis (MVA) was run to highlight patterns of missing data (Tabachnick & Fidell, 2007). The pattern of missing data was random and the extent of missing data was very low ( $\leq 5\%$ ) for most variables. The listwise deletion procedure for handling missing values in which cases with incomplete data are dropped from the analysis was used for all variables except the variable of *Received training* which had missing data greater than 5%. Dummy variables were created so that cases with complete data were assigned a value of 0 and cases with missing data were assigned a value of 1. Dummy variables were correlated with relevant demographic characteristics to determine whether the data were missing at random. No significant correlation coefficients were found for any variables; therefore data were judged to be missing at random (McKnight, McKnight, Sidani & Figueredo, 2007). Hot deck random single imputation procedures were used to replace a missing value on *received training* (McKnight et al., 2007). The imputation process involves taking a random choice from a series of good matches from the data set by replacing missing value with same data of another case. A sensitivity analysis was run on cases with complete data and then on cases with imputed data to compare findings (Tabachnick & Fidell, 2007). No significant differences were found.

### 3.3.9. Normality.

Normality of distribution on all variables was assessed with statistical or graphical methods as part of the regression analyses. Normality was checked with scores by using a Normal Quantile Plot, a probability plot that graphically compares two probability distributions by plotting their quantiles against each other. The variables were found to have normal distribution.

### 3.3.10. Linearity.

The linearity assumption suggests that there is a linear relationship between two variables. Meeting this assumption is necessary for conducting the planned regression analysis. Linearity was examined with bivariate scatterplots between each independent variable and the dependent variable. All independent variables were normally distributed and linearly related to the dependent variable (Tabachnick & Fidell, 2007).

### 3.3.11. Homoscedasticity.

Homoscedasticity is related to the assumption that distribution of residuals is homogenous across the different values on the variables. The bivariate scatterplots between two variables were roughly of the same width all over the variables' values, with some bulging toward the middle (Tabachnick & Fidell, 2007). Homogeneity was not violated.

### 3.2.12. Multicollinearity.

Multicollinearity is the excessive intercorrelation of independent variables included in the regression model (Garson, 2012). Multicollinearity can occur when cross-products reflecting interactions are formed (Tabachnick & Fidell, 2007). Correlation coefficients near 1.0 violate the assumption of no perfect collinearity, whereas high correlations increase the standard error of the beta coefficients and make assessment of the unique role of each independent difficult or impossible (Garson, 2012). The Variance-Inflation Factor (VIF) test assesses multicollinearity by regressing each independent on all the other independent variables in the regression model simultaneously (Garson, 2012). When VIF is high there is high multicollinearity resulting in instability of the regression coefficients (i.e., unstandardized and standardized). As a rule, VIF greater than 4.0 indicates a multicollinearity problem (Garson, 2012). The final conceptual model includes statistically significant variables that are theoretically important and have low multicollinearity.

This study assessed the effect of *non-routineness of the task* on the two outcome variables: (1) *information-seeking behaviour* and (2) *use of accumulated knowledge* (i.e. hypothesis 1). However, it could be expected that other confounding variables affect these outcomes. Other predictors that could affect the main relationship of interest include: the three domains of problem-solving ability (*personal control, problem-solving confidence, and avoidance-approach style*) (i.e. hypothesis 2), and the potentially confounding variables of context and nurse characteristics. For each outcome, a multiple regression analysis was



completed to assess the relationship between the outcomes and the predictors determined below.

The data analysis procedure entailed:

### 3.13. Step 1: Identify confounding variables to include in analysis

An examination of the confounding variables for inclusion in the multiple regression analysis was considered graphically through examining histograms, scatter plots and frequency distributions to visualize data, for example, outliers, skewness or kurtosis. Variables were selected based on the literature review for critical care nurses' use of accumulated knowledge and information-seeking behaviours. The selected variables for nursing characteristics and context were entered into the models based on information science theory (i.e., Bystrom & Jarvelin, 1995), and nursing empirical evidence such as Spenceley et al. (2008) and McKnight (2006). The selected variables for nursing characteristics to use in multiple regression analysis included: *age, years as a critical care nurse*, and *education*. Multicollinearity of the selected predictors was examined through the Variance-Inflation Factor (VIF) test.

Spenceley et al. (2008) indicated that nurses' *information-seeking behaviour* is influenced by age, years of nursing experience and level of education based on an integrative review of the literature. The selected context variables for the multiple regression analysis included: *received training*, *supervisor support* (i.e., supervisor encourages nurse to develop new skills or encourages participation in important decisions), and *context*. An integrative review of the literature indicated that context influences nurses' *information-seeking behaviour* through the availability of administrative support, organizational environment, and training opportunities (Spenceley et al., 2008).

The dependent variables for this study included: *information-seeking behaviour*, and *use of accumulated knowledge*. The independent variable was *non-routineness of the task*. The moderating variables were the problem-solving ability domains: *personal control*, *problem-solving confidence*, *avoidance-approach style*. Moderation was tested with the interaction terms: *personal control x non-routineness of the task*, *problem-solving confidence x non-routineness of the task*, and *avoidance-approach style x non-routineness of the task*. Moderators selected key predictors for each outcome variable, and confounding variables, *context* and *nurse characteristics*, were included in regression model using the forced entry method. The variables for the conceptual model were considered as statistically significant predictors influencing the outcome based on the associated  $p \leq 0.05$ .

### 3.14. Step 2: Multiple Regression Analysis

A multivariate linear regression analysis was completed to test both Hypothesis 1 and Hypothesis 2. The forced entry method was used to include predictors in the regression equations. The selected predictors for the outcome variables are: *Non-routineness of the task*, *Supervisor support*, *Context*, *Age*, *Education*, *Training*, *Years as Critical Care Nurse*, and *Personal Control*. Moderation interaction variables were included for the analysis of the outcome variables. Significant interactions ( $p \leq 0.05$ ) would be kept in the model for each hypothesis however there were no interactions found in the regression model analyses (See Table I.5. & Table J.6. in appendices).

The model fit was assessed with the F-test, Adjusted  $R^2$ , and  $R^2$  to determine the variation in the dependent variable accounted for by the predictors. The association of the independent variable with the dependent variables, after statistically controlling for the confounding variables, was determined with the value of the t-test and the magnitude of the b coefficients and Beta coefficients. The predictors for the conceptual model were considered as significantly influencing the outcome based on  $p \leq 0.05$ . A regression model with a  $R^2$  in the range of 0.10 to 0.15 is reasonable when the interest lies in the relationship between variables, not in prediction (Grace-Martin, 2005). Adjusted  $R^2$  explains the proportion of total variance that is accounted for by the variables in the model and incorporates the model's degrees of freedom (Grace-Martin, 2005). F-tests were completed to test whether the regression model is significant, and were also calculated to determine whether the proposed relationship between the response variable and the set of predictors is statistically reliable (Grace-Martin, 2005). Therefore, the stronger the relationship is between the dependent variable and the independent variables, the larger F will be. The bivariate correlations are reported in Appendix H.

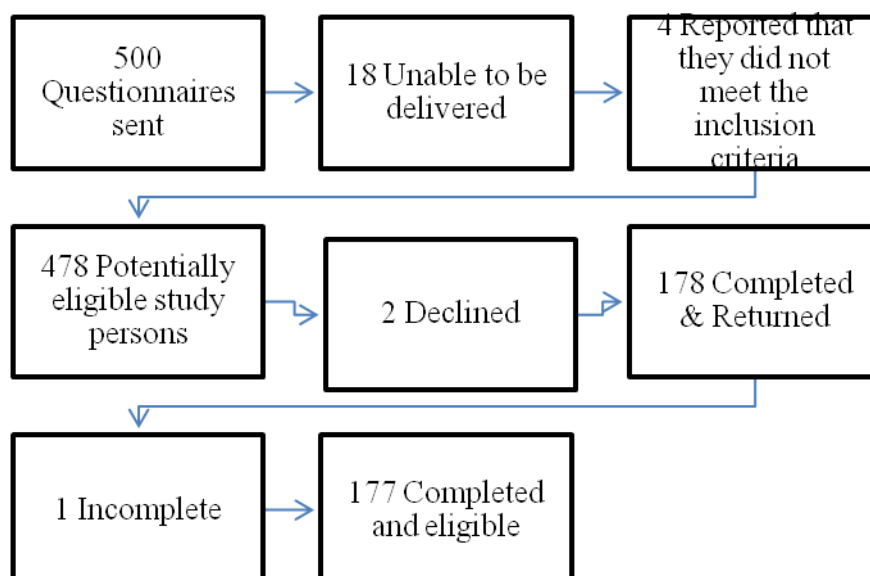
## CHAPTER 4: RESULTS

This exploratory cross-sectional study was designed to examine if *non-routineness of the task* positively affects critical care nurses' *information-seeking behaviour* and *use of accumulated knowledge*, and if critical care nurses' *perception of their problem-solving ability* moderates this relationship. This chapter presents the results of the study. It begins with a report on the response rate and the psychometric evaluation of the study instruments. This is followed by a description of the demographic characteristics of the sample and of the nurses' standing on the variables. Finally, the results pertaining to each hypothesis are presented.

### 4.1. Response rate

Study packages were mailed to the home addresses of 500 potentially eligible critical care nurses. Figure 4.1. summarizes the number of packages received. Of these packages, 18 were returned because they were undeliverable. Four nurses indicated that they did not qualify for the study as they were not critical care nurses. Two people declined participation in the study by providing an indication in writing and sending back a blank questionnaire. Therefore, the number of potential respondents was 476.

**Figure 4.1.** Summary of Responses



One hundred and seventy-eight completed surveys were returned. One survey was incomplete and excluded from the analysis. A total of 177 eligible nurses completed the questionnaire and their data were included in the analysis.

The ineligible responses were excluded from both the numerator and the denominator for the calculation of the response rate. The response rate was determined by dividing the number of completed and eligible surveys ( $n = 177$ ) by the number of potentially eligible persons ( $n = 476$ ) (Asch, Jedrziwski & Christakis, 1997). This resulted in a response rate of 37.11%.

#### **4.2. Characteristics of Participants**

The characteristics of participating nurses are presented in Table 4.1. Their age ranged from 25 to 71 with an average of 46.47 years (SD 10.263). The median age was 47 and the mode was 46 suggesting that the majority of the participants' ages clustered around the mean.

Most participants were female ( $n=167$ , 94.4%) Registered Nurses ( $n=174$ , 98.3%). They worked as full time ( $n=120$ , 67.8%,) staff nurses ( $n=164$ , 92.7%) on a Medical Surgical ( $n=100$ , 56.5%) Intensive Care Unit ( $n=156$ , 87.6%).

The nurses worked in academic health science centres ( $n=103$ , 58.2%) and non-academic ( $n=74$ , 41.8%) hospitals primarily in urban settings (81.4%). The nurses had an average of 11.94 years working on their current unit, 15.46 years working in their current organization, 21.45 years working as a nurse, and 15.62 years working as a critical care nurse. Most participants had completed education programs receiving a Diploma/Certificate ( $n=131$ , 74%), or Bachelor degree ( $n=70$ , 40.1%); few had a Master's Degree ( $n=7$ , 4%). This study examined nurses with a Bachelor or Master's Degree ( $n=77$ , 43.5%) with those nurses who did not complete these programs ( $n=100$ , 56.5%). Higher educational levels have been found to significantly affect perceptions of research in practice (McCloskey, 2008). Not all nurses are educationally prepared to evaluate or understand research. Staff nurses with a Baccalaureate degree are able to critique and evaluate research and therefore able to work toward translating evidence into practice. Nurses with diplomas or certificates are not traditionally as well prepared to do these activities. Staff nurses with a master's degree and advanced practice nurses are in a position to assist evidence-based practice initiatives and translate findings into practice (McCloskey, 2008). Bachelor and Master's Degree were combined as a group since they require long-term education programs with translation and critique of evidence based practice while Diploma/Certificate programs are short-term education programs with less emphasis on translation and critique of evidence based practice.

Table 4.1.

## Employment and Demographic information

|                            |  | n   | %    |
|----------------------------|--|-----|------|
| Primary role               | Staff Nurse  | 164 | 92.7 |
|                            | Clinical Resource  | 6   | 3.4  |
|                            | /Educator/Advanced Practice  |     |      |
|                            | Nurse Practitioner   | 1   | 0.6  |
|                            | Other (i.e. Patient care coordinator, director, charge nurse & unit manager) | 6   | 3.4  |
| Level of care              | Intensive care   | 156 | 87.6 |
|                            | Step-down  | 19  | 10.7 |
|                            | Ward   | 2   | 1.1  |
| Type of Critical care unit | Medical/Surgical   | 100 | 56.5 |
|                            | Coronary   | 44  | 24.9 |
|                            | Paediatrics/Neonatal   | 20  | 11.3 |
|                            | ER/Trauma/Northern outpost   | 12  | 6.8  |
| Current employment status  | Full-time  | 120 | 67.8 |
|                            | Part-time  | 42  | 23.7 |
|                            | Casual   | 15  | 8.5  |

One-hundred and five (59.3%) critical care nurses indicated that they had at some point received training (i.e., library skills, research skills or computer skills) to seek evidence-based information resources. The majority of nurses reported using a computer to search information for patient care (97.2%), and to conduct searches at home outside work hours (57.6%) and at the hospital during a shift (94.4%). Forty-seven (26.6%) nurses reported they completed searches at hospital after shift. The majority of nurses used the Internet (n=163, 92.1%), electronic databases (n=95, 53.7%) (i.e., Ovid & Pubmed), and e-books/e-journals (n=74, 42.5%) to seek information. Thirty-eight nurses (21.9%) indicated that they accessed teleconferences and other electronic resources such as Intranet, hospital policy and procedures, drug guidelines, *Medi-Tech*, and webinars.

### 4.3. Descriptive Results for Study Variables

Table 4.2. shows the mean scale scores for participants' responses on the study variables with the 95% confidence intervals and standard deviations. The range of potential scores for each scale is also shown. Overall, all variables have a low standard deviation indicating low variability in scores, and the range of scale scores are narrow. This indicates that data points tend to be closer to the mean.

### 4.4. Psychometric Evaluation of Study Instruments

Internal consistency reliability was examined for all measures used in the study, using the Cronbach's alpha coefficient. These results can be found in Table 4.2. The Cronbach alpha coefficients were greater than 0.7 for all study instruments, except for *use of accumulated knowledge* (and sub-scale of personal experience). Overall the measures showed internal consistency reliability. The low value ( $< 0.7$ ) for the Cronbach's alpha coefficient for *use of accumulated knowledge* may be due to low variability in responses to the items (Gerrish et al., 2007).

Table 4.2.

## Cronbach's Alpha and Descriptive Statistics Study Variables

| <b>Scale</b>   | <b>n</b> | <b># of items</b> | <b>Mean</b> | <b>SD</b> | <b><math>\alpha</math></b> | <b>LL</b> | <b>UL</b> |
|--|----------|-------------------|-------------|-----------|----------------------------|-----------|-----------|
| <b>Dependent Variables</b>   |          |                   |             |           |                            |           |           |
| <i>Information-seeking behaviour</i><br>(Scale range 1.83-4.42)            | 175      | 9                 | 3.41        | 0.46      | 0.768                      | 3.34      | 3.48      |
| Published information use<br>(Scale range 1.17-4.5)                        | 175      | 6                 | 2.87        | 0.58      | 0.766                      | 2.78      | 2.95      |
| Informal information use<br>(Scale range 2.33-5)                           | 175      | 3                 | 3.95        | 0.57      | 0.741                      | 3.87      | 4.04      |
| <i>Use of Accumulated knowledge</i><br>(Scale range 2.8-4.78)              |          |                   |             |           |                            |           |           |
| Personal experience use<br>(Scale range 1.67-4.8)                          | 176      | 6                 | 3.8         | 0.49      | 0.646                      | 3.72      | 3.87      |
| Training, conferences,<br>policy/protocols & reports<br>(Scale range 2-5 ) | 175      | 3                 | 3.84        | 0.70      | 0.812                      | 3.74      | 3.95      |
| <b>Confounding Variables</b>   |          |                   |             |           |                            |           |           |
| <i>Supervisor support</i><br>(Scale range 2-7)                             | 177      | 8                 | 4.51        | 1.29      | 0.809                      | 4.32      | 4.70      |
| <i>Context</i><br>(Scale range 2-5)  | 176      | 16                | 3.52        | 0.51      | 0.85                       | 3.48      | 3.63      |
| <b>Independent Variable</b>  |          |                   |             |           |                            |           |           |
| <i>Non-routineness of the task</i><br>(Scale range 1-7)                    | 174      | 3                 | 4.29        | 1.3       | 0.845                      | 4.09      | 4.48      |
| <b>Moderating Variables</b>  |          |                   |             |           |                            |           |           |
| <i>Personal Control</i><br>(Scale range 5-25)                              | 172      | 5                 | 12.30       | 4.52      | 0.764                      | 11.62     | 12.98     |
| <i>Problem-Solving Confidence</i><br>(Scale range 11-38)                   | 171      | 11                | 21.91       | 5.74      | 0.811                      | 21.05     | 22.78     |
| <i>Avoidance-Approach Style</i><br>(Scale range 17-62)                     | 171      | 16                | 36.39       | 10.26     | 0.858                      | 34.84     | 37.94     |

#### 4.5. Research Hypotheses

The research hypotheses for this study were tested through linear regression. Application of the first step resulted in the selection of the following predictors, which were most conceptually meaningful: *Non-routineness of the task*, *Supervisor support*, *Context*, *Age*, *Education*, *Received training*, *Years as critical care nurse*, and *Problem-solving ability* (including its domains of *Personal control*, *Avoidance-approach style*, and *Problem-solving confidence*). Reducing the number of predictors prevented redundancy in the model and provided the most parsimonious conceptual model.

The results of hypothesis testing are presented below. First, the results related to the dependent variable, *use of accumulated knowledge*, are presented. The findings for hypotheses 1a, 2a and 2b are summarized in Table 4.3. Second, the results related to the dependent variable, *information-seeking behaviour*, are presented and the findings for hypotheses 1b, 2c and 2d are summarized in Table 4.4. and Table 4.5.

#### 4.6. Use of Accumulated of Knowledge

Accumulated knowledge is acquired through personal experience and training, conferences, policy/protocols, and reports. The hypotheses for *use of accumulated knowledge* include:

Hypothesis 1a is: “Non-routineness of the task has a negative relationship with the use of accumulated knowledge”.

Hypothesis 2a is: “Nurses’ perception of high problem-solving abilities (i.e. high confidence, high personal control, and a positive attitude on approaching problems) attenuates the negative relationship between the non-routineness of the task and information sought from accumulated knowledge”.

Hypothesis 2b is: “Nurses’ perception of low problem-solving abilities (i.e. low confidence, low personal control, and a negative attitude on approaching problems) strengthens the negative relationship between non-routineness of the task and information sought from accumulated knowledge”.

Hypothesis 1a, 2a and 2b were tested separately for each dimension of problem-solving ability because it was important to understand how each dimension (i.e. *personal control*, *problem-solving confidence* and *avoidance-approach style*) explains variation in *use of accumulated knowledge*. Previous literature has reported that each problem-solving ability domain explains variation in the *use of accumulated knowledge* (Heppner et al., 2004). The



findings are summarized below. Neither *avoidance-approach style* nor *problem-solving confidence* entered as having a significant relationship in the model. The tables summarizing these findings are presented in Appendix I, and the results for *personal control* are presented below.

The F test ( $F = 0.902$ ) is non-significant and none of the variables entered in the regression model are significant. The three separate regression models are summarized in Appendix I. None of the models are significant ( $p > 0.05$ ) as determined by F test. Therefore, *non-routineness of the task* did not have a relationship with *use of accumulated knowledge*. The problem-solving domain, *personal control*, did not have a relationship with *use of accumulated knowledge*. Further, *personal control*, did not moderate the relationship between *non-routineness of the task* and *use of accumulated knowledge* (Table 4.3.).

Table 4.3.

## Use of Accumulated Knowledge with Personal Control

| Variable                     | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|------------------------------|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task  | 0.007  | 0.026 | 0.902 | 0.023  | 0.281  | 0.779 | (-0.044 - 0.058) |
| Supervisor support           | -0.009 | 0.032 |       | -0.026 | -0.268 | 0.789 | (-0.072 - 0.055) |
| Context                      | 0.104  | 0.080 |       | 0.129  | 1.302  | 0.195 | (-0.054 - 0.261) |
| Age                          | 0.002  | 0.005 |       | 0.047  | 0.423  | 0.673 | (-0.007 - 0.011) |
| Education                    | -0.026 | 0.075 |       | -0.031 | -0.355 | 0.723 | (-0.174 - 0.121) |
| Training                     | 0.062  | 0.070 |       | 0.072  | 0.887  | 0.376 | (-0.076 - 0.199) |
| Years as Critical Care Nurse | -0.094 | 0.096 |       | -0.106 | -0.975 | 0.331 | (-0.283 - 0.096) |
| Personal Control             | -0.011 | 0.008 |       | -0.117 | -1.373 | 0.172 | (-0.026 - 0.005) |

Note.  $R^2 = 0.045$ , Adjusted  $R^2 = -0.005$ ,  $F = 0.902$ ,  $p = 0.516$ ,  $N=162$

#### 4.7. Information-seeking behaviour

The hypotheses for *information-seeking behaviour* include:

Hypothesis 1b is: “Non-routineness of the task has a positive effect on information-seeking behaviour (published information and informal information)”.

Hypothesis 2c is: “Nurses’ perception of high problem-solving abilities (i.e. high confidence, high personal control, and a positive attitude on approaching problems) strengthens the positive relationship between the non-routineness of the task and information-seeking behaviour”.

Hypothesis 2d is: “Nurses’ perception of low problem-solving abilities (i.e. low confidence, low personal control, and a negative attitude on approaching problems) attenuates the positive effect on the relationship between the non-routineness of the task and information-seeking behaviour”.

Hypothesis 1b, 2c and 2d were tested separately for each dimension of problem-solving ability because it was important to understand how each dimension (i.e. *personal control*, *problem-solving confidence* and *avoidance-approach style*) explains variation in *information-seeking behaviour*. Previous literature has reported that each dimension of problem-solving ability, namely, control (Srinivasan & Tikoo, 1992), confidence (Kuhlthau, 1993), and avoidance-approach style (Case, Andrews, Johnson & Allard, 2005), accounts for variation in *information-seeking behaviour*. The findings are summarized below. Neither *avoidance-approach style* nor *problem-solving confidence* entered as significant predictors in the model. The tables summarizing these findings are presented in Appendix J, and the results for *personal control* are presented below.

Table 4.4.  
Information-seeking behaviour with Personal Control

| Variable                     | B      | SE    | F     | Beta   | t      | p     | (95%)CI           |
|------------------------------|--------|-------|-------|--------|--------|-------|-------------------|
| Non-routineness of the task  | 0.064  | 0.027 | 4.161 | 0.178  | 2.393  | 0.018 | (0.011 – 0.117)   |
| Supervisor support           | -0.004 | 0.033 |       | -0.010 | -0.107 | 0.915 | (-0.069 – 0.062)  |
| Context                      | 0.118  | 0.082 |       | 0.132  | 1.433  | 0.154 | (-0.045 – 0.280)  |
| Age                          | 0.009  | 0.005 |       | 0.186  | 1.804  | 0.073 | (-0.001 – 0.018)  |
| Education                    | 0.055  | 0.077 |       | 0.058  | 0.718  | 0.474 | (-0.097 – 0.207)  |
| Training                     | 0.192  | 0.072 |       | 0.200  | 2.677  | 0.008 | (0.050 – 0.334)   |
| Years as Critical Care Nurse | -0.029 | 0.099 |       | -0.029 | -0.291 | 0.771 | (-0.224 – 0.167)  |
| Personal Control             | -0.017 | 0.008 |       | -0.163 | -2.074 | 0.040 | (-0.033 - -0.001) |

Note.  $R^2 = 0.179$ , Adjusted  $R^2 = 0.136$ ,  $F = 4.161$ ,  $p = 0.000$ ,  $N=162$

Table 4.5.

Information-seeking behaviour with the interaction term for Personal Control x Non-routineness of the task

| Variable                                       | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|--|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task                    | 0.059  | 0.078 | 3.675 | 0.165  | 0.764  | 0.446 | (-0.094 – 0.212) |
| Supervisor support                             | -0.004 | 0.033 |       | -0.010 | -0.111 | 0.911 | (-0.069 – 0.062) |
| Context  | 0.118  | 0.082 |       | 0.131  | 1.426  | 0.156 | (-0.045 – 0.281) |
| Age  | 0.009  | 0.005 |       | 0.187  | 1.785  | 0.076 | (-0.001 – 0.018) |
| Education                                      | 0.055  | 0.077 |       | 0.059  | 0.718  | 0.474 | (-0.097 – 0.208) |
| Training                                       | -0.018 | 0.027 |       | -0.179 | -0.677 | 0.499 | (-0.072 – 0.035) |
| Years as Critical Care Nurse                   | 0.192  | 0.072 |       | 0.200  | 2.666  | 0.009 | (0.050 – 0.334)  |
| Personal Control                               | -0.029 | 0.100 |       | -0.030 | -0.295 | 0.768 | (-0.226 – 0.168) |
| Personal Control x Non-routineness of the task | 0.000  | 0.006 |       | 0.022  | 0.064  | 0.949 | (-0.012 – 0.013) |

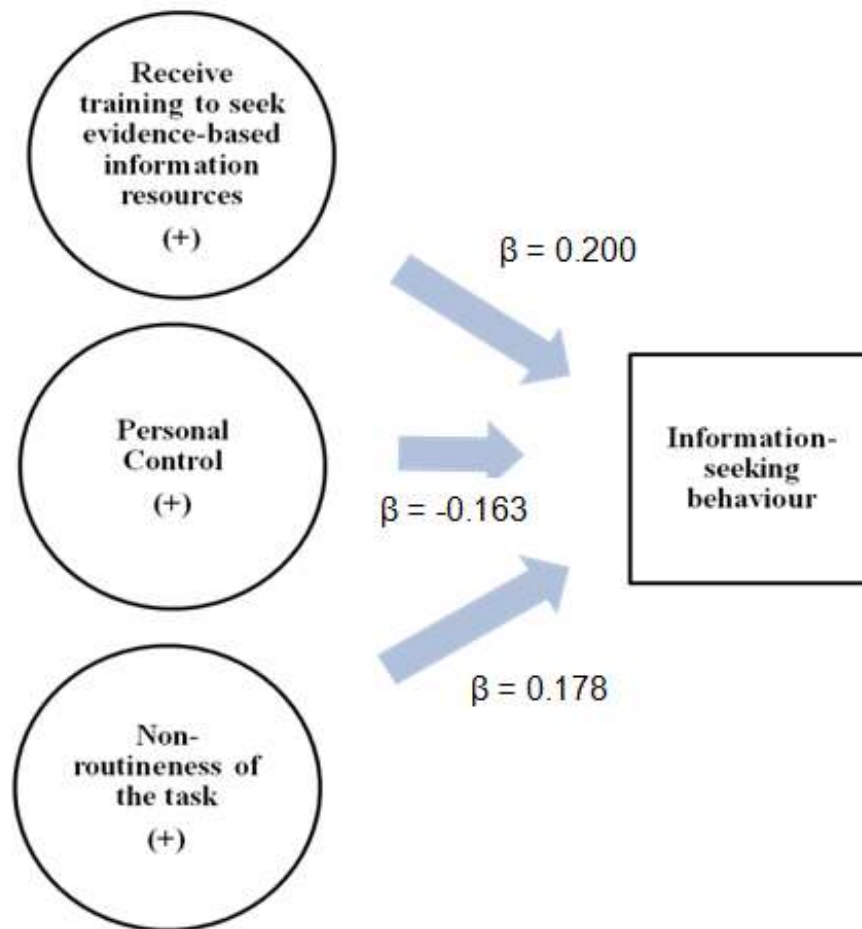
Note.  $R^2 = 0.179$ , Adjusted  $R^2 = 0.130$ ,  $F = 3.675$ ,  $p = 0.000$ ,  $N=162$

*Information-seeking behaviour* had a positive linear relationship with *Received training* ( $b = 0.192$ ), *Non-routineness of the task* ( $b = 0.064$ ), and *Personal control* ( $b = -0.017$ ), with an Adjusted  $R^2 = 0.136$  and  $R^2 = 0.179$  (Table 4.4). It is important to note that a negative regression weight for *personal control* indicates that nurses' behaviours and attitudes are typically associated with successful *personal control* during problem-solving.

Further, Table 4.5. shows the results of the multiple regression analysis for the moderating variable, *personal control*, with the relationship between *non-routineness of the task* and *information-seeking behaviour*. The results are non-significant for the interaction term *personal control x non-routineness of the task* ( $b = 0.000$  &  $p > 0.05$ ).

#### **4.8. Conceptual Model**

The results supported the model (Figure 4.2.). As discussed above, variables were analyzed through a forced entry method and were included in the conceptual model based on  $p < 0.05$  indicating that predictors of the outcome variables are significant. There are no conceptual models for *use of accumulated knowledge* because none of the hypothesized variables entered explained variation in the *use of accumulated knowledge*.

**Figure 4.2.** Information-seeking Behaviour Conceptual Model

## CHAPTER 5: DISCUSSION

Critical care nurses engage in complex tasks during the performance of patient care. Nurses have information needs, especially during non-routine tasks, and therefore need to seek further information to complete patient care tasks. The purpose of the study was to examine the relationship between *non-routineness of tasks* and nurses' *information-seeking behaviour* and the *use of accumulated knowledge*; and, to explore how nurses' perception of their problem-solving abilities (i.e. *personal control*, *problem-solving confidence*, and *avoidance-approach style*) moderate these relationships when completing patient care tasks in the critical care hospital setting. In this chapter, the study potential limitations, and key findings are discussed in relation to theoretical literature and previous research on critical care nurses' *information-seeking behaviour*, and the *use of accumulated knowledge*. Further implications related to practice, education, administration, and research, are presented in conjunction with the overall contributions and conclusions of the study.

### 5.1. Limitations of the Study

Since this was an exploratory study, potential limitations are apparent. Potential limitations are discussed in terms of internal validity and external validity.

#### 5.5.1. Potential threats to internal validity.

The following potential limitations could affect the internal validity of this study. This was a cross-sectional study so data were obtained from the participants at a single point in time using a self-completed postal questionnaire. The use of a longitudinal design, collected at several measurement points would allow assessment of how change in study variable scores over time are related, thus providing stronger evidence of causality.

This study relied on self-report for the measurement of both dependent and independent variables through a questionnaire. Evaluative adequacy of inferences made from test scores, in terms of both empirical evidence and theoretical rationale determines the validity of a measure. Construct validity establishes that a test is measuring the construct it claims to be measuring. There could be method variance or response distortions (i.e., acquiescence response bias or social desirability bias) when using self-report questionnaire. In this study, common method variance was prevented, for example, by using different scale anchors.



Confounding variables could impact the internal validity of this study. There was an inability to control for all differences among participants that could have influenced information seeking. Using a random sample of critical care nurses from the CNO research participant database helped to decrease the potential of selection bias from sampling. Examples of possible confounding variables that could have effects include programs that emphasize evidence-based practice, patient acuity and complexity between types of critical care units, and the actual organization in which the nurse works.

Furthermore, there were challenges related to the sample size in this study. The most parsimonious recommendation of 5 cases per variable then doubling the sample due to moderation was chosen to guide the sample size estimation since this was an exploratory study. Questionnaires were sent to a total sample of 500 critical care nurses and 177 nurses completed the questionnaire with a response rate of 37.11%. The sample size was relatively small and could have affected the power. Moderated multiple regression is the preferred statistical method for identifying interaction effects when the predictor and the moderator are continuous variables, or when the predictor is continuous and the moderator is categorical (Aiken & West, 1991; Cohen & Cohen, 1983; McClelland & Judd, 1993; McNeil, Newman, & Kelly, 1996; Stone-Romero, Alliger, & Aguinis, 1994). The problem-solving ability domains did not have an interaction effect with the relationship of *non-routineness of the task* and *information-seeking behaviour* in this study. Villa, Howell, Dorfman and Daniel (2002) noted that small sample size (Cohen & Cohen, 1983; Cohen, 1988) could decrease the power to detect interactions for a study. It can be argued that this study may not have enough power to detect a moderating relationship due to the small sample size.

### **5.5.2. Potential threats to external validity.**

The following potential limitations could possibly affect the external validity of this study. The sample was derived from the College of Nurses of Ontario (CNO) research participant database. The sample is limited because it may not fully represent Ontario critical care nurses; as it only includes those nurses who indicated willingness to participate in research. There may also be systematic differences between these nurses and those who did not indicate willingness to participate in research. This has implications regarding generalizability of the findings of the study.

Furthermore, an unforeseen Ontario postal strike occurred in the summer of 2011 during the study's data collection. The postal strike could have influenced response because

mail could have arrived out of order (i.e. received questionnaire before invitation letter) or not at all. Further, people could have been frustrated with the mail strike and perhaps avoided mailing letters. However, Dillman's Total Design Method (2009) was used to enhance the response rate. This study included a final contact to the sample through a second thank you postcard mailing after the second questionnaire mailing. The postcard reiterated a request for volunteers to participate in the study. This additional contact was made due to the unforeseen 2011 Ontario postal strike.

The above are potential limitations of the study. Key findings will be examined below in the context of the literature and conceptualization. Descriptive findings of the sample, the variables, and the findings of the hypotheses will be discussed.

## **5.2. Key Findings**

### **5.5.3. Descriptive Findings.**

#### ***5.5.5.1. Description of the Sample.***

The sample in the current study was compared to the CNO published sources to determine how representative it was of the population of interest. It is important to note that, since the response rate was slightly lower than expected, this increased the possibility for selection bias. The comparisons showed that the current sample was similar to those of the CNO reports for Ontario Registered Nurses. The nurses in this study ranged in age from 25 to 71 with an average age of 46.47 years. The mean age of Ontario Registered Nurses is 46.3 years (CNO, 2009) (Critical care nurses' averages were not reported).

Most participants were female who worked full time. Similar results were found through CNO statistics for Ontario Registered Nurses. There are 97,017 RNs who reported employment in Ontario (CNO, 2011). Comparably, 62,313 (49.52%) of RNs work in the acute care hospital setting; the majority are female (94.61%), who have a full-time position (67.9%), with the majority of nurses, (43.51%), between the ages 45 to 59 (CNO, 2010). It is noteworthy that critical care nurse specific information was not identified in CNO reports.

Overall, the sample in the current study appears to be representative of the population of nurses working in Ontario. Demographic and employment factors were also similar to those found in CNO statistics.

### 5.3. Descriptive Findings of the Dependent variables

#### 5.5.4. Information-Seeking Behaviour and Use of Accumulated Knowledge.

The mean levels of *information-seeking behaviour* and *use of accumulated knowledge* were compared to findings in the literature, when possible, to provide a better understanding and interpretation of the findings. It should be noted that little research has been completed specifically on critical care nurses' *information-seeking behaviour* for patient care tasks. *Information-seeking behaviour* was measured through published information and informal information using the *Developing Evidence-Based Practice* sub-scales (Gerrish et al., 2007).

##### 5.5.5.2. Information-Seeking Behaviour.

In this study, critical care nurses perceived that they sought knowledge through the use of published information *seldom to sometimes* in practice. McKnight (2004; 2006) completed participant observation and in-context interviews of on-duty critical care nurses on a 20-bed critical care unit in a community hospital. Her study findings indicated that nurses' information behaviour is centered on the patient, seeking information from people, the patient record, and other systems. Rarely do critical care nurses use published sources during shift (McKnight, 2006). Nurses most frequently sought information from other colleagues and those with a higher level of experience, clinical relevance or perceived specific expertise. Text and electronic-based information was more infrequently used and they usually used Google rather than database search engines. Print-based guidelines ranked higher than electronic versions (Marshall et al., 2011). They see the literature as having variability in quality of evidence and rather use an organization approved guideline. The critical care nurses mostly used patient-specific information, but they also used some social and logistic information (McKnight, 2004; McKnight, 2006). Similarly, Corcoran-Perry and Graves (1990) found that 46 cardiovascular nurses working in three metropolitan hospitals at the beginning of their shift sought patient-specific data most frequently. There is also the notion of a collaborative decision-making process when seeking information for a patient care task. Someone "trusted" would review literature and report back to other nurses (Marshall et al., 2011).

Additionally, in this study, critical care nurses perceived that they sought knowledge through the use of informal information *sometimes to frequently* in practice. Marshall, West and Aitken (2011) completed a study on a 13-bed Level III intensive care unit within an Australian tertiary teaching hospital to determine intensive care nurses' perspectives of

information use in the resolution of clinical uncertainty for enteral feeding practices. They found that the nurses preferred to receive information from colleagues to support clinical decisions. People, as information sources, were considered most useful and most accessible in the clinical setting; however the nature and accuracy of the evidence base for information passed verbally is unclear (Marshall, West & Aitken, 2011). Further, critical care nurses would seek information from more experienced colleagues and seldom, if ever, from a less experienced colleague (Marshall, West & Aitken, 2011). Text and electronic information sources were seen as less accessible due to the time required to access the information (Marshall, West & Aitken, 2011).

Overall, in this study, critical care nurses perceived that they sought knowledge using their *information-seeking behaviours seldom to sometimes* in practice. Interestingly, the majority of critical care nurses in this study indicated that they used a computer to search for information related to patient care tasks. Moreover, 22% of critical care nurses indicated that they used teleconferences and other electronic resources, such as: the intranet, hospital policy and procedures, drug guidelines, health information system (i.e. *Meditech*), and webinars. The critical care nurses in this study specified that they did information searches at home, at the hospital during the shift, and at the hospital after the shift. McKnight (2004; 2006) found that critical care nurses acted on, or passed on most of the information found and some information was even recorded for their own use during the shift. Nurses expressed respect for evidence-based practice; however they had no time or opportunity to read research literature while on duty (McKnight, 2004; McKnight, 2006). Task completion is considered more important than research and use of best evidence (McCaughan et al., 2002; Thompson et al., 2008).

This research suggests that critical care nurses use computers to search for information on patient care tasks during their shift. However, this study also noted that critical care nurses seek information after their shift and at home, implying that they do not always have a sufficient amount of time, or the necessary resources, to complete a thorough search during their shift. It also suggests that critical care nurses could have unsuccessful searches during their shift and continue to search when they have time after their shift. This study also confirmed that critical care nurses preferred to seek information sources from colleagues (informal information) for their patient care tasks, which is consistent with results of several studies (Cranley et al., 2009; Spencely et al., 2008; Kosteniuk, D'Arcy, Stewart et al., 2008; Doran et al., 2007; Tan, Stark, Lowinger et al., 2006; Dee & Stanley, 2005;

Estabrooks et al., 2005; Pravikoff, Tanner & Pierce, 2005; McKnight, 2004; Thompson et al., 2005; Pravikoff, Pierce & Tanner, 2003; Cogdill, 2003; Urquhart & Crane, 1994).

### **5.5.5.3. Use of Accumulated knowledge.**

Accumulated knowledge is *a priori* known through preconceived ideas of knowledge. Therefore, the solution to the task already exists in the individual's mind prior to, and independent of, the specific task. Overall, in this study, the *use of accumulated knowledge* based on personal experience and knowledge received from training, conferences, policy/protocols, and reports in critical care nurses' practice occurred *sometimes to frequently*. *Use of accumulated knowledge* was measured through personal experience and knowledge received from training, conferences, policy/protocols, and reports, using the *Developing evidence-based practice* sub-scales (Gerrish et al., 2007).

Estabrooks et al. (2005) found that personal experience was a commonly used knowledge source for routine clinical nursing practice. Corcoran-Perry and Graves (1990) found that institution-specific data and domain knowledge (i.e., perceived, discovered, or learned knowledge) was important to patient care by cardiovascular nurses. Moreover, McKnight (2004; 2006) found that critical care nurses occasionally sought knowledge-based information.

Further, it should be noted that the accumulated knowledge of a critical care nurse may not be based on up-to-date evidence-informed practices or knowledge. Therefore, nurses may have an information need without their awareness of that need. For example, Marshall et al. (2011) emphasized that nurses' perception of their practice was consistent with institutional policies and procedures, and this provided security in their decision-making. However, documents (i.e., enteral feeding clinical practice guideline and enteral feeding policy) were found not to incorporate current best evidence in Marshall et al.'s (2011) study. This presents a conflict in the quality of information provided yielding variability in practice which may be different from evidence-based guidelines or policies. Organizations need to maintain up-to-date guidelines and policies based on recent evidence, and nurses need to be proactive when they come across an out-dated source (i.e. remove source, make improvements, or create supporting up-to-date resources).

Organizations need to provide support through training for critical care nurses to learn information-seeking skills. In this study, the results suggest that those critical care nurses who received information-seeking training sought information when they had a non-routine task. As noted in the literature review, the existence of administrative and research support,

with a positive climate for learning and growth, assists with the development of nurses' information-seeking skills (Spenceley et al., 2008). Further, Advanced Practice Nurses could provide resource support to nurses. For example, practice leaders and educators in hospitals can be "information/change agents", and help reveal latent information needs, as well as assist with knowledge translation, so nurses can apply evidence-informed practices (Choo, 2007, p.12). Nurses' knowledge translation as a work process, through the means of seeking information for a patient care task, is important to the safety and quality of patient care. "Clinical nurses are not typically professionally trained to find and quality-filter condition-specific, patient-centric content to satisfy sophisticated information needs" (Jones, Schilling & Pesut, 2011, p.25). DiCenso (2003) indicates the following skills are necessary to satisfy an information need for a patient care task: (1) defining the problem; (2) conducting an efficient search to locate the best evidence; (3) critically appraising the evidence; and, (4) considering evidence and its implications in the context of the patients' circumstances and values. In this study, more than half of the critical care nurses indicated that they received training (i.e., library skills, research skills, or computer skills) to seek evidence-based information resources. This suggests that training is inconsistent across different organizations. In contrast, current nursing students are developing these information-seeking skills through their formal education. A study found that nursing students were more likely to perform a database search one to five times a week when compared to clinical nurses (Dee & Stanley, 2005). It can be postulated that future generations of nurses will be more equipped to satisfy information needs, when they occur during patient care, due to their preparation during nursing school. However, it is important to keep in mind that high quality accessible resources need to be made available by organizations in order to support successful information-seeking practices.

#### **5.4. Discussion of Findings Related to the Hypotheses**

##### **5.5.5. Hypothesis 1.**

In this study, *non-routineness of the task* did not have a significant relationship with critical care nurses' *use of accumulated knowledge*; however, it was positively associated with *information-seeking behaviour*. These findings will be discussed both theoretically and empirically.

Byström and Järvelin (1995) indicate that routine tasks occur in situations in which an individual typically has a ready response. These routine tasks are so familiar that they are

typically not thought of as problems and most often go unnoticed (Byström & Järvelin, 1995). Nevertheless, critical care nurses can use accumulated knowledge such as personal experience and knowledge acquired from training, conferences, policy/protocols and reports to complete the patient care tasks. In this study, a majority of nurses reported using colleagues as an informal resource when seeking information for a patient care task. It is also apparent that critical care nurses can use previously learned knowledge or readily available information to resolve the simple familiar task, thereby completing the task easily. This study found that *non-routineness of the task* did not have a significant relationship with critical care nurses' *use of accumulated knowledge* when the task was simple and familiar. Perhaps, this result occurred due to the range restriction in the measurement of the *use of accumulated knowledge* (scale range 2.8-4.78). It would also contribute to a low alpha value. Conceptually there may be limited variability on any measure of nurses' *use of accumulated knowledge* because essentially everyone would rely on accumulated knowledge for routine tasks. There were challenges, both conceptually due to the very nature that all individuals use accumulated knowledge and methodologically related to finding a measurement tool with sensitivity to detect differences.

At the other end of the continuum, non-routine tasks require individuals to seek new information through resources, such as published or informal information, to resolve questions about the task (Byström & Järvelin, 1995). In this study, *non-routineness of the task* had a positive relationship with *information-seeking behaviour*. At the center of this continuum, tasks have both routine and non-routine features. Therefore, in these types of tasks, part of the solution, and means to the solution, are routine and simple, whereas some new information is needed to resolve the more complex and non-routine components (Heppner & Krauskopf, 1987).

The literature supports this study's findings that when critical care nurses encounter an uncertain situation, inferring that the situation is not routine or familiar; information is sought from colleagues (Marshall et al., 2011). As mentioned previously, colleagues are an informal information resource to critical care nurses in the study. It should be noted that nurses must trust their colleagues' verbal communication as a resource for informal information (Spenceley et al., 2008). Nurses trust that the information is correct and based on evidence. Although, critical care nurses use published information, the literature indicates that text and electronic information sources are less accessible due to the lack of time during a shift to search out these kinds of resources (Marshall et al., 2011). However, critical care nurses in this study indicated that they search for information for patient care tasks during

their shift, after their shift, and at their home. Therefore, the study findings suggest that critical care nurses who have information needs will seek information when they have a non-routine patient care task.

#### 5.5.6. Hypothesis 2.

The two domains of perception of problem-solving ability, *problem-solving confidence* and *avoidance-approach style*, did not have a relationship with *non-routineness of the task* and *information-seeking behaviour*. Moreover, the domains of perception of problem-solving ability did not moderate the relationship between *non-routineness of the task* and *information-seeking behaviour*. A statistically significant linear relationship was found between *personal control* and *information-seeking behaviour*. Further, it should be noted that none of the perception of problem-solving ability domains explained *use of accumulated knowledge*.

The problem-solvers' choice of strategy influences how information is sought for a non-routine task (Gill & Hicks, 1996). Heppner et al. (2004) indicates that there are differences in individuals' perception of their problem-solving abilities. People who perceive themselves as effective problem-solvers, such that they have high confidence, high personal control, and a positive attitude on approaching problems, act in contrast to those who perceive themselves as ineffective, such that they lack confidence, personal control, and avoid problems. Effective problem-solvers are aware of their environment and efficiently use appropriate sources and channels, whereas ineffective problem-solvers tend to avoid trying to solve problems and make less use of helping resources (Heppner et al., 2004).

The literature indicates that nurses may suppress or avoid information needs and information-seeking so they do not appear to be less than competent to their colleagues (MacIntosh-Murray & Choo, 2005). However, another study indicated that nurses tend to ask for help, and demonstrate a lack of confidence in information retrieval (Urquhart & Crane, 1994). Bucknall (2003) indicated that a lack of familiarity with patient situations resulted in a slowing of decision-making by nurses because of uncertainty and a lack of confidence. Moreover, O'Leary and Mhaolrunaigh (2012) found that nurses who made routine decisions relied mostly on their experience and an assessment of the patient. However, nurses making non-routine decisions experienced more uncertainty about their decisions and used a variety of information sources, and the information-seeking process was more extensive.

Nevertheless, *personal control*, showed a positive linear relationship with *information-seeking behaviour*. Heppner and Krieschok (1983) found that individuals who



have high personal control reported fewer dysfunctional thoughts and irrational beliefs, such as negative thoughts regarding performance, related to their perceptions of their problem-solving abilities. Individuals draw on personal frameworks of beliefs and values when they have information needs, and must seek additional resources to make decisions about patient care (Thompson, Cullum, McCaughan, Sheldon & Raynor, 2004). This study found that critical care nurses who have *personal control*, meaning that they are able to direct their emotions and behaviours while solving problems, will seek information when needed for patient care tasks.

### 5.5. Major confounding variables

The major confounding variables for the study will be discussed theoretically and empirically with evidence from the literature in terms of *context* and *nurse characteristics*. The major confounding variables for the study were: *supervisor support*, *context*, *age*, *education*, *received training*, and *years as critical care nurse*.

The confounding variable of *context* can be viewed from a macro perspective. For example, the *Promoting action on research implementation in health services model (PARIHS)* assists with identifying the important elements within the nursing practice setting that need to be in place in order to foster the utilization of evidence for practice (i.e., research, clinical experience, patient experience, and local data/information) so nurses can make decisions regarding patient care. Many factors influence the uptake of evidence into nursing practice such as the evidence being used, the quality of the context, and the type of facilitation (Rycroft-Malone, 2004). However, Estabrooks (2003) suggests that use of evidence is mainly due to individual rather than organizational factors, but without the “right environment” individual factors may not exert their influence (p.59). Information-seeking is the phase prior to the use of evidence, however similar principles can be extended to *information-seeking behaviour* and *use of accumulated knowledge*. In this study, there is a micro focus on the individual perspective, rather than an overall macro focus on context as it pertains to *information-seeking behaviour* for evidence-based practice and *use of accumulated knowledge*.

Spenceley et al. (2008) conceptualized elements of nurse information-seeking to inform practice. Two major themes were identified: (1) the setting, context, and structure of nursing work; and, (2) scope of practice, as related to information needs. The first theme was about how structural and cultural attributes of the work setting influence how nurses access, use, and value information to support their practice (Spenceley et al., 2008). The second

theme constituted the practice of nurses and the information needed to support their practice (Spenceley et al., 2008). A nurse with particular attributes, education and experience, working in a particular setting, identifies an information need. Factors that mediate the relation between the identification of the information need, acting on the need and nurse attributes include: (1) decision to pursue information, including the time available; (2) other priorities and workload; (3) the urgency of the need; (4) the expectations of others; (5) source attributes and preferences; and, (6) barriers to information access arising in the particular work setting (Spenceley et al., 2008). Information-seeking is either avoided or pursued by the nurse to retrieve information to assist with their practice (Spenceley et al., 2008).

Nurses' *information-seeking behaviour* and *use of accumulated knowledge* are influenced by nurse attributes such as age, years of nursing experience, and level of education (Baessler, 1994; Dee, 2005, Lathey, 2001; Ramming, 1992; Spath, 1996; Irving, 1997; Lamond, 1996; Palfreyman, 2003; Urquhart, 1994; Urquhart & Davies, 1997; Royle, 2000; Secco, 2006; Squires, Moralejo & Lefort, 2007; Spenceley et al., 2008). In this study, no significant relationships were found pertaining to nurse attributes with *information-seeking behaviour* and *use of accumulated knowledge* which differs from the nursing literature. As stated previously, both methodological factors, such as the measurement tool with lack of sensitivity to detect differences and conceptual factors, such that naturally all individuals use accumulated knowledge could be possible explanations for inconsistencies

Moreover, the nursing literature indicates that context influences nurses' *information-seeking behaviour* and *use of accumulated knowledge* through the availability of administrative support (Baessler, 1994; Irving, 1997; Estabrooks, 2005; McDiarmid, 1998; Secco, 2006; Gerrish & Clayton, 2004; Spenceley et al., 2008), organizational setting (Estabrooks et al., 2005a; Irving et al., 1997; Spenceley et al., 2008 ) and training opportunities (Hall et al., 2003; Lathey, 2001; Ramming, 1992; Spath, 1996, Royal College of Nursing, 2005, Urquhart & Davies, 1997; Winter, 1990; Royle, 2000; Secco, 2006; Spenceley et al., 2008). In this study, *received training* to seek evidence-based information resources was found to have a significant relationship with *information-seeking behaviour*. *Administrative support* and *context* did not have a significant relationship with *information-seeking behaviour*, which differs from the nursing literature. There were no significant results found with the confounding variables of *context* and the *use of accumulated knowledge*. Possibly, methodological factors such as the models tested or different populations targeted in previous studies are inconsistent with this study.

The only confounding variable to have a relationship with the outcome variable, *information-seeking behaviour*, is *received training* to seek evidence-based information resources. *Received training* had a significant positive relationship with *information-seeking behaviour*. As previously stated, most critical care nurses in this study, reported that they had *received training* (i.e., library skills, research skills or computer skills) to seek evidence-based information resources. The literature indicates that nursing students make more use of all available resources, and they are better trained, than clinical nurses when seeking information; but overall both groups lacked database-searching skills (Dee & Stanley, 2005). O'Leary and Mhaolrunaigh (2012) argue that resources should be directed at ensuring that there is more research information at hand for nurses at the point of care, rather than using resources to train nurses to look up and interpret research information. Further, disseminating evidence-based knowledge through staff that nurses trust, such as Advanced Practice Nurses, could be targeted with specific training and resources so that they are transferring current, research-based information to other nurses.

Next, the final conceptual model will be discussed with the outcome variable, *information-seeking behaviour*. No conceptual model was developed for the outcome variable, *use of accumulated knowledge*.

## 5.6. Final Conceptual Model

The final conceptual model includes *received training*, *non-routineness of the task* and *personal control*, each having a positive linear direct relationship with *information-seeking behaviour*. The regression model had an adjusted  $R^2 = 0.136$ , F-test = 4.161 and  $p = 0.000$ . The beta regression coefficients are small indicating other variables could be influencing the dependent variables. However, overall this study had reasonable results since it is interested in relationships rather than predictors. *Supervisor support*, *context*, *age*, *education*, *years as critical care nurse*, *problem-solving confidence* and *avoidance-approach style* did not have a significant relationship in the regression model. *Use of accumulated knowledge* also did not have any significant findings in the study. The overall implications and conclusions of the study will be discussed below.

## 5.7. Implications

The implications of this study are relevant to nursing: (1) practice, (2) education, (3) administration, and (4) research. Each will be discussed below.

### 5.5.7. Practice.

Evidence shows that the non-routineness of nursing tasks has a relationship with *information-seeking behaviour*. This suggests that when critical care nurses have an unfamiliar task and an information need, they will seek information from various sources. It is important that nurses recognise and pursue evidence-informed resources prior to completing unfamiliar tasks. All nurses need to be competent by having the appropriate knowledge, skill and judgement in the completion of particular tasks for patient care. Nurses are accountable and responsible for maintaining their clinical competence.

This study provides evidence that problem-solving ability, in particular, a sense of *personal control* influences critical care nurses' *information-seeking behaviour*. This means that nurses who can direct their emotions and behaviours when solving problems will seek information. This implies that individuals who have positive thoughts (i.e., fewer dysfunctional thoughts and irrational beliefs) regarding their performance (Heppner & Krieshok, 1983) will seek information when they have information needs.

Additionally, this study found that those critical care nurses who received training on information-seeking (i.e. research skills, library skills, and computer skills) demonstrated *information-seeking behaviours*. Critical care nurses who received information-seeking training were more likely to seek information for patient care tasks when they had information needs. This research suggests that employers need to support critical care nurses by assisting with the development of their *information-seeking behaviours* to appropriately complete patient care tasks. Expanding critical care nurses research, library and computer skills in the practice environment will also give them opportunities to appreciate the range of resources available, discriminate between good and poor quality resources, and how to best access these resources within their organizations.

Moreover, this study reveals how information is perceived to be sought by critical care nurses from resources and on what information resources are perceived necessary to promote access to and use of evidence-based information. Although, the majority of nurses prefer to use colleagues as a resource, this study found that critical care nurses used a computer to search information for patient care. In particular, they used the internet, electronic databases (i.e., Ovid and Pubmed) and e-books/e-journals. A majority of nurses indicated that they searched for information during shifts and to a lesser degree searched at home outside work hours or at the hospital after their patient care shifts. Nurses need to have easy access to computers with electronic resources during their work hours. Pursuing

evidence-based information to complete patient care while at work needs to be valued as an important step to provide quality patient care and improve patient outcomes.

### **5.5.8. Education.**

This study can help direct efforts towards training nurses in effective problem-solving (e.g., use of decision support tools), the development of critical thinking skills and information-seeking skills (e.g. development of library, research and/or computer skills). The findings emphasize the relevance of context through access to training when providing education and developing training strategies. Those nurses who indicated that they previously received information-seeking training for library, research, and computer skills were more likely to seek information. The organizations in which the nurse work can help develop these skills by providing information-seeking training, access to educational support (i.e., librarians, clinical educators, Advanced Practice Nurses) or opportunities to support learning of information-seeking skills through external programs. The nurse could also develop information-seeking skills through continuing education programs (i.e. Bachelor, Master's degree). The findings may also help to raise nurses' awareness of their problem-solving abilities (e.g. *avoidance-approach style*, *problem-solving confidence*, and *personal control*) and the subsequent affect on their *information-seeking behaviours*.

This study indicates that *personal control* has a positive relationship with *information-seeking behaviour*. Educational strategies might specifically target the development of the problem-solving ability domain of *personal control*. Critical care nurses could develop skills to be more aware of their emotions and how it impacts their behaviours. Behaviour modification could be completed by the nurse to improve problem-solving by learning methods to assist with directing their emotions and behaviours while problem-solving. Further, this study found that those critical care nurses who received information-seeking training would actively pursue resources to satisfy their information needs. The findings show that critical care nurses will seek information during non-routine tasks suggests that nurse educators can assist nurses to learn and identify appropriate resources, and advocate for them to have access to such resources within clinical units.

### **5.5.9. Administration.**

The study provides nurse administrators with the insight that critical care nurses will likely seek information when they have a non-routine task. More importantly, critical care

nurses may seek information at the hospital during or after work as well as from home to support the conduct of non-routine patient care tasks. In addition, they use electronic devices to search for this information. Administrators can provide support for the acquisition of evidence-based resources, electronic devices (i.e., computers, smart phones, and personal digital assistants), and access to computer-based resources (i.e., medication and best practice guidelines). The findings also highlight the potential value of administrative support for nurses to attend training programs that enhance problem-solving and information-seeking skills.

This study also highlights the important influence of organizational context on nurses' *information-seeking behaviours*. For example, it can inform nurse administrators about the effects of *context*, in particular, access to training for information-seeking skills. As this study found that critical care nurses who attended previous information-seeking training were more likely to seek information, there is support for administrators to invest in information-seeking skills education programs.

#### **5.5.10. Research.**

This study has implications for critical care nursing research in terms of adding to the literature and nursing knowledge of nurses' *information-seeking behaviours*, perceptions of their problem-solving abilities, and the influence of *personal control* on the completion of non-routine patient care tasks. Replication of this study might focus on different nurse populations (i.e., international critical care nurses) to identify similarities or differences in *information-seeking behaviours* in the face of non-routine tasks. Since changing patient demographics (i.e., age, co-morbid factors) are becoming increasingly prevalent across general nursing units, it would be interesting to examine non-routine tasks in this environment.

Further, the exploration of *information-seeking behaviour* and problem-solving domains could be researched in observation studies to gain more "real world" perspectives by collecting data in the natural setting. As this was an exploratory study, ecological validity could be assessed through future observational studies or field studies using qualitative methods to assist in the understanding of *information-seeking behaviour*. As information is continually expanding, it is important to understand the evolution of how nurses' perceive their problem-solving abilities, particularly in the context of the emerging ubiquity of clinical information systems in every practice setting.

It would also be useful to investigate the relationship between problem-solving abilities, such as *personal control*, *information-seeking behaviour* and clinical decision-making. The process of evidence-based practice includes decision-making (i.e., formulating a practice judgement and plan to address the patient care task) and starts when a nurse has perceived information needs encountered as a result of a non-routine task. The nurse chooses to pursue an information need and decision-making initiates once information has been obtained and processed. Nurses decide what data to collect, interpret the information, plan and administer interventions and finally evaluate the outcomes to check for problem resolution (Bucknall, 2000).

Estabrooks, Squires, Cummings, Birdsell and Norton's (2009) research has indicated that leadership, culture, evaluation, social capital, formal interactions, informal interactions, structural/electronic resources and organizational slack features of context are associated with research utilization. They have developed the *Alberta Context Tool (ACT)* to measure these features. This tool could be used in future research to explore how *context* and task characteristics interact to influence nurses' *information-seeking behaviour*. Also, selecting contexts with more variability (i.e., critical care hospital settings that are somewhat similar) would enable further exploration of the role of *context* in influencing *information-seeking behaviour*.

Finally, in future research, this study could be completed with different specialties of nursing to compare results among specialty groups. This study could also be completed with nursing students. Problem-solving ability domains, *information-seeking behaviours* and the *non-routineness of tasks* could be perceived differently in other specialties or within different sectors/settings of the health care system. Different sampling strategies could also be used to acquire a sample that is representative to the population of interest. For example, quota sampling could be used to insure the sample has a certain distribution of demographic variables (i.e., critical care speciality certification/education or years of experience in a specialty of nursing). Further, sample recruitment could occur at specific organizations rather than from a database of volunteers who would like to participate in research. There could be systematic differences between those who specifically volunteer to be involved in research versus not volunteering.

## **5.8. Conclusions.**

This exploratory study contributes to the nursing literature by expanding the knowledge of critical care nurses' perceptions of their problem-solving abilities, especially as

it relates to published and informal information sought during the performance of non-routine tasks. This study found that *non-routineness of the task* had a positive relationship to *information-seeking behaviour*. This finding suggests that critical care nurses will seek information when they have an unfamiliar task. The study also confirmed that critical care nurses use colleagues as their primary resource to seek information for a patient care task.

This research has provided insight into critical care nurses' perceptions of their problem-solving abilities, particularly in relation to their sense of *personal control*. *Personal control* was found to have a positive linear relationship with *information-seeking behaviour*. The development of problem-solving skills is important for critical care nurses to support evidence-based decisions when faced with the completion of routine and non-routine tasks.

Overall this study found that critical care nurses faced with a non-routine task, previously received information-seeking training, and have *personal control* when problem-solving, will seek information. Critical care nurses' *use of accumulated knowledge* had non-significant findings in this study. It is important that critical care nurses use evidence-based information to guide practice so that quality patient care occurs.



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## APPENDICES

## APPENDIX A

## SELECTED CRITICAL CARE NURSE INFORMATION-SEEKING STUDIES

| Author(s)                        | Study design  | Setting, sample and response rate  | Variables  | Study results  |
|----------------------------------|---|--|--|--|
| Corcoran-Perry and Graves (1990) | Self-report & observation-interview   | 175 instances of supplemental-information-seeking behavior were collected from 46 cardiovascular nurses in 3 metropolitan hospitals. | The Krikelas model was used as a framework for investigating supplemental-information-seeking behavior of cardiovascular nurses. | Findings indicated that the nurses sought patient-specific data most frequently, followed by institution-specific data and domain knowledge. They needed a surprisingly large portion of the information to track people, equipment, medications, and reports.   |
| McKnight (2004)                  | Observation and in-context interviews to describe 50 hours of the observable information behavior | Critical care nurses in a 20-bed critical care hospital unit   | Open, in vivo, and axial coding to develop a grounded theory model of nurses consistent pattern of multimedia interactions.      | Nurses' information seeking was centered on the patient. They mostly sought information from people, the patient record and other digital systems. They acted on or passed on most of the information they found. Some information they recorded for their personal use during the shift. The researcher observed the nurses using mostly patient specific information, but they also used some social and logistic information. They occasionally sought knowledge based information. Barriers to information acquisition included illegible handwriting, difficult navigation of online systems, equipment failure, unavailable people, social protocols and mistakes caused by multi-tasking people working with multiple complex systems. No formal use was observed of standardized nursing diagnoses, nursing interventions, or nursing outcomes taxonomies. While the nurses expressed respect for evidence-based practice, there clearly was no time or opportunity for reading research literature (either on paper or online) while on duty. |

| Author(s)  | Study design  | Setting, sample and response rate  | Variables  | Study results  |
|--|---|--|--|--|
| McKnight (2006)  | Observational study<br>Participant observation and in-context interviews were used to record 50 hours of information behaviour of a purposive sample. | Sample = on-duty critical care nurses on 20-bed CCU<br>Setting = community hospital.           | Nurses' information behaviour                          | Nurses' information behaviour centered on the patient, seeking information from people, the patient record, and other systems. The nurses mostly used patient-specific information, but they also used some social and logistic information. They occasionally sought knowledge-based information. Barriers to information acquisition included illegible handwriting, difficult navigation of online systems, equipment failure, unavailable people, social protocols and mistakes caused by people multitasking while working with multiple complex systems. Although the participating nurses understood and respected EBP, many believed that taking time to read published information on duty was not only difficult, but perhaps also ethically wrong. They said that a personal information service available to them at all hours of the day or night would be very useful. |
| Shim, Silfen, Patel, Chiu, Zhu, Kelly, Park, Allen and Cimino (2006) | Descriptive -observation, staff surveys & Focus groups  | Setting = Cardiothoracic Step-Down Unit at New York Presbyterian Hospital<br>n=16 staff nurses | Information Need<br>Information Source<br>Nursing Task | Focus groups identified: types of information needs, peak demands, most utilized information sources, level of satisfaction with information sources, frustrating instances for obtaining information Nursing Tasks with associated information needs (%age of time recognized) were identified for intervention to improve access to information sources: 1) Medication management 25%, 2) Patient bed allocation (special cause), 3) Physician paging 28%<br>Identified 228 nursing Information need instances and 29 information sources  |

| Author(s)                        | Study design   | Setting, sample and response rate   | Variables   | Study results   |
|----------------------------------|--|---|---|---|
|                                  |  |   |   | <p>associate with 6 categories of nursing tasks within the clinical context.</p> <p>Obtained information needs: Clinical information, Admission/transfer/discharge information, medication information, interdisciplinary communication, test or procedure information, equipment related information</p>   |
| Marshall, West and Aitken (2011) | Instrumental case study design- verbal protocols, Q methodology and focus groups | 13-bed Level III intensive care unit within an Australian tertiary teaching hospital verbal protocols (n=6) Q methodology (n=17) focus groups (n=6) | Determine intensive care nurses' perspectives of information use in the resolution of clinical uncertainty for enteral feeding practice | <p>Preference for information from colleagues to support clinical decisions. People as information sources were considered most useful and most accessible in clinical setting. Text and electronic information sources were seen as less accessible due to time required to access the information within the documents.</p> <p>Social exchange of clinical information may meet the needs of nurses working in complex, time-pressured environments however extent of evidence base for information passed through verbal communication is unclear.</p> |

## APPENDIX B

### TASK COMPLEXITY CONSTRUCTS

| Type of Construct  | Description   |
|--|---|
| 1. Degree of difficulty  | Definition treats task complexity as a measure of the task's potential for being perceived as difficult by the task performer. May be operationalized based upon performer-reported assessments of difficulty, or upon indirect measures, such as the degree to which the task must be constantly attended to.  |
| 2. Sum of JCI or JDS factors   | Defines task complexity in terms of the task's potential to induce a state of arousal or enrichment in the task performer, operationalized using instruments such as the JCI (Job Characteristics Index) or JDS (Job Diagnostic Survey).  |
| 3. Degree of stimulation   | Definition treats task complexity as a measure of the task's potential to induce a state of stimulation or arousal in the task performer. Similar to degree of difficulty except that it is normally measured using physiological measurements (e.g., pupil dilation) as opposed to self-reporting.   |
| 4. Amount of work required to complete the task or information load associated with the task | Definition treats task complexity as a measure of a task's potential to induce various information processing levels, such as peak processing rate (e.g., bits/second) or total amount of processing (e.g., bits processed). Such processing is intended to be measured objectively, instead of being based on task performer perceptions or responses. It is also nearly always constructed so that task performance strategy is held constant.  |
| 5. Amount of Knowledge   | Definition is based upon the amount of knowledge that must be acquired in order to perform the task. Definition may be operationalized using metrics such as the amount of time required to learn the task.   |
| 6. Size  | Defines task complexity using the information theory of the minimum theoretical size of the problem space necessary to perform the task. Most commonly used in assessing software complexity.   |
| 7. Number of Paths   | Defines task complexity in terms of the number of alternative paths that are possible using given performance strategy. Has been used for both general tasks and for analyzing the complexity of computer programs, where it measures the number of branches (e.g., if constructs).   |
| 8. Degree of task structure  | Defines task complexity as the degree to which a task is not programmed, i.e., the degree to which accepted task-specific procedures for performing the task do not exist. Lack of structure can result from a number of sources, including the lack of a clear goal state to be achieved, the inability to establish the initial starting point of the task and relevant task attributes, and/or a lack of knowledge of strategies suitable for moving between the initial state and the goal state. |
| 9. Non-routineness** or novelty of task  | Defines task complexity in terms of the degree to which the task is unfamiliar to the task performer. A routine task is typically viewed as the opposite of a complex task under this definition.   |
| 10. Degree of Uncertainty  | Defines task complexity as the degree to which actual performance of the task cannot be predicted at the outset of the task owing to uncertainty. Normally, such uncertainty can arise as a result of lack of structure (see above) or from stochastic uncertainties inherent in the task itself.   |

|  |   |
|--|---|
| 11. Complexity of underlying system or environment | Definition specifically relates to the task of controlling or predicting the behavior of systems. Defines task complexity in terms of the objective attributes of the system (e.g., number of components, degree of interrelationships).  |
| 12. Function of alternatives and attributes        | Specifically focused on choice tasks, definition treats task complexity to be an objective function of the alternatives available in the task (e.g., number of alternatives, discriminability) and the task's attributes (e.g., the number of criteria needing to be considered, the degree to which they are interdependent).  |
| 13. Function of task characteristics               | A more general version of the attributes alternatives definition of task complexity, it defines task complexity to be direct function of all possible task characteristics, such as inherent uncertainties in the nature of the task, tradeoffs that must be made between different goal criteria, and the degree to which steps taken in performing the task are irreversible. |

(Gill & Hicks, 2006, p. 8-10)

**\*\*Construct of interest for the study**

## APPENDIX C

### DEMOGRAPHIC INFORMATION

1. Please tell us your **professional designation**, select only **one**
  - 1 RN (Registered Nurse)
  - 2 Registered Nurse, Extended Class (EC)
  
2. Please tell us your **primary role**, select only **one**
  - 1 Staff Nurse
  - 2 Clinical Resource Nurse/Educator/Advanced Practice Nurse
  - 3 Nurse Practitioner
  - 4 Other (Please specify) \_\_\_\_\_
  
3. What type of Critical Care unit do you work on most of the time, select only **one**:
  - 1 Staff Nurse
  - 2 Coronary Care Unit
  - 3 Medical Intensive Care Unit
  - 4 Surgical Intensive Care Unit
  - 5 Paediatric Intensive Care Unit
  - 6 Neurological Intensive Care Unit
  - 7 Burn Intensive Care Unit
  - 8 Trauma
  - 9 Other. Please Specify \_\_\_\_\_
  
4. Please mark the level of care that best describes the critical care area in which you work.
  - 1 Intensive care
  - 2 Step-down
  - 3 Ward
  
5. Please indicate the items that best describe your 'typical' work environment. Please check all those that apply.
  - 1 Telemetry
  - 2 Continuous cardiac monitoring
  - 3 Invasive hemodynamic monitoring
  - 4 Short-term ventilation Surgical Intensive Care Unit
  - 5 Prolonged ventilation Paediatric Intensive Care Unit
  - 6 BIPAP Neurological Intensive Care Unit
  - 7 IABP Burn Intensive Care Unit
  - 8 Administration of vasodilators and vasopressors
  - 9 Intermittent renal replacement therapy
  - 10 Continuous renal replacement therapy
  - 11 Invasive intracranial monitoring
  - 12 Invasive cooling devices
  - 13 Non-invasive warming/cooling devices
  - 14 Continuous nursing care
  - 15 Intermittent nursing care
  - 16 Patients with single organ system failure
  - 17 Patients with multi-organ system failure

6. What type of hospital setting do you work in, select only one?

- <sub>1</sub>Rural  
 <sub>2</sub>Urban

7. What type of hospital setting do you work in, select only **one**?

- <sub>1</sub> Academic  
 <sub>2</sub> Non-academic

8. How long have you worked on this unit? \_\_\_\_\_ years \_\_\_\_\_ months

9. How long have you worked with this organization? \_\_\_\_\_ years \_\_\_\_\_ months

10. How long have you worked as a nurse? \_\_\_\_\_ years \_\_\_\_\_ months

11. How long have you worked as a critical care nurse? \_\_\_\_\_ years \_\_\_\_\_ months

12. What is your gender?

- <sub>0</sub>Male  
 <sub>1</sub>Female

13. Year of Birth \_\_\_\_\_

14. Please mark your *completed* education program(s). (**Select all that apply**)

- <sub>1</sub> Diploma/Certificate  
 <sub>2</sub> Bachelors Degree  
 <sub>3</sub> Masters Degree  
 <sub>4</sub> PhD, DN

15. What is your **current** employment status?

- <sub>1</sub>Full-time  
 <sub>2</sub>Part-time  
 <sub>3</sub>Casual

16. Do you use a computer to search for information for patient care?

- <sub>1</sub> yes  
 <sub>2</sub> no

17. If yes, where do you search? Please check all that apply.

- <sub>1</sub> At home  
 <sub>2</sub> At hospital  
 <sub>3</sub> At hospital during shift  
 <sub>4</sub> At hospital after shift  
 <sub>5</sub> Other. Please Specify \_\_\_\_\_



18. If yes, do you use electronic resources to seek information? Please check all that apply.

- 1 Internet
- 2 Electronic databases (i.e. Ovid, Pubmed)
- 3 Personal digital assistants (i.e. handheld computers)
- 4 e-books/e-journals
- 5 Teleconferences
- 6 Other. Please Specify \_\_\_\_\_

**APPENDIX D****PRE-NOTIFICATION LETTER**

**Date here, 2011**

Dear study participant,

I am writing to ask for your help with an important study being conducted by a doctoral student at the Lawrence S. Bloomberg, Faculty of Nursing, University of Toronto to understand critical care nurses' information-seeking, accumulated knowledge, non-routineness of the task, and perception of problem-solving abilities during patient care tasks. In the next few days you will receive a request to participate in this project by answering questions about your experiences as a critical care nurse and information-seeking for non-routine tasks during patient care.

We would like to do everything we can to make it easy and enjoyable for you to participate in the study. I am writing in advance because many people like to know ahead of time that they will be asked to fill out a questionnaire. This research can only be successful with the generous help of people like you.

In recognition of your contribution, you will be asked to choose a charity so that a donation can be made in compensation of your time and you will also be sent a certificate of participation in the study. I hope you will take 20-25 minutes of your time to help us. Participants who complete the questionnaire may choose one of three selected charities so that a donation can be made in compensation. Most of all, I hope that you enjoy the questionnaire and the opportunity to voice your thoughts and opinions about critical care nursing practices.

Best Wishes,

Kristine Newman

Kristine Newman, RN, CRN(C), MSc.  
Doctorate Candidate

Phone: 1-866-230-2326  
E-mail: kristine.newman@utoronto.ca  
Lawrence S. Bloomberg Faculty of Nursing,  
University of Toronto  
155 College Street, Toronto, ON., M5T 1P8

## APPENDIX E

### COVER LETTER, QUESTIONNAIRE RESPONSE INFORMATION AND CONSENT



**TITLE: The exploration of Critical Care Nurses' use of accumulated knowledge and information-seeking for non-routine tasks**

**PRINCIPAL INVESTIGATOR:** Kristine Newman, RN, CRN(C), MSc.  
 Doctorate Candidate  
 Lawrence S. Bloomberg Faculty of Nursing,  
 University of Toronto  
 Phone: 1-866-230-2326  
 E-mail: kristine.newman@utoronto.ca

**THESIS SUPERVISOR:** Diane Doran, RN, PhD, FCAHS  
 Lawrence S. Bloomberg Faculty of Nursing,  
 University of Toronto  
 Phone: 416-978-2866  
 E-mail: diane.doran@utoronto.ca

You are being asked to take part in a research study. Before agreeing to participate in this study, it is important that you read and understand the following explanation of the proposed study procedures. The following information describes the purpose, procedures, benefits, discomforts, risks and precautions associated with this study. It also describes your right to refuse to participate or withdraw from the study at any time. In order to decide whether you wish to participate in this research study, you should understand enough about its risks and benefits to be able to make an informed decision. This is known as the informed consent process. Please contact the research team to explain anything you do not understand before signing this consent form. Make sure all your questions have been answered to your satisfaction before signing this document.

#### **Purpose**

The study will examine the relationships of Critical Care nurses' information-seeking, accumulated knowledge, non-routineness of the task, and perception of problem-solving abilities during patient care tasks.

#### **Procedures**

The study involves critical care registered nurses completing a questionnaire. You will be asked to complete a paper questionnaire. The questionnaire will ask you about the tasks you complete routinely and non-routinely for patient care; information-seeking behavior; perceptions of your problem-solving abilities, as well as supervisor support, culture and other organizational factors.

## **Risks and Benefits**

The research team is not aware of any risk to nurses who choose to participate in this study. Then benefits include:

(1) the opportunity for the participant to represent the Ontario Critical Care Registered Nurse population in the hospital sector regarding information-seeking practices during a non-routine task,

(2) the opportunity for the participant to include their participation in the study as a component of the Colleges of Nurses of Ontario quality assurance program, and

(3) the opportunity for the participant to impact future practices of Ontario critical care nursing practice community through sharing their perceptions of information-seeking when having a non-routine task

## **Confidentiality**

All information obtained during the study will be held in strict confidence. You will be identified with a study code number only. Your name will not appear on any research data for this study.

Only the Principal Investigator, Doctoral thesis supervisor and researcher assisting with double checking data entry will have access to your answers to the surveys. You may choose not to respond to any of the questions if you wish. The data collected during this study will be reported only in summary form in a way that does not identify any individual or their employer.

Participants will be free to withdraw from the study prior to the data analysis stage however all data remains confidential for this study. All data will be stored in a secure archive location of the Lawrence S. Bloomberg Faculty of Nursing, University of Toronto for 7 years following publication of the study results.

## **Participation**

Your participation in this study is voluntary. You have been invited to participate because you are a Registered Nurse (RN) working in a critical care setting. You can choose not to participate by withdrawing from the study. You are not obligated to complete the entire document and may choose not to answer some questions without any consequence.

## Questions

If you would like to discuss any aspects of the study please feel free to contact the Principal Investigator listed below.

### Principal Investigator

Kristine Newman, RN, CRN(C), MSc.  
 Doctorate Candidate  
 Phone: 1-866-230-2326  
 E-mail: kristine.newman@utoronto.ca  
 Lawrence S. Bloomberg Faculty of Nursing,  
 University of Toronto  
 155 College Street, Toronto, ON., M5T 1P8

If you have questions about your rights as a research participant, please contact Daniel Gyewu, Research Ethics Board Manager, Research Ethics Office, University of Toronto, at telephone 416-946-3389 or by e-mail ethics.review@utoronto.ca or Dr. Diane Doran, Doctoral thesis supervisor, at telephone 1-416-978-2866 or by email diane.doran@utoronto.ca

### Consent

A questionnaire is enclosed. You may return the questionnaire in the self-addressed stamped envelope that is enclosed as an indication of your consent to participate in the study.

I have had an opportunity to discuss this study and my questions have been answered to my satisfaction. I consent to take part in the study with the understanding I may withdraw at any time. I have received a copy of this consent form. I voluntarily consent to participate in the study.

Nurse's name (Please Print) \_\_\_\_\_

Nurse's Signature \_\_\_\_\_

e-mail address \_\_\_\_\_

Date \_\_\_\_\_

If you would like a summary of the findings at the end of the study to be sent to you, please provide your e-mail address.

Participants who complete the questionnaire may choose one charity below so that a donation can be made in compensation of their time to complete the questionnaire. Please mark your choice of charity.

Heart and Stroke Foundation of Ontario \_\_\_\_\_

Ontario Lung Association \_\_\_\_\_

Registered Nurses Foundation of Ontario \_\_\_\_\_

**APPENDIX F**  
**THANK YOU POST CARD**

Front

Date, 2011

Last week a questionnaire was mailed to you because your name was randomly selected from the College Of Nurses of Ontario critical care nurse volunteers to participate in nursing research.

If you have already completed and returned the questionnaire, please accept our sincere thanks. If not, please do so at your convenience before (?) date. We are especially grateful for your help with this important study.

If you did not receive a questionnaire, or it was misplaced, please call us at 1-866-230-2326 and we will get another one in the mail for you today.

Sincerely,

*Kristine Newman*

Kristine Newman, RN, CRN(C), MSc.  
Doctorate Candidate

Back



155 College Street, Toronto,  
ON., M5T 1P8

ID

Study Participant Address

## APPENDIX G

## CERTIFICATE OF PARTICIPATION

|  |   |
|--|---|
|   | <h1>Certificate of Participation</h1>   |
| <p>_____ has participated in the study, "The exploration of critical care nurses' use of accumulated knowledge and information seeking".</p> |   |
| <p><b>Date, 2011</b></p>   | <p><i>Kristine Newman</i></p>   |
| <p>Principal Investigator:</p>   | <p>Kristine Newman, RN, CRN(C), MSc.<br/>Doctorate Candidate, Lawrence S.<br/>Bloomberg Faculty of Nursing,<br/>University of Toronto</p> |

**APPENDIX H**  
**CORRELATION MATRIX**

|                                  | 1                | 2                | 3                 | 4               | 5                 | 6                | 7                 | 8                | 9               | 10              | 11                | 12 |
|----------------------------------|------------------|------------------|-------------------|-----------------|-------------------|------------------|-------------------|------------------|-----------------|-----------------|-------------------|----|
| 1. Non-routineness of the task   |                  |                  |                   |                 |                   |                  |                   |                  |                 |                 |                   |    |
| 2. Use of accumulated knowledge  | 0.013<br>(172)   |                  |                   |                 |                   |                  |                   |                  |                 |                 |                   |    |
| 3. Age                           | 0.033<br>(171)   | 0.046<br>(172)   |                   |                 |                   |                  |                   |                  |                 |                 |                   |    |
| 4. Received Training             | 0.078<br>(174)   | 0.111<br>(174)   | 0.040<br>(174)    |                 |                   |                  |                   |                  |                 |                 |                   |    |
| 5. Avoidance-Approach Style      | -0.166*<br>(168) | -0.143<br>(169)  | -0.208**<br>(168) | -0.083<br>(171) |                   |                  |                   |                  |                 |                 |                   |    |
| 6. Problem-solving confidence    | -0.073<br>(168)  | -0.121<br>(168)  | -0.099<br>(168)   | -0.177<br>(171) | 0.522**<br>(169)  |                  |                   |                  |                 |                 |                   |    |
| 7. Personal Control              | 0.056<br>(169)   | -0.156*<br>(170) | -0.262**<br>(169) | -0.084<br>(172) | 0.586**<br>(170)  | 0.594**<br>(169) |                   |                  |                 |                 |                   |    |
| 8. Supervisor support            | 0.019<br>(174)   | 0.088<br>(175)   | 0.128<br>(174)    | 0.163*<br>(177) | -0.107<br>(171)   | -0.061<br>(171)  | -0.196**<br>(172) |                  |                 |                 |                   |    |
| 9. Context                       | -0.052<br>(174)  | 0.146<br>(174)   | 0.198**<br>(173)  | 0.165*<br>(176) | -0.235**<br>(175) | -0.006<br>(170)  | -0.227**<br>(171) | 0.540**<br>(176) |                 |                 |                   |    |
| 10. Use computer to search       | 0.037<br>(172)   | -0.087<br>(173)  | -0.063<br>(172)   | 0.069<br>(175)  | 0.066<br>(170)    | -0.058<br>(170)  | 0.039<br>(171)    | 0.139<br>(175)   | 0.031<br>(174)  |                 |                   |    |
| 11. Education                    | -0.013<br>(172)  | -0.026<br>(173)  | -0.415**<br>(172) | 0.034<br>(175)  | -0.018<br>(169)   | -0.109<br>(169)  | 0.076<br>(170)    | 0.016<br>(175)   | -0.001<br>(174) | 0.025<br>(173)  |                   |    |
| 12. Years as critical care nurse | 0.105<br>(174)   | 0.016<br>(175)   | 0.650**<br>(174)  | 0.013<br>(177)  | -0.126<br>(171)   | -0.194*<br>(171) | -0.286**<br>(172) | 0.158*<br>(177)  | 0.110<br>(176)  | -0.010<br>(175) | -0.335**<br>(175) |    |



|                                   | 1               | 2               | 3                | 4                | 5                 | 6                | 7                 | 8               | 9                | 10             | 11              | 12             |
|-----------------------------------|-----------------|-----------------|------------------|------------------|-------------------|------------------|-------------------|-----------------|------------------|----------------|-----------------|----------------|
| 13. Information-seeking behaviour | 0.162*<br>(172) | 0.513*<br>(175) | 0.210**<br>(172) | 0.235**<br>(175) | -0.256**<br>(169) | -0.153*<br>(169) | -0.225**<br>(170) | 0.172*<br>(175) | 0.226**<br>(175) | 0.050<br>(173) | -0.005<br>(173) | 0.144<br>(175) |

Note. Pearson correlations, (N)

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

**APPENDIX I****USE OF ACCUMULATED KNOWLEDGE TABLES**

Table I.1.

## Use of Accumulated Knowledge with Problem-Solving Confidence

| Variable                     | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|------------------------------|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task  | 0.002  | 0.026 | 0.850 | 0.006  | 0.071  | 0.944 | (-0.049 - 0.053) |
| Supervisor support           | -0.005 | 0.032 |       | -0.017 | -0.171 | 0.865 | (-0.069 - 0.058) |
| Context                      | 0.119  | 0.079 |       | 0.148  | 1.502  | 0.135 | (-0.037 - 0.275) |
| Age                          | 0.002  | 0.005 |       | 0.047  | 0.421  | 0.675 | (-0.007 - 0.011) |
| Education                    | -0.045 | 0.076 |       | -0.053 | -0.590 | 0.556 | (-0.196 - 0.106) |
| Training                     | 0.072  | 0.070 |       | 0.083  | 1.027  | 0.306 | (-0.066 - 0.210) |
| Years as Critical Care Nurse | -0.072 | 0.096 |       | -0.082 | -0.753 | 0.453 | (-0.261 - 0.117) |
| Problem-solving confidence   | -0.006 | 0.006 |       | -0.084 | -1.028 | 0.306 | (-0.018 - 0.006) |

Note.  $R^2 = 0.043$ , Adjusted  $R^2 = -0.008$ ,  $F = 0.850$ ,  $p = 0.560$ ,  $N = 161$

Table I.2.

## Use of Accumulated Knowledge with Problem-Solving Confidence x Non-routineness of the task

| Variable   | B      | SE    | F     | Beta   | t       | p     | (95%)CI          |
|--|--------|-------|-------|--------|---------|-------|------------------|
| Non-routineness of the task                              | -0.152 | 0.110 | 0.991 | -0.471 | -0.1383 | 0.169 | (-0.369 - 0.065) |
| Supervisor support                                       | -0.005 | 0.032 |       | -0.015 | -0.152  | 0.880 | (-0.068 - 0.058) |
| Context  | 0.105  | 0.079 |       | 0.131  | 1.318   | 0.189 | (-0.052 - 0.261) |
| Age  | 0.003  | 0.005 |       | 0.078  | 0.685   | 0.494 | (-0.006 - 0.012) |
| Education  | -0.048 | 0.076 |       | -0.056 | -0.628  | 0.531 | (-0.198 - 0.102) |
| Training   | 0.064  | 0.070 |       | 0.075  | 0.922   | 0.358 | (-0.074 - 0.202) |
| Years as Critical Care Nurse                             | -0.088 | 0.096 |       | -0.101 | -0.921  | 0.359 | (-0.278 - 0.101) |
| Problem-solving confidence                               | -0.037 | 0.022 |       | -0.501 | -1.666  | 0.098 | (-0.082 - 0.007) |
| Problem-solving confidence x Non-routineness of the task | 0.007  | 0.005 |       | 0.623  | 1.440   | 0.152 | (0.152 - 0.017)  |

Note.  $R^2 = 0.056$ , Adjusted  $R^2 = 0.000$ ,  $F = 0.991$ ,  $p = 0.450$ ,  $N = 161$

Table I.3.

## Use of Accumulated Knowledge with Avoidance-approach style

| Variable                     | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|------------------------------|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task  | -0.004 | 0.026 | 1.023 | -0.012 | -0.153 | 0.878 | (-0.056 - 0.048) |
| Supervisor support           | -0.005 | 0.032 |       | -0.017 | -0.172 | 0.864 | (-0.069 - 0.058) |
| Context                      | 0.098  | 0.081 |       | 0.121  | 1.211  | 0.228 | (-0.062 - 0.259) |
| Age                          | 0.001  | 0.005 |       | 0.036  | 0.321  | 0.749 | (-0.008 - 0.011) |
| Education                    | -0.038 | 0.075 |       | -0.045 | -0.504 | 0.615 | (-0.186 - 0.111) |
| Training                     | 0.069  | 0.069 |       | 0.080  | 0.996  | 0.320 | (-0.068 - 0.206) |
| Years as Critical Care Nurse | -0.079 | 0.095 |       | -0.090 | -0.833 | 0.406 | (-0.266 - 0.108) |
| Avoidance-approach style     | -0.005 | 0.003 |       | -0.126 | -1.474 | 0.142 | (-0.012 - 0.002) |

Note.  $R^2 = 0.051$ , Adjusted  $R^2 = 0.001$ ,  $F = 1.023$ ,  $p = 0.421$ ,  $N = 161$

Table I.4.

Use of Accumulated Knowledge with interaction of Avoidance-approach style x Non-routineness of the task

| Variable   | B      | SE    | F     | Beta   | t       | p     | (95%)CI          |
|--|--------|-------|-------|--------|---------|-------|------------------|
| Non-routineness of the task                            | -0.151 | 0.096 | 1.023 | -0.469 | -0.1581 | 0.116 | (-0.340 - 0.038) |
| Supervisor support                                     | -0.012 | 0.032 |       | -0.036 | -0.367  | 0.714 | (-0.075 - 0.052) |
| Context  | 0.090  | 0.081 |       | 0.110  | 1.108   | 0.270 | (-0.070 - 0.250) |
| Age  | 0.002  | 0.005 |       | 0.042  | 0.370   | 0.712 | (-0.007 - 0.011) |
| Education  | -0.028 | 0.075 |       | -0.032 | -0.367  | 0.714 | (-0.176 - 0.121) |
| Training   | 0.079  | 0.069 |       | 0.092  | 1.140   | 0.256 | (-0.058 - 0.216) |
| Years as Critical Care Nurse                           | -0.074 | 0.094 |       | -0.084 | -0.780  | 0.436 | (-0.260 - 0.113) |
| Avoidance-approach style                               | -0.022 | 0.011 |       | -0.550 | -1.974  | 0.050 | (-0.045 - 0.000) |
| Avoidance-approach style x Non-routineness of the task | 0.004  | 0.003 |       | 0.579  | 1.599   | 0.112 | (-0.001 - 0.009) |

Note.  $R^2 = 0.067$ , Adjusted  $R^2 = 0.011$ ,  $F = 1.203$ ,  $p = 0.297$ ,  $N=161$

Table I.5.

Use of Accumulated Knowledge with three domains of Problem-solving abilities and three domains of interaction of Problem-solving abilities x Non-routineness of the task

| Variable   | B      | SE    | F     | Beta   | t      | p     | (95%)CI           |
|--|--------|-------|-------|--------|--------|-------|-------------------|
| Non-routineness of the task                              | -0.181 | 0.129 | 0.895 | -0.561 | -1.405 | 0.162 | (-0.435 - 0.052)  |
| Supervisor support                                       | -0.012 | 0.033 |       | -0.038 | -0.379 | 0.706 | (-0.077 - 0.058)  |
| Context  | 0.087  | 0.084 |       | 0.108  | 1.032  | 0.304 | (-0.080 - 0.010)  |
| Age  | 0.002  | 0.005 |       | 0.056  | 0.476  | 0.635 | (-0.007 - 0.116)  |
| Education  | -0.026 | 0.078 |       | -0.030 | -0.330 | 0.742 | (-0.180 - 0.210)  |
| Training   | 0.073  | 0.071 |       | 0.084  | 1.022  | 0.309 | (-0.068 - 0.109)  |
| Years as Critical Care Nurse                             | -0.094 | 0.099 |       | -0.107 | -0.951 | 0.343 | (-0.291 - -0.014) |
| Personal Control   | -0.037 | 0.041 |       | -0.396 | -0.906 | 0.367 | (-0.117 - 0.006)  |
| Avoidance-approach style                                 | -0.012 | 0.015 |       | -0.297 | -0.828 | 0.409 | (-0.041 - 0.019)  |
| Problem-solving confidence                               | -0.002 | 0.031 |       | -0.024 | -0.058 | 0.954 | (-0.063 - 0.060)  |
| Personal Control x Non-routineness of the task           | 0.007  | 0.009 |       | 0.411  | 0.771  | 0.442 | (-0.010 - 0.024)  |
| Avoidance-approach style x Non-routineness of the task   | 0.002  | 0.003 |       | 0.305  | 0.697  | 0.487 | (-0.004 - 0.008)  |
| Problem-solving confidence x Non-routineness of the task | 0.001  | 0.007 |       | 0.095  | 0.168  | 0.867 | (-0.012 - 0.014)  |

Note.  $R^2 = 0.075$ , Adjusted  $R^2 = -0.009$ ,  $F = 0.895$ ,  $p = 0.560$ ,  $N = 158$

Table I.6.

Use of Accumulated Knowledge with Personal Control x Non-routineness of the task

| Variable                                       | B      | SE    | F     | Beta   | t      | p     | (95%)CI           |
|--|--------|-------|-------|--------|--------|-------|-------------------|
| Non-routineness of the task                    | -0.109 | 0.075 | 1.119 | -0.338 | -1.463 | 0.145 | (-0.256 - 0.038)  |
| Supervisor support                             | -0.013 | 0.032 |       | -0.039 | -0.400 | 0.689 | (-0.076 - 0.050)  |
| Context  | 0.099  | 0.079 |       | 0.123  | 1.252  | 0.212 | (-0.057 - 0.256)  |
| Age  | 0.003  | 0.005 |       | 0.077  | 0.686  | 0.494 | (-0.006 - 0.012)  |
| Education                                      | -0.021 | 0.074 |       | -0.025 | -0.287 | 0.775 | (-0.168 - 0.125)  |
| Training                                       | 0.059  | 0.069 |       | 0.068  | 0.850  | 0.397 | (-0.078 - 0.196)  |
| Years as Critical Care Nurse                   | -0.108 | 0.096 |       | -0.122 | -1.127 | 0.261 | (-0.297 - 0.081)  |
| Personal Control                               | -0.053 | 0.026 |       | -0.566 | -1.999 | 0.047 | (-0.104 - -0.001) |
| Personal Control x Non-routineness of the task | 0.010  | 0.006 |       | 0.609  | 1.663  | 0.098 | (-0.002 - 0.022)  |

Note.  $R^2 = 0.062$ , Adjusted  $R^2 = 0.007$ ,  $F = 1.119$ ,  $p = 0.353$ ,  $N = 162$



Table I.7.

## Use of Accumulated Knowledge with three domains of Problem-solving abilities

| Variable                     | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|------------------------------|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task  | -0.002 | 0.027 | 0.834 | -0.008 | -0.088 | 0.930 | (-0.056 - 0.052) |
| Supervisor support           | -0.006 | 0.032 |       | -0.018 | -0.185 | 0.854 | (-0.070 - 0.058) |
| Context                      | 0.096  | 0.084 |       | 0.118  | 1.141  | 0.256 | (-0.070 - 0.262) |
| Age                          | 0.001  | 0.005 |       | -0.026 | 0.223  | 0.824 | (-0.008 - 0.010) |
| Education                    | -0.037 | 0.077 |       | 0.043  | -0.477 | 0.634 | (-0.190 - 0.116) |
| Training                     | 0.070  | 0.071 |       | 0.081  | 0.984  | 0.327 | (-0.070 - 0.210) |
| Years as Critical Care Nurse | -0.085 | 0.098 |       | -0.096 | -0.865 | 0.388 | (-0.278- 0.109)  |
| Personal Control             | -0.008 | 0.011 |       | -0.084 | -0.713 | 0.477 | (-0.029- -0.014) |
| Avoidance-approach style     | -0.004 | 0.005 |       | -0.088 | -0.764 | 0.446 | (-0.013- 0.006)  |
| Problem-solving confidence   | 0.002  | 0.008 |       | 0.028  | 0.252  | 0.801 | (0.015- 0.019)   |

Note.  $R^2 = 0.054$ , Adjusted  $R^2 = -0.011$ ,  $F = 0.834$ ,  $p = 0.596$ ,  $N=158$

**APPENDIX J**  
**INFORMATION-SEEKING BEHAVIOUR TABLES**

Table J.1.

## Information-seeking behaviour with Problem-Solving Confidence

| Variable                     | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|------------------------------|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task  | 0.056  | 0.027 | 3.862 | 0.156  | 2.081  | 0.039 | (0.003 – 0.109)  |
| Supervisor support           | 0.002  | 0.033 |       | 0.004  | 0.047  | 0.963 | (-0.064 – 0.067) |
| Context                      | 0.136  | 0.082 |       | 0.154  | 1.671  | 0.097 | (-0.025 – 0.297) |
| Age                          | 0.009  | 0.005 |       | 0.194  | 1.855  | 0.066 | (-0.001 – 0.018) |
| Education                    | 0.031  | 0.079 |       | 0.033  | 0.396  | 0.693 | (-0.124 – 0.187) |
| Training                     | 0.190  | 0.072 |       | 0.200  | 2.642  | 0.009 | (0.048 – 0.333)  |
| Years as Critical Care Nurse | -0.016 | 0.099 |       | -0.016 | -0.162 | 0.872 | (-0.211 – 0.179) |
| Problem-solving confidence   | -0.010 | 0.006 |       | -0.118 | -1.543 | 0.125 | (-0.022 – 0.003) |

Note.  $R^2 = 0.169$ , Adjusted  $R^2 = 0.125$ ,  $F = 3.862$ ,  $p = 0.000$ ,  $N=161$

Table J.2.

## Information-seeking behaviour with interaction of Problem-Solving Confidence x Non-routineness of the task

| Variable   | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|--|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task                              | 0.082  | 0.114 | 3.418 | 0.228  | 0.714  | 0.476 | (-0.144 – 0.307) |
| Supervisor support                                       | 0.001  | 0.033 |       | 0.004  | 0.043  | 0.965 | (-0.064 – 0.067) |
| Context  | 0.139  | 0.082 |       | 0.156  | 1.682  | 0.095 | (-0.024 – 0.301) |
| Age  | 0.009  | 0.005 |       | 0.189  | 1.772  | 0.078 | (-0.001 – 0.018) |
| Education  | 0.032  | 0.079 |       | 0.034  | 0.400  | 0.690 | (-0.124 – 0.188) |
| Training   | 0.192  | 0.072 |       | 0.201  | 2.643  | 0.009 | (0.048 – 0.335)  |
| Years as Critical Care Nurse                             | -0.013 | 0.100 |       | -0.014 | -0.133 | 0.895 | (-0.210 – 0.184) |
| Problem-solving confidence                               | -0.005 | 0.023 |       | -0.055 | -0.195 | 0.846 | (-0.051 – 0.042) |
| Problem-solving confidence x Non-routineness of the task | -0.001 | 0.005 |       | -0.095 | -0.233 | 0.816 | (-0.012 – 0.009) |

Note.  $R^2 = 0.169$ , Adjusted  $R^2 = 0.120$ ,  $F = 3.418$ ,  $p = 0.001$ ,  $N=161$

Table J.3.

## Information-seeking behaviour with Avoidance-approach style

| Variable                     | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|------------------------------|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task  | 0.047  | 0.027 | 4.165 | 0.133  | 1.755  | 0.081 | (-0.006 – 0.100) |
| Supervisor support           | 0.000  | 0.033 |       | 0.001  | 0.013  | 0.990 | (-0.064 – 0.065) |
| Context                      | 0.121  | 0.083 |       | 0.135  | 1.451  | 0.149 | (-0.044 – 0.285) |
| Age                          | 0.008  | 0.005 |       | 0.177  | 1.678  | 0.095 | (-0.001 – 0.017) |
| Education                    | 0.047  | 0.077 |       | 0.050  | 0.605  | 0.546 | (-0.106 – 0.199) |
| Training                     | 0.200  | 0.071 |       | 0.211  | 2.812  | 0.006 | (0.060 – 0.341)  |
| Years as Critical Care Nurse | -0.008 | 0.097 |       | -0.009 | -0.087 | 0.931 | (-0.200 – 0.184) |
| Avoidance-approach style     | -0.006 | 0.004 |       | -0.142 | -1.795 | 0.075 | (-0.013 – 0.001) |

Note.  $R^2 = 0.180$ , Adjusted  $R^2 = 0.137$ ,  $F = 4.165$ ,  $p = 0.000$ ,  $N = 161$

Table J.4.

Information-seeking behaviour with interaction of Avoidance-approach style x Non-routineness of the task

| Variable   | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|--|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task                            | 0.084  | 0.099 | 3.698 | 0.236  | 0.849  | 0.397 | (-0.111 – 0.279) |
| Supervisor support                                     | 0.002  | 0.033 |       | 0.005  | 0.060  | 0.952 | (-0.063 – 0.067) |
| Context  | 0.123  | 0.084 |       | 0.137  | 1.469  | 0.144 | (-0.042 – 0.288) |
| Age  | 0.008  | 0.005 |       | 0.175  | 1.661  | 0.099 | (-0.001 – 0.017) |
| Education  | 0.044  | 0.078 |       | 0.047  | 0.568  | 0.571 | (-0.109 – 0.197) |
| Training   | 0.198  | 0.072 |       | 0.208  | 2.759  | 0.007 | (0.056 – 0.339)  |
| Years as Critical Care Nurse                           | -0.010 | 0.097 |       | -0.010 | -0.100 | 0.920 | (-0.202 – 0.183) |
| Avoidance-approach style                               | -0.002 | 0.012 |       | -0.046 | -0.176 | 0.861 | (-0.025 – 0.021) |
| Avoidance-approach style x Non-routineness of the task | -0.001 | 0.003 |       | -0.131 | -0.387 | 0.699 | (-0.006 – 0.004) |

Note.  $R^2 = 0.181$ , Adjusted  $R^2 = 0.132$ ,  $F = 3.698$ ,  $p = 0.000$ ,  $N=161$

Table J.5.

## Information-seeking behaviour with three domains of Problem-solving abilities

| Variable                     | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|------------------------------|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task  | 0.054  | 0.028 | 3.323 | 0.152  | 1.924  | 0.056 | (-0.001 – 0.109) |
| Supervisor support           | -0.003 | 0.033 |       | -0.007 | -0.078 | 0.938 | (-0.068 – 0.063) |
| Context                      | 0.124  | 0.086 |       | 0.139  | 1.441  | 0.152 | (-0.046 – 0.294) |
| Age                          | 0.008  | 0.005 |       | 0.174  | 1.631  | 0.105 | (-0.002 – 0.017) |
| Education                    | 0.045  | 0.079 |       | 0.048  | 0.572  | 0.568 | (-0.111 – 0.202) |
| Training                     | 0.200  | 0.073 |       | 0.210  | 2.757  | 0.007 | (0.057 – 0.344)  |
| Years as Critical Care Nurse | -0.027 | 0.100 |       | -0.028 | -0.268 | 0.789 | (-0.225 – 0.171) |
| Personal Control             | -0.012 | 0.011 |       | -0.117 | -1.069 | 0.287 | (-0.034 – 0.010) |
| Avoidance-approach style     | -0.003 | 0.005 |       | -0.061 | -0.577 | 0.565 | (-0.012 – 0.007) |
| Problem-solving confidence   | -0.001 | 0.009 |       | -0.010 | -0.092 | 0.926 | (-0.018 – 0.016) |

Note.  $R^2 = 0.184$ , Adjusted  $R^2 = 0.129$ ,  $F = 3.323$ ,  $p = 0.001$ ,  $N = 158$

Table J.6.

Information-seeking behaviour with three domains of Problem-solving abilities and three domains of interaction of Problem-solving abilities x Non-routineness of the task

| Variable   | B      | SE    | F     | Beta   | t      | p     | (95%)CI          |
|--|--------|-------|-------|--------|--------|-------|------------------|
| Non-routineness of the task                              | 0.141  | 0.133 | 2.572 | 0.396  | 1.058  | 0.292 | (-0.122 – 0.403) |
| Supervisor support                                       | -0.003 | 0.034 |       | -0.007 | -0.079 | 0.937 | (-0.070 – 0.064) |
| Context  | 0.132  | 0.087 |       | 0.148  | 1.513  | 0.133 | (-0.040 – 0.304) |
| Age  | 0.008  | 0.005 |       | 0.172  | 1.564  | 0.120 | (-0.002 – 0.18)  |
| Education  | 0.046  | 0.081 |       | 0.049  | 0.569  | 0.570 | (-0.113 – 0.205) |
| Training   | 0.198  | 0.074 |       | 0.207  | 2.679  | 0.008 | (0.052 – 0.344)  |
| Years as Critical Care Nurse                             | -0.032 | 0.103 |       | -0.033 | -0.313 | 0.755 | (-0.235 – 0.171) |
| Personal Control   | -0.037 | 0.042 |       | -0.364 | -0.889 | 0.376 | (-0.121 – 0.046) |
| Avoidance-approach style                                 | 0.006  | 0.015 |       | 0.134  | 0.400  | 0.690 | (-0.024 – 0.036) |
| Problem-solving confidence                               | 0.016  | 0.032 |       | 0.192  | 0.504  | 0.615 | (-0.047 – 0.080) |
| Personal Control x Non-routineness of the task           | 0.006  | 0.009 |       | 0.308  | 0.616  | 0.539 | (-0.012 – 0.023) |
| Avoidance-approach style x Non-routineness of the task   | -0.002 | 0.003 |       | -0.250 | -0.611 | 0.542 | (-0.008 – 0.004) |
| Problem-solving confidence x Non-routineness of the task | -0.004 | 0.007 |       | -0.295 | -0.554 | 0.580 | (-0.018 – 0.010) |

Note.  $R^2 = 0.188$ , Adjusted  $R^2 = 0.115$ ,  $F = 2.572$ ,  $p = 0.003$ ,  $N = 158$