2017

Identification And Exploration Of The Information Needs And Information-Seeking Behaviors Of Medical-Surgical Nurses During Patient Care

Carrie Lee Gardner
University of Alabama at Birmingham

IDENTIFICATION AND EXPLORATION OF THE INFORMATION NEEDS AND INFORMATION-SEEKING BEHAVIORS OF MEDICAL-SURGICAL NURSES DURING PATIENT CARE

by

CARRIE LEE GARDNER

JACQUELINE MOSS, COMMITTEE CHAIR
ETA S. BERNER
REBECCA S. MILTNER
PENNI WATTS
MARISA L.WILSON

A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham,
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy

BIRMINGHAM, ALABAMA

2017

IDENTIFICATION AND EXPLORATION OF THE INFORMATION NEEDS AND INFORMATION-SEEKING BEHAVIORS OF MEDICAL-SURGICAL NURSES DURING PATIENT CARE

CARRIE LEE GARDNER

NURSING

ABSTRACT

Errors during the course of clinical practice are common and can lead to adverse events in hospitalized patients. Insufficient information and lack of clinician knowledge can serve as major contributing factors to the incidence of errors that occur during patient care. Nurses at the bedside need immediate access to patient specific information, at the point of care, and in an easily accessible format. There is a need for better understanding of the information needs and information-seeking behaviors of medical-surgical nurses. The purpose of this mixed-methods study was to explore the information-seeking behaviors of nurses when delivering patient care on medical-surgical units to inform the development of clinical decision support systems for medical-surgical acute care nurses. Twenty-five medical surgical nurses were observed for 4-hour observation sessions and then participated in semi-structured post-observation interviews. Each information-seeking episode initiated by the nurses was categorized by the need-creating event, the type of information accessed, the source of information, and the mode/format of information exchange though a computerized observational data collection tool. Semi-structured interviews provided more information regarding unmet information needs, information source preferences, perceptions of accessibility and ease of use of sources, and personal experiences with information-seeking. Findings revealed that nurse most often search for information in order to support the patient treatment and the provision of

patient care. Information regarding current and new orders and the schedule of patient care were the most frequently accessed types of information. Nurses in this study most often accessed electronic sources and utilized information in a computerized format. Qualitative interview responses supported that nurses felt that information was readily available and that computerized formats best fit into their normal workflow. However, problems with navigation of electronic systems and technology failure led to unmet information needs. The findings from this study support a considerable shift in the preferred and observed formats and sources of information utilized by nurses in clinical environments with fully integrated electronic medical records. In addition, data regarding the times of day that medical-surgical nurses most frequently search for certain types of information can inform the development of usable and needed clinical decision support.

Keywords: information needs, information-seeking behaviors, information exchange, medical-surgical nurses, observational tool

DEDICATION

This dissertation is dedicated to my husband, my children, and my family who have supported me over the past years during my doctoral studies. We all share in this accomplishment. This would not have been possible without you.

ACKNOWLEDGMENTS

To begin, I acknowledge my dissertation committee members who were more than generous with their expertise and time. A special thanks to Dr. Jacqueline Moss, my committee chair for her unending guidance and support throughout my entire dissertation process. She always believed in my potential for success even when I didn't believe in myself.

I also acknowledge my family and friends who have encouraged me throughout this entire process. Their constant and endless support have helped me survive this journey. I could not have made it through this process without them and I am so grateful for them. They truly serve as my foundation and help to ground me. To my parents (Jerry and Carol), Amy, Bryant, Sam, Louise, and Larry your support and love kept me going most days. Thank you again for helping to make this degree possible. To Scott, Meg, and Tate, this is your degree too. You have been there for all of the chats, classes, intensives, first and last drafts, defenses, and revisions. Thank you for understanding my absences from daily life and for loving and supporting me at all times. I couldn't have made it without you.

I acknowledge my colleague and mentor, Dr. Amy Spurlock, who provided guidance throughout my doctoral studies. She provided me with insight into methodology and statistical analysis and always served as a constant source of support.

Last but certainly not least, I thank my PhD cohort. Their unending support helped me to survive this dissertation journey. I could always count on them for a vote of

confidence, a shoulder to cry on, and a dose of laughter. They will always hold a special place in my heart.

TABLE OF CONTENTS

Page

APPENDIX

LIST OF TABLES

Table *Page*

CHAPTER 1

INTRODUCTION

In 2000, the Institute of Medicine published the report "To Err is Human" which estimated that medical errors result in the loss of 44,000 to 98,000 lives each year in the United States with the total national cost of these preventable adverse events estimated between $17 and $29 billion (Kohn, Corrigan, & Donaldson, 2000). A more recent literature review by James (2013) estimated that medical errors and preventable adverse events are associated with 210,000-440,000 deaths of patients in the United States each year. As reported by Makary and Daniel (2016) medical errors are the third leading cause of death in the United States. In addition to the loss of life and financial costs, medical errors also lead to loss of trust and decreased satisfaction of patients with the healthcare system. In subsequent years following the publication of the Institute of Medicine report "To Err is Human", there has been a significant response from the general public, governmental agencies, and professional societies calling for changes to the healthcare system to promote the safe delivery of quality care to patient consumers in the United States (James, 2013; Kohn et al., 2000).

As defined by Kohn et al. (2000), safety is "the freedom from accidental injury" (p.18) and an error is "the failure of a planned action to be completed as intended or the use of the wrong plan to achieve an aim" (p.4). When reporting the results of the Harvard Medical Practice Study, Leape et al. (1991) defined adverse events as "an unintended injury that was caused by medical management and that resulted in

measurable disability" (p. 377). Preventable adverse events can be categorized into errors of commission, errors of omission, errors of communication, errors of context, and diagnostic errors (James, 2013). Although human errors are inevitable and can't be completely eliminated, better system designs can lessen their frequency. Healthcare organizations must focus on system changes rather than individual changes and the simplification of tasks within systems to prevent adverse events and to minimize reliance on clinician memory (Kohn et al., 2000). Work process standardization can help minimize and reduce the reliance that clinicians have on memory, and can lead to an improvement in the access to timely and accurate information during the care of the patient which can result in improved outcomes (Kohn et al., 2000).

Errors of communication serve as a major causal category for the incidence of preventable adverse events (James, 2013). Seminal studies by Leape et al. (1995) and Wilson et al. (1995) reported that insufficient information and inadequate clinician knowledge serve as major contributing factors to the incidence of medical errors that occur during the provision of patient care. A retrospective review conducted by Wilson et al. (1995) identified that 51% of the reported adverse events (2,353) were highly preventable and recurrence of 42.6% of these events could potentially be prevented with improvements in information transfer in the forms of education and communication. As reported by Leape (1995), almost half of all medication errors were linked to the clinician having insufficient information about the patient or the medication. In addition, this same study identified, through a systems analysis of adverse drug events, that of the sixteen major types of system failures the top seven were a result of lack of sufficient information (Leape et al., 1995). As outlined by the World Alliance for Patient Safety

(2008) a lack of availability and transfer of practice and patient knowledge to clinicians can contribute to unsafe patient care. Improvements in staff communication and the communication of test results to clinicians have also been established as a National Patient Safety Goal (The Joint Commission, 2016). In an analysis conducted by The Joint Commission (2015), communication problems and information management issues accounted for the root causes of 85% of the sentinel events reviewed.

As reported by Keers, Williams, Cooke, and Ashcroft (2013b), nurses may spend up to one third of their time during a shift on activities related to the administration of medications. In light of the frequency of medication administration by nurses and the high incidence of errors with medication administration, much of the nursing literature regarding nursing errors has focused on the process of administering medications. Lack of knowledge regarding a medication and inadequate knowledge or lack of familiarity with patients have all been reported as significant factors impacting errors during medication administration. As reported by Kopp, Erstad, Allen, Theodorou, and Priestley (2006), 23% of the total errors that occurred in Australia were due to lack of drug knowledge and 4% were due to lack of patient information. More recent studies have continued to demonstrate the connection between lack of information, poor communication, and drug administration errors (Härkänen, Ahonen, Kervinen, Turunen, & Vehviläinen-Julkunen, 2015; Keers et al., 2013b; Pham et al., 2011). Communication was found to be the second most common contributing cause for emergency department medication errors (11% error occurrences) in a study by Pham et al. (2011). In their systematic review, Keers, Williams, Cooke, and Ashcroft (2013a) cited inadequate knowledge and communication as major causes of medication errors. Härkänen et al.

(2015) reported that if nurses consulted and asked for information from other professionals during medication administration the risks of errors in medication administration increased three-fold. Through studies utilizing self-report measurements, nurses and healthcare professionals have also identified lack of pharmacological knowledge and inadequate awareness of high-risk medications as causes for medication administration errors (Cheragi, Manoocheri, Mohammadnejad, & Ehsani, 2013; Kim & GyeongAe, 2014).

Clinicians must have accessible and available information pertinent to the patient to promote safe and effective care (Institute of Medicine, 2001). Nurses provide continuous patient care in the healthcare setting and comprise one the largest groups of healthcare providers. In addition, they make multiple and complex clinical decisions and are responsible for collecting, communicating and storing large amounts of information from a variety of sources during patient care (Corcoran-Perry & Graves, 1990; Kelley & Brandon, 2012). Nurses in clinical practice frequently make decisions in the clinical setting under uncertain conditions (Banning, 2008; O'Neill, Dluhy, & Chin, 2005). This uncertainty during the decision making process and the occurrence of unstructured tasks can lead to variations in patient care (Banning, 2008). In order to make informed clinical decisions, nurses at the bedside need immediate access to patient specific information, at the point of care, and in an easily accessible format. Health information technology (HIT) can provide a platform for the communication and delivery of information to nurse (Berner, 2009). The design of information technology that will fit into workflow and best deliver information to nurses is dependent on understanding how nurses access and use information during the course of patient care (Moss & Elias, 2010).

Clinical decision support systems (CDSS) are a type of health information delivery technology that can aid clinicians by providing them with immediate access to automated information pertinent to the care of the patient (Berner, 2009; Institute of Medicine, 2001; Van de Velde et al., 2016). By providing the right information, to the right person, in the right format, through the right channel, at the right time in the patient care process, CDSS have the potential to improve patient outcomes and the quality of patient care (Osheroff, 2009; Saba & McCormick, 2011). The primary purposes of CDSS are to assist clinicians in the problem solving process, to support clinical judgment, and to improve the effectiveness of the clinical decision making process (Saba & McCormick, 2011). However, disruption of routine workflow practices by the CDSS typically leads to poor utilization and lack of adherence to recommendations. Customization of CDSS into the routine workflow of clinicians is imperative to encourage clinician use of system functions (Berner, 2009; Karsh, 2009). Understanding the information needs and the workflow of the clinician helps to improve the usability and utilization of the CDSS in clinical practice.

Information Needs of Nurses

An information need is a subjective experience that occurs in the mind of a person and emerges in response to different types of motives such as unlearned motives, social motives, economic motives, physiological motives, and cognitive needs/motives. This need for information and a lack of information lead to a cognitive state of uncertainty and stress which serves as an activating mechanism for the person to seek information (Potnis, 2015; Wilson, 1997). The literature supports that nurses most frequently seek

information to help them make patient care decisions, and nurses also value and desire information about the patient both clinically and personally (Blythe & Royle, 1993; Kelley, Docherty, & Brandon, 2013). Observational studies of nurses and other health care providers in the acute care clinical setting have supported the following categories of nursing information needs: demographic patient specific information, plans of care (including treatments and schedules), physiological trends and norms, teaching, institutional protocols and policies, medication related issues, and responses to care and treatments (Blythe & Royle, 1993; Kelley et al., 2013; Kelley & Brandon, 2012; McKnight, Stetson, Bakken, Curran, & Cimino, 2001; Reddy, Pratt, Dourish, & Shabot, 2002). However, there is a need for further delineation of the categories of information sought by nurses and a better understanding of how to deliver the needed information to nurses at the appropriate time and in the appropriate format during the process of daily workflow (Anton, Woodson, Twose, & Roderer, 2014).

Information Sources and Information-Seeking Behaviors of Nurses

Multiple studies have found and reported that nurses typically prefer to obtain health information from human resources, such as colleagues and other health care professionals, while on duty providing direct patient care (Dee & Stanley, 2005a; Marshall, West, & Aitken, 2011; McKnight, 2006; O'Leary & Mhaolrúnaigh, 2012). As reported by Marshall et al. (2011), nurses usually consult with a colleague with a perceived higher level of expertise in the area requiring decision support. In addition, if nurses do not receive resolution of their clinical uncertainty with their first encounter with a human resource, many will continue to seek information from a different

colleague. Nurses rely heavily on social interactions, which include informal exchanges with other colleagues, as a source of practical knowledge (Doran et al., 2007; Estabrooks et al., 2005). The findings from these studies suggest that social interactions and personal experiences are the two most frequently utilized sources for nurses to obtain practice knowledge. These traditionally valued sources of knowledge regarding nursing practice do not have the evidence-based legitimacy of other more formal sources, such as journals and databases, which are built on research-based evidence (Dee & Stanley, 2005a; Estabrooks et al., 2005). However, the structure and constraints of nursing clinical practice may cause nurses to rely on sources with perceived ease of access (Estabrooks et al., 2005).

Nursing Use of Clinical Decision Support Systems

Clinical decision making is a complex process requiring sufficient practitioner knowledge, in addition to a supportive environment and reliable information regarding patient care (Marshall et al., 2011). The literature supports the use of CDSS by nurses to support the clinical decision making process in the clinical setting. CDSS can impact nursing processes during patient care through the utilization of decision support algorithms, reminders for assessments, and recommendations for interventions for specific health alterations (Choi, Choi, Bae, & Lee, 2011; Dowding, Mitchell, et al., 2009). In a study by Choi et al. (2011), nurses expressed a desire and need for CDSS to remind them of regularly scheduled care and recommended assessment and monitoring for nursing-specific outcomes such as medication errors, pressure ulcers, nosocomial infections, and falls. There has also been reported success with systems designed to

recognize early warning signs of patient decline with subsequent decision support and notification of the rapid response team (Yuan, Finley, Long, Mills, & Johnson, 2013). Utilization facilitators included the resilience of nurses in clinical practice, trust in the system combined with clinical judgment, and ability to adapt the system to the work environment (Campion, Waitman, Lorenzi, May, & Gadd, 2011; Dowding, Mitchell, et al., 2009). Success has also been demonstrated when CDSS are integrated into an existing system or previously implemented algorithms. By utilizing existing systems and algorithms, the potential impact on the cognitive and physical workflow processes of the nurse can be decreased (Hoekstra et al., 2010).

Despite the documented utilization of CDSS and computer information systems in the clinical setting, many nurses report dissatisfaction with systems due to poor navigability and inadequate support for nursing-sensitive documentation. Workflow designs and human-computer interaction can significantly impact the implementation process and subsequently the usability and successful utilization of the system (Dowding, Mitchell, et al., 2009; Yuan et al., 2013). As reported by Dowding, Mitchell, et al. (2009), nurses often develop "work-around" processes and override recommendations in order to make the CDSS fit into their clinical workflow. As a result of these actions of incorrect usage, CDSS technology can actually lead to an increase in errors and variations in clinical practice. Even in studies where nurses responded positively regarding the computerization of documentation and decision support, there was a desire for better performance and more specificity in terms of nursing workflow (Choi et al., 2011; Kossman & Scheidenhelm, 2008).

Rationale for the Study

Early research in the area of nursing information needs provided broad categories of the types of information needed by nurses during patient care (Corcoran-Perry & Graves, 1990; Lange, 1992). However, much of the literature focusing on the information needs of nurses are from dated studies that occurred before the widespread introduction and implementation of electronic sources of information into clinical practice. This study was needed because of the changes to practice and workflow that have evolved related to these new information sources. There was a lack of current observational studies looking at the information needs, information-seeking behaviors of nurses, and chosen information sources in a more current technology rich practice environment. More recent studies, that did account for the integration of electronic information sources into clinical practice, only recruited nurses practicing in specialty and critical care areas (Kelley & Brandon, 2012; Newman, Doran, & Nagle, 2014; Newman & Doran, 2012; Reddy et al., 2002). A current study utilizing structured real-time observations of medical-surgical nurses in a practice environment with electronic information sources was needed to generate quality data which will add to the body of knowledge regarding nursing information needs and behaviors.

Purpose

The purpose of this mixed methods study was to explore the information-seeking behaviors of nurses when delivering patient care on medical-surgical units to inform the development of CDSS for medical-surgical acute care nurses.

Specific Aim

The specific aim for this dissertation was to observe and describe the information-seeking behaviors of medical-surgical nurses in an acute care facility to inform and guide the development of CDSS.

Research Questions

The following research questions were used for this study:

1. What are the observed information-seeking behaviors of medical-surgical nurses in an acute care facility when delivering patient care across an entire shift?
2. What are the observed purposes for medical-surgical nurses seeking information in an acute care facility when delivering patient care across an entire shift?
3. What are the sources of information accessed by medical-surgical nurses in an acute care facility when seeking information when delivering patient care across an entire shift?
4. What is the format of information accessed by medical-surgical nurses in an acute care facility when seeking information when delivering patient care across an entire shift?
5. What is the observed duration of individual information-seeking episodes utilized by medical-surgical nurses in an acute care facility when delivering patient care across an entire shift?

6. What are the observed times that medical-surgical nurses' access information when delivering patient care across an entire shift?

Design

A mixed methods research approach was utilized for this study. The design of this proposed study allowed for the collection and integration of qualitative and quantitative data to measure the identified study variables. The research questions for this study focused on the sources and format of information accessed by nurses during patient care and the information-seeking behaviors of nurses in the acute care setting. This study was conducted on five medical-surgical units at a large teaching/academic hospital located in the southeastern United States. The participants for this study were registered nurses working at the bedside in an acute care facility on medical-surgical floors.

Data collection for this study included structured observations of nurses in their work environment recording their use of information during patient care with post observation collection of qualitative data through the conduction of semi-structured interviews and the description of information artifacts. The unit of analysis for this study was an information-seeking episode by the nurse. An information-seeking episode was defined as any time the nurse accesses a source of information in order to deliver direct patient care. A quantitative data collection tool was developed, modified, and utilized to code and describe each information-seeking episode of the nurse in terms of the purpose/need-creating event, type of information, source of information, mode/format of information delivery, and duration. The primary researcher conducted all observations and all semi-structured interviews during the data collection process. Each participant

was observed and interviewed individually. Information artifacts, such as personal notes, report sheets, pictures of white boards, and print outs, that are utilized by participants during observations were described by the researcher and were analyzed through qualitative content analysis. The proposed study consisted of two separate phases. Validation of the categories for the data collection tool occurred during phase 1. Phase 2 involved actual data collection which included the observations of nurses, post observation semi-structured interviews with each nurse, and the description of information artifacts. The categorical data was analyzed using descriptive statistics and chi-square tests. Correlations were analyzed to determine if the demographic variables of age of the nurse, years of nursing experience, and years of experience on the floor were correlated to the study variable of purpose/need-creating event, type of information, source, and mode/format. Associations among interval level demographic data, duration data, and categorical frequency data were analyzed using analysis of variance (ANOVA). Chi-square tests of independence were performed in order to determine if there were differences in the observed frequencies of the purpose, types, source, and mode/format of the information-seeking episodes between the units and the episode start times. Participant responses obtained during semi-structured interviews and information artifacts utilized during the observation sessions (such as personal notes, report sheets, pictures of white boards, and print outs) were analyzed through qualitative content analysis.

Conceptual Model

Krikelas (1983) developed his Model of Information-Seeking Behavior to describe the response a person has when information is needed and the components of the process a person undertakes to obtain the needed information (Appendix A). He was one of the first to develop an information-seeking model and to emphasize the importance of uncertainty as a motivating factor for seeking information (Sawant, 2015). Krikelas proposes that once people are aware of a state of uncertainty, they begin attempting to reduce that uncertainty to an acceptable level through accessing information from available sources (Krikelas, 1983). Information-seeking begins when a person recognizes that a current state of knowledge is less than the level of knowledge required to adequately meet the information need and will end when the perception of inadequate information ceases to exist (Krikelas, 1983; Sawant, 2015). According to Krikelas (1983), a person will perceive a need for information when the current state of personal knowledge is inadequate to deal with a particular issue or problem. Once a need is established, the information seeker can decide if the information need is immediate or if it should be deferred. Sources of information are then utilized to generate information for perceived immediate needs. Source preferences are identified as internal sources, which are generated by the information-seeker, or external sources such as interpersonal interactions or recorded literature (Krikelas, 1983; Sawant, 2015). Internal sources can include personal stored memories/experiences or direct personal observations. Information seekers can also utilize external sources such as other knowledgeable persons or books, journals, and databases when conducting information-seeking activities (Krikelas, 1983; Sawant, 2015).

Description of Model Concepts

Need creating event/environment. As defined by Krikelas, a need creating event is a situation that causes uncertainty in a person which leads to seeking information in order to reduce the uncertainty to an acceptable level (Krikelas, 1983; Sawant, 2015).

Immediate and deferred needs. Once a need is identified by the information seeker, it is categorized as immediate or deferred. The information seeker then decides on the source of information needed to resolve immediate information needs. Activities that are undertaken to meet immediate needs are further defined as information-seeking behaviors (Krikelas, 1983). Deferred needs often lead to information gathering at a later time, while immediate needs lead to choices of sources to satisfy the more urgent level of uncertainty (Sawant, 2015).

Source preferences. Krikelas defined sources preferences as internal or external in nature (Sawant, 2015). Internal sources include personal memories, experience, and direct personal observations. The other major sources of information are external to the information seeker and can include interpersonal contact or recorded literature (Krikelas, 1983; Sawant, 2015). Historically, Krikelas defined recorded literature sources as printed literature found in libraries and interpersonal sources as direct face-to face conversation between two individuals. However, due to increasing the use of technology in the areas of information storage and retrieval, these definitions have evolved over recent years. Recorded literature can include online information and resources while interpersonal

sources can be asynchronous or electronic in format and delivered through platforms such as email or electronic documentation (Sawant, 2015).

Rationale for Model Selection

Krikelas' model has served as a methodological framework for studies examining the information needs and behaviors in health care providers. This study focused on the variables of purpose/need-creating event, type of information, source of information, and mode/format of information in order to describe the information-seeking behaviors of nurses during information- seeking episodes. Similar studies have utilized Krikelas' model to guide the development of study variables, data collection tools, and interview questions. In a seminal study of nursing information needs, Corcoran-Perry and Graves (1990) utilized Krikelas' model to identify and define the following study variables: need-creating event or environment, information need, external sources of information, and source preferences. Similarly, Kelley and Brandon (2012) utilized this framework and the constructs of the framework to develop an observational tool for measurement of the following variables: nursing information needs (collected, communicated, and stored) and the sources of information. McKnight et al. (2001) developed semi-structured interview questions based on the concepts of Krikelas' model in order to gather information regarding the information needs and communication difficulties of physicians and nurses. Krikelas' model is linear in nature which has been cited as a weakness due to its lack of complexity and flexibility (Sawant, 2015). However, as noted by Sawant (2015), a strength of this model is the conceptualization of broader sources of information such as personal memory, observations, and interpersonal interactions in

addition to more formal library based sources. In addition, Krikelas identified and recognized the importance of the context and setting of the information-seeking episode when trying to understand the information needs of individuals (Sawant, 2015).

The components of the Krikelas model guided the researcher during the development of semi-structured interview questions and the appropriate initial categories for the observational tool to be utilized in data collection. Based on the model, the initial categories for the tool included the purpose/need creating event, type of information, information source, and mode/format of information delivery for each information-seeking episode undertaken by the nurse. The research questions that guided the study focused on the observed purposes, sources, and formats of information accessed by nurses during patient care. The need-creating event that serves as a catalyst for information gathering, as noted in the model, was measured categorically through the observational tool as the purpose and type of information sought by the nurse. The source and mode/format of the information, which can be categorized as internal or external, measured the source preference as outlined in the model. The semi-structured interview questions provided further data describing source preferences, perceptions of accessibility and ease of use of sources, perceptions of unmet information needs, deferred information needs, and the utilization of internal information sources that may not be directly observable by the researcher.

Operational Definition of Terms

Information- A stimulus that reduces uncertainty (Krikelas, 1983).

Information need- A subjective experience occurring in the mind of the person in need and is a representation of a future goal that is desired (Burnkrant, 1976; Wilson, 1999).

Information-seeking behaviors- Activities that are undertaken to identify relevant information to satisfy a perceived immediate need (Krikelas, 1983; Wilson, 1999).

Health information-seeking behavior- Activities that are undertaken by health care providers in order to identify relevant information to satisfy a perceived need that arises during the provision of direct patient care.

Information-seeking episode- An event that begins in response to a perceived information need, proceeds to the initiation of information-seeking behaviors, and ends when the need is believed to have been satisfied or the task is abandoned due to lack of available information (Krikelas, 1983).

Purpose of the information-seeking episode/need-creating event- An event that causes uncertainty in the information seeker and leads to the perception that the current state of knowledge is not adequate to deal with an issue. The reason that the provider initiates the information task (Krikelas, 1983; Moss, Berner, & Savell, 2007; Sawant, 2015).

Information Type- The type of data accessed to reduce uncertainty (Krikelas, 1983; Wilson, 1999).

Information source- Suppliers or generators of information that are accessed in order to meet a perceived gap in knowledge or a perceived information need (Krikelas, 1983).

Information mode/format- The means or the method by which the provider obtains information (Moss et al., 2007).

Information-seeking episode duration- The amount of time that elapses from the beginning or initiation of an information-seeking episode to the completion or abandonment of the task (Moss et al., 2007).

Assumptions

1. Nurses value and need accurate and timely patient information when caring for patients.
2. Nurses use a variety of sources for information retrieval during patient care and have a variety of information-seeking behaviors.
3. Accurate data and timely delivery of data are important when developing CDSS that fit into nursing workflow. Understanding the information needs of nurses can provide a better basis for the development of CDSS.

Limitations

The setting for this study was a large teaching/academic hospital. All observations occurred on five medical-surgical units within this hospital. Therefore, the results of the study may not be generalizable to nurses in other hospitals.

Summary

Clinicians need accurate and timely information during the delivery of patient care. HIT, and more specifically CDSS, can be utilized to provide clinicians with accurate information at the point of care. The findings from this study can help define the most frequent information needs of nurses as they arise in response to the normal clinical workflow of a medical-surgical nurse, and the associated information-seeking behaviors and time constraints of medical-surgical nurses, in order to guide the development of CDSS. Chapter 2 will provide a review of the relevant literature and further explanation of the concepts of the study.

CHAPTER 2

LITERATURE REVIEW

Introduction

Errors during the course of clinical practice are common and can lead to adverse events and even death in the hospitalized patient (James, 2013; Makary & Daniel, 2016; Stetson et al., 2001). Makary and Daniel (2016) reported that medical errors have become the third leading cause of death in the United States. When categorizing the causes of preventable adverse events, James (2013) included errors of communication as a major category. Information transfer and communication play an important role in the delivery of safe, quality care to patients in the health care setting. Lack of available information and breakdowns in the transfer of patient and practice knowledge to nurses can contribute to suboptimal and unsafe patient care (World Alliance for Patient Safety, 2008). A better understanding of the types of information accessed by clinicians and the use of this information in practice can inform the development of information delivery systems that can decrease the potential for errors in practice (Moss & Elias, 2010).

During the course of patient care, nurses are responsible for collecting, communicating, and storing pertinent information (Corcoran-Perry & Graves, 1990; Kelley & Brandon, 2012). Accurate and timely delivery of information during clinical practice is important in order to meet the information needs of nurses and ultimately support decision making processes (Kelley & Brandon, 2012). Early research in the area of information needs by Covell, Uman, and Manning (1985) found that 30% of the

information needs of physicians were not met during a patient visit. Subsequent studies have also reported that the information needs of clinicians, including nurses, are often unmet in the clinical setting (Collins, Bakken, Cimino, & Currie, 2007; Currie et al., 2003; Ricks & ten Ham, 2015). Through an observational study, Currie et al. (2003) found that clinicians had an average of 8 to 13 events of unmet information needs per hour which further highlights the need for better information delivery to clinicians at the point of care. Ricks and ten Ham (2015) found that even though nurses indicated they had access to a wide range of information, they felt that the information was limited in scope and did not meet their individual information needs when providing care. Nurses at the bedside need immediate access to patient specific information, at the point of care, and in an easily accessible format. In order to make informed decisions and to exercise professional judgement, nurses need reliable information and sources (Ndosi & Newell, 2010). However, further research needs to be conducted to provide a better understanding of ways to consolidate data in a more accessible format and to identify ways to deliver the needed data to nurses at the appropriate time and in the appropriate mode during the process of daily workflow (Anton et al., 2014; Corcoran-Perry & Graves, 1990; Currie et al., 2003; Lange, 1992).

Clinical decision support can be defined as any tool or technique that provides pertinent information to the clinician at the appropriate time to enhance clinical decision making and the provision of care (Berner, 2009; Forum, 2010). HIT can be utilized to facilitate the delivery of information to the clinician to support decision making. CDSS within an electronic medical record have the capability of providing information to clinicians in a timely manner at the point of care (Berner, 2009). Computerized/

automated CDSS can include tools such as computerized pathways and algorithms, alerts, and reminders to provide information throughout the patient care process (Berner, 2009; Karsh, 2009; Saba & McCormick, 2011). The need for utilization of accurate information to inform decision making is reported throughout the literature, and researchers stress the importance of meshing CDSS with workflow processes (Choi et al., 2011; Dowding, Mitchell, et al., 2009; Kossman & Scheidenhelm, 2008). There is a significant gap in the knowledge base regarding how to meet the information needs of the nurse through information technology, specifically CDSS, and also poor definition of workflow processes and accessibility issues specific to nursing care that impact the use of CDSS. Findings from this research study regarding the information needs and associated information-seeking practices of nurses as they arose in response to normal clinical workflow can guide the development of CDSS.

Search Strategies

The literature obtained to further explore the concepts in this study was located through a comprehensive search of the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and Google Scholar. Searches were performed in order to obtain pertinent articles addressing nursing information needs, nursing information sources, information use, information exchange, and the information-seeking behaviors utilized by nurses in the clinical setting. The following key medical subject headings were used during the search of databases: “information seeking behaviors”, “information resources”, “nursing information needs”, “acute care”, “information exchange”, “decision making” and “nurses”. Studies that focused on primary care, patient information needs,

patient information sources, nursing educational needs, family caregiver information needs, and nursing students were excluded. Following the electronic searches, additional articles were identified through a comprehensive ancestry search of relevant paper references. A descendancy approach was also utilized allowing for the discovery of recent articles citing the previously chosen articles.

Introduction of the Concepts

Information Needs

An information need can be defined as a subjective experience that occurs in the mind of a person and is the representation of a future goal that is desired (Burnkrant, 1976; Wilson, 1997). The lack of information, in response to a perceived need, leads to a cognitive state of uncertainty and stress which serves as an activating mechanism for the person to seek information (Potnis, 2015; Wilson, 1997). Nurses make multiple and complex clinical decisions and have a need for accurate and timely information at the point of care (Corcoran-Perry & Graves, 1990). Accurate information, sometimes from a variety of sources and formats, is needed to support this decision making process (Kelley & Brandon, 2012; Koch et al., 2012).

Nursing information needs are identified in response to the nurse's recognition of gaps in knowledge and the desire to resolve these gaps (Xu et al., 2005). Research by Corcoran-Perry and Graves (1990) first categorized the information needs of nurses as follows: patient-specific data, institution-specific information, domain knowledge, and procedural information. Patient-specific data includes information regarding general patient information (i.e., history and health status), medication data (i.e., last dose of pain

medication), laboratory reports, cardiovascular status, physician orders, education /discharge orders, exercise/activity, and diet (Corcoran-Perry & Graves, 1990; Kelley & Brandon, 2012; Lange, 1992). Institutional-specific information includes the sub-categories of tracking (i.e., people, medications, and equipment), policies, admission, transferring/discharging patients, and charges. Domain knowledge and procedural information encompass the last two categories of nursing information needs. Domain knowledge involves the seeking of both nursing knowledge and knowledge from other disciplines. In this category, nurses sought information regarding medications (i.e., rate of administration and compatibility) and information regarding specific disease processes and treatments. The last category involved the seeking of information regarding specific procedural steps and treatment protocols (Corcoran-Perry & Graves, 1990).

Throughout the literature, patient-specific data has been demonstrated as the most frequently occurring nursing information need. Corcoran-Perry and Graves (1990) identified patient-specific data as 49% of the data sought and collected by nurses during the provision of patient care. A subsequent study by Lange (1992), reported that 90% of information-seeking episodes involved nurses searching for patient-specific data. An observational study by Currie et al. (2003) further demonstrated that patient-specific informational needs are twice as likely to arise than domain or institutional information needs.

Information Use

As reported by Corcoran-Perry and Graves (1990), the reason nurses most frequently seek information is to support the provision of direct patient care. Findings

from this study support that in an effort to enhance the delivery of patient care, nurses initiate information searches in the areas of general nursing care, medication administration, nursing care planning, care management, and order/policy confirmation. Blythe and Royle (1993) further explained that nurses primarily engage in information-seeking episodes to assist and support the decision making processes that occur during patient care. As outlined by McKnight (2006), critical care nurses choose to seek information and pursue answers to questions of uncertainty based on a sense of responsibility to the patient. Information needs and questions not directly related to the patient or patient care had a much lower priority for the participating nurses.

As noted by McKnight (2006), nurses pursue information to answer clinical questions based on the importance of the information as it directly relates to clinical judgement and care of the patient. Communication and the delivery of information provides the basis for the coordination of patient care in the clinical setting (Moss & Elias, 2010). Nurses make crucial decisions during patient care and must have accurate and available information to enhance their judgements and decisions (Thompson, Cullum, McCaughan, Sheldon, & Raynor, 2004). Nurses often stop searching for information to resolve uncertainty based on sufficient quantity rather than quality of data (O'Leary & Mhaolrúnaigh, 2012). Nurses most frequently seek information directly related to the provision of care to the patient (Blythe & Royle, 1993; Corcoran-Perry & Graves, 1990; Currie et al., 2003; Kelley et al., 2013; Lange, 1992; McKnight, 2006). As noted by Moss and Elias (2010), the primary purpose of information exchange and information gathering was similar in all nurses and centered around the status of the

patient. However, different patterns of information seeking and exchange occurred depending on the type of clinical care the nurse was providing to the patient.

Information Sources, Information-Seeking Behaviors of Nurses, and Information Formats

Nurses seek data from available information sources in order to reduce uncertainty and satisfy a perceived information need. Information sources can be defined as suppliers or generators of information in order to meet a perceived gap in knowledge or an information need (Krikelas, 1983). Activities that are undertaken to identify relevant information to satisfy a perceived need are information-seeking behaviors (Krikelas, 1983; Wilson, 1999). Nurses need current and accurate information to support their practice. However, in order to best guide nursing practice there must be an understanding of the information sources nurses rely on during the provision of patient care.

Current and preferred information sources and formats. According to Wilson (1997), one of the fundamental requirements of an information-seeking episode is there must be a potential information source that is accessible to the information-seeker. In addition, the source should be viewed as credible and information should be provided through a preferred channel of communication for the seeker. Information needs and information-seeking studies have extensively described frequently utilized sources of information by nurses. Some of the most frequently cited sources include people/ personnel (including patients, family members, and other healthcare professionals), patient charts/records, nursing documentation, paper based reports/materials,

computerized systems, monitoring systems, and internet/online sources (Corcoran-Perry & Graves, 1990; Estabrooks et al., 2005; Lange, 1992). Through observations and participant interviews, Estabrooks et al. (2005) developed a taxonomy of information sources utilized by nurses during practice. The following categories emerged: social interactions, experiential knowledge, documentary sources, and a priori knowledge. Social interactions involve interactions between nursing peers and other personnel and can be either informal or formal in nature. Experiential knowledge is gained through observations of nurses during practice and is based on individual experiences as well as the experiences of colleagues. Documentary sources are written or printed materials that contain pertinent information and can include unit-based sources (i.e., patient charts, policy manuals) or off-unit sources such as books, journals, or databases. A priori knowledge that is intrinsic to the nurse is gained from school, prior experiences, and personal beliefs (Estabrooks et al., 2005).

Corcoran-Perry and Graves (1990) identified that 90% of the external information sources accessed by nurses are either verbal or written. In an observational study, McKnight (2006) found that critical care nurses sought information from a variety of sources including other people, patient records, monitoring/computer systems, and notice boards. The findings from the study indicated that nurses rarely obtained information from published sources. Nurses are also more likely to utilize pre-processed protocol and guidelines rather than free text written or internet sources (O'Leary & Mhaolrúnaigh, 2012).

Seminal research in the area of information behavior supports the use of other people as a common and convenient source of information during the information-

seeking process (Krikelas, 1983; Wilson, 1997). Similarly, information needs and information-seeking research studies involving nurses have also cited verbal interactions as a significant source, and often the most frequently utilized source, of patient data (Estabrooks et al., 2005; Spenceley, O'Leary, Chizawsky, Ross, & Estabrooks, 2008b; Thompson et al., 2004). Interpersonal information derived from interactions with other people has been identified as being used more frequently than other non-computer or computer-based information sources (Secco et al., 2006). More recently, studies have continued to cite social interactions and nursing colleagues as the most commonly identified and preferred information source (Marshall et al., 2011; Newman & Doran, 2012; Wahoush & Banfield, 2014). However as reported by Kelley et al. (2013), nurses can also place heavy emphasis and frequently utilize verbal interactions with patients and family members as sources of information. Other sources that emerged as significant sources in this same study included nursing documentation in the electronic medical record and individual nursing paper-based report sheets (Kelley et al., 2013).

Benefits and challenges to current sources of information and formats.

Current available sources of information tend to reflect the nature of the practice environment of nurses today. Sources of information and data are typically utilized by nurses based on accessibility and ease of use (Doran et al., 2007; Estabrooks et al., 2005; McCaughan, Thompson, Cullum, Sheldon, & Raynor, 2005). Current factors such as increased patient acuity, shorter hospital stays, and increasing workloads of nurses support the use of convenient and efficient information sources (Spenceley et al., 2008b). Conversing with colleagues allows for an efficient use of time and an opportunity for

collaborative decision making processes (Marshall et al., 2011; Thompson et al., 2001). Nurses report that colleagues and other health professionals serve as familiar, convenient, reliable, and concise information sources (Dee & Stanley, 2005b). In addition, the holistic approach to nursing care can potentially impact the perceived value that nurses place on subjective sources such as patients, colleagues, and personal experience/knowledge and the frequency in which they are utilized (Corcoran-Perry & Graves, 1990; Spenceley et al., 2008b). Nursing documentation sources and personal report sheets are also valuable repositories of patient specific information and are easily accessible to nurses. Documentation data provides the nurse with valuable physiological trends and norms (Kelley et al., 2013). In a study by Dee and Stanley (2005a), the nursing participants typically preferred the usage of handwritten or print sources rather than electronic resources due to perceived user accessibility and familiarity. However, nurses who have received training in technology and who have a higher comfort level with technology are more likely to seek electronic sources of information especially if that information is accessible at the point of care (Collins et al., 2007; Dee & Stanley, 2005a; Newman & Doran, 2012).

There are challenges and barriers to the use of all information sources including human factor issues. Verbal interactions have been cited extensively throughout the literature as a highly preferred source of information by nurses. Verbal interactions can lack legitimacy and are often not based on the most current research-based evidence to support nursing care (Dee & Stanley, 2005a; Estabrooks et al., 2005). However, nurses cite multiple barriers to searching for information from other sources. As reported by McKnight (2006) challenges to accessing information and acquiring information include

difficulty with navigating computer systems, illegible handwriting, equipment failure, and social protocol barriers. Nurses also face other specific challenges associated with the utilization of electronic sources for information acquisition. Workflow designs and human-computer interaction can significantly impact the usability and successful utilization of electronic systems (Dowding, Mitchell, et al., 2009; Yuan et al., 2013). A perceived lack of time during the provision of patient care, the failure of systems to integrate into workflow, and a lack of navigational skills have been cited as major deterrents to utilizing electronic sources for information gathering during the provision of patient care (Dee & Stanley, 2005b; Hunt, Cimino, & Koziol, 2013; Koch et al., 2012; McKnight, 2006; Tannery, Wessel, Epstein, & Gadd, 2007).

Nurses value the legitimacy and importance of research knowledge and accurate patient information. However, they often question the usability and accessibility of the delivery systems providing the information (Thompson, Aitken, Doran, & Dowding, 2013; Thompson et al., 2001). Computerized documentation systems are perceived as unorganized, and nurses often reported difficulties finding the information needed to make informed decisions (Embi et al., 2013; McKnight, 2006). Nursing documentation can be disseminated throughout the electronic record resulting in difficulty locating pertinent patient information and nursing specific data (Stevenson & Nilsson, 2012). Even in studies where nurses responded positively regarding the computerization of documentation and decision support, there was a desire for better performance and more specificity in terms of nursing workflow (Choi et al., 2011; Kossman & Scheidenhelm, 2008).

Clinical Decision Making

Nurses function as significant decision makers in the healthcare system and make clinical decisions rapidly throughout the course of patient care (Thompson et al., 2013). Clinical decision making is a complex process and occurs when nurses are making judgements regarding the most appropriate course of action during patient care (Banning, 2008; Ellis, 2017). In an early study by Watson (1994), medical-surgical nurses were found to make 18 decisions during a 2-hr period of observations. Bucknall (2000) provided further insight into the frequency of decision making episodes of acute care nurses. Findings from this study indicated that critical care nurses make patient care decisions approximately every 30 seconds with as many as 238 decision making episodes observed during a 2-hr observation. In light of the frequency of decision making episodes by nurses, less than optimal judgements and decisions can clearly introduce the potential for unnecessary harm to patients in the healthcare system (Thompson et al., 2013)

Definition of clinical decision making. Clinical decision making is an evolving process of gathering and evaluating information in order to identify the most appropriate course of action by the nurse (Ellis, 2017). Throughout the literature multiple terms such as clinical decision making, problem solving, clinical judgement, and clinical reasoning have been utilized when examining the decision making processes of nurses (Johansen & O'Brien, 2016; Simmons, 2010). While all of these terms include elements of the process and outcome of decision making, the concepts of problem solving and clinical reasoning focus on the thinking and analytical strategies used to arrive at a judgment or clinical decision (Kautz, Kuiper, Pesut, Knight-Brown, & Daneker, 2005; Simmons, 2010).

Clinical decision making can be defined as a complex and continual process that involves the gathering, interpretation, and evaluation of subjective and objective information in relation to a specific patient scenario in order to support nursing actions to achieve a desired patient outcome (Johansen & O'Brien, 2016; Lauri et al., 2001; Tiffen, Corbridge, & Slimmer, 2014). During clinical decision making, nurses must be knowledgeable in nursing science, have access to reliable and accurate sources of information, and have supportive patient care networks and work environments (Banning, 2008; O'Neill et al., 2005). Nurses must be able to gather and manage complex information in order to make informed clinical judgements and to function as autonomous decision makers in the clinical setting (Banning, 2008).

Uncertainty in clinical decision making. Nurses in professional practice frequently make complex decisions under conditions of uncertainty and risk (Ebright, Patterson, Chalko, & Render, 2003; Simmons, 2010). Uncertain environments and unstructured tasks can lead to variations in patient care (Thompson et al., 2013).

Cognitive Continuum Theory and clinical decision making. Historically, decision making research has focused on two distinct and differing paradigms. The first paradigm defines decision making as an analytical and rational thinking process and stems from a systematic positivist stance (Bjork & Hamilton, 2011; Custers, 2013). Analytical decision making is characterized by retraceable steps, high confidence in the method, high cognitive consistency, slow processing rate, and few errors (Dunwoody, Spilsbury, Thompson, Brownlow, & Pattenden, 2000; Tower, Chaboyer, Green, Dyer, &

Wallis, 2012). The opposing paradigm noted in the literature describes the phenomenon of intuitive decision making with a philosophical humanistic basis. Through this paradigm, decision making is described as rapid with cues being evaluated perceptually rather than objectively. Using this intuitive approach, the decision maker has high confidence in the outcome but low confidence in the method with a normal distribution of errors but low cognitive consistency (Dunwoody et al., 2000; Hammond, 1981).

The Cognitive Continuum Theory (CCT) provides a framework that incorporates these two paradigms and rejects the dichotomous view of decision making as either analytical or intuitive in nature. This theory views decision making as a continuum where the two end points are analysis and intuition with quasi-rational cognition falling in between (Bjork & Hamilton, 2011; Dunwoody et al., 2000; Hamm, 1988; Hammond, 1981). Furthermore, the theory dismisses the decision making process as purely analytical or intuitive in nature. Hammond (1996) proposes that cognition that is not purely analytical or intuitive in nature falls between the two poles and can be defined as quasirationality (Standing, 2008).

Through the CCT analysis, quasi-rationality, and intuition are defined as three distinct dimensions associated with the modes of cognition (Hammond, 1996). Analysis is defined as having a high level of cognitive control, slow processing, and a high confidence in the decision making method. Intuition is characterized by a low level of cognitive control and rapid processing for decision making. Clinicians utilizing intuition for decision making have a low confidence in method, but a high level of confidence in outcome. Quasirationality is the area in the middle of the continuum that incorporates qualities of analysis and intuition (Cader, Campbell, & Watson, 2005; Standing, 2008).

For further clarification and delineation of the three modes of cognition, the CCT depicts six modes of inquiry along the cognition continuum axis. Mode 1 is viewed as the most analytical mode while mode 6 is considered the most intuitive mode. Modes 2 and 3 are quasirational modes with higher tendencies toward analysis and modes 4 and 5 are weighted more toward the intuition side of the continuum (Hammond, 1981; Standing, 2008). A diagram of the CCT is provided in Appendix B.

The other axis of the CCT depicts the task properties continuum. The CCT is based on the assumption that the decision making process is highly contingent on the properties and demands of the task being undertaken (Hammond, 1996). The structure of a task or task properties encompass the availability of information to an individual, the features of the actual decision, the possibility of accuracy, and the time available to make the decision. Task properties are classified along a continuum ranging from ill-structured to well-structured (Hamm, 1988). Well-structured tasks tend to provide more time for cognition and decision making and a more analytical approach, while less structured tasks have task properties that induce intuitive decision making (Harbison, 2001). The more structured the task properties, the more analytically induced the decision making mode of the clinician (Dowding, Spilsbury, Thompson, Brownlow, & Pattenden, 2009; Hamm, 1988).

The CCT provides a basis and support for this study by outlining the need to structure tasks to improve the analytical processes of the practicing nurse during the decision making process. As noted by Hamm (1988), changing the task environment and providing more structure can impact the nature of the task and the subsequent choice of cognitive mode by the decision maker. Clinicians typically operate in modes 5 and 6

relying heavily on intuition rather than analysis. By improving the structure of a task and providing the right information to the clinician during the decision making process, clinicians could be encouraged to use a higher analytical mode such as mode four which encompasses system aided judgment (Standing, 2008). This theory can guide the development of information delivery technology to improve the analytical mode of decision making by simplifying and structuring information gathering task properties (Thompson et al., 2004).

Clinical Decision Support Systems

Well-developed CDSS can provide structure to the delivery of information during workflow to nurses and augment the decision making processes of nurses (Dowding, Mitchell, et al., 2009). These systems can provide decisional support for nurses guiding assessment, problem identification/diagnosis, care planning, implementation and outcomes evaluation. CDSS can be utilized by nurses to monitor a patient's progress or status and to assist and support in the decision making process through alerts, reminders, and algorithms (Choi et al., 2011; Dowding, Mitchell, et al., 2009). Automatic care planning and point of care guidelines for high risk patients and patient educational guidelines are areas nurses report as potentially benefitting from CDSS (Choi et al., 2011).

Nurses report a desire for CDSS that have built in reminders for the regular assessment of nursing specific outcomes (Choi et al., 2011). Risk assessments to prevent the development and subsequent complications in the areas of falls and injuries, pressure ulcers, and diabetes are frequently reported in the literature (Alvey, Hennen, & Heard,

2012; Lee, 2013). Assessment tools can be pre-populated with data from other systems within the electronic health record leading to less disruption in the normal clinical workflow of the nurse (Bakken et al., 2008). Evidence-based CDSS for pressure ulcer staging introduced into one facility actually improved the accuracy of staging by individual nurses thereby standardizing the staging process (Alvey et al., 2012). Evidence-based assessment CDSS have proven to be easily integrated into the clinical workflow of nurses without an increased documentation burden potentially improving detection of alterations in patient status (Fick, Steis, Mion, & Walls, 2011).

Analysis/diagnosis and planning of patient care are also potential areas where CDSS can provide support in the decision making process of nurses. CDSS can be successfully utilized for analysis and assignment of nursing diagnoses for patient care planning (Lee, 2013). Automatic options for developing a plan of care for patients with high risk problems is another potential use for CDSS and one that nurses favor (Choi et al., 2011). Galanter, Liu, and Lambert (2010) reported high rates of nursing compliance with clinical alerts prompting providers to change intravenous medications to oral medications providing further support for the utilization of CDSS in the planning phase of the nursing process. Improved documentation and assessment of pressure ulcers and malnutrition as outlined by Fossum, Ehnfors, Svensson, Hansen, and Ehrenberg (2013), can positively impact the planning of care for patients experiencing these types of alterations.

Multiple factors can influence the utilization of CDSS by nurses in the acute care clinical setting. Initially, the success and effectiveness of the system can be impacted by the implementation process and the usability in the healthcare setting in which it is

implemented (Yuan et al., 2013). Nurses should be involved in the development, design, selection, and implementation processes to promote effective use of the system (Lyerla, LeRouge, Cooke, Turpin, & Wilson, 2010). Despite the importance of usability as an important predictive factor in the successful utilization of CDSS, other factors such as training, culture, and familiarity of the nurse with the electronic system can also impact usage (Dowding, Mitchell, et al., 2009; Yuan et al., 2013). Additionally, the experience of nurses with the system, the ability to adapt to technology usage, and the adaptability to practice also should be considered as important predictors of implementation success (Dowding, Mitchell, et al., 2009).

Reported barriers to utilization of CDSS include inappropriate structure and content of the system in relation to nursing and patient needs, inflexibility of the system, lack of knowledge of the technology and system usage, time and effort demands of the system, duplicate documentation demands in the CDSS and the nursing notes, and potential for error in the medical devices (Campion et al., 2011; Dowding, Mitchell, et al., 2009; Yuan et al., 2013). As reported by Dowding, Mitchell, et al. (2009) barriers such as inflexibility must be addressed to prevent nurses from manipulating the system to achieve the required system outcome rather than assisted decision making. The CDSS should be implemented into routine workflow and provide specific guidelines for decision support at the time and location of the actual decision making process (Roukema, Steyerberg, van der Lei, & Moll, 2008).

Gaps in the Current Literature

Prior to initiating an information search, nurses must identify or perceive a need (Wilson, 1997). Early research in the area of nursing information needs provided broad categories of information needed by the nurse (Corcoran-Perry & Graves, 1990; Lange, 1992). Further delineation of specific patient information categories could better support contemporary nursing care in different nursing practice environments (Corcoran-Perry & Graves, 1990; Kelley & Brandon, 2012). Improved specificity of information categories in relation to the nursing role and specialty is necessary in order to meet the information needs of nurses caring for patients with varying levels of acuity, differences in age, and multiple disease processes (Hunt et al., 2013; Reddy et al., 2002; Secco et al., 2006). In addition to the types of information needed by nurses, further research is necessary in order to better understand of the types of tasks that trigger an information-seeking episode. Nurses will often not seek information or recognize an information need if a task is considered routine in nature (Newman et al., 2014; Newman & Doran, 2012; Ward, Vartak, Schwichtenberg, & Wakefield, 2011). Further research is needed to better define how nurses perceive and interpret a need for information in both routine and non-routine patient care tasks.

In order to support nursing practice and decision making, further research is needed to identify sources of information utilized by nurses and the retrieval of information from these sources (McCaughan et al., 2005; O'Leary & Mhaolrúnaigh, 2012; Secco et al., 2006; Thompson et al., 2001). Evidence-based knowledge and accurate information have the potential to decrease variations in clinical practice and improve the quality of care patients receive (Jaspers, Smeulers, Vermeulen, & Peute,

2011). Past research found that nurses tend to rely on information sources, such as colleagues and peers, that are not based on current information and evidence due to perceived accessibility, usability, and time constraints (Estabrooks et al., 2005; Marshall et al., 2011; O'Leary & Mhaolrúnaigh, 2012). However, there is a lack of current studies evaluating the sources of information in clinical practice settings with fully integrated electronic documentation. Much of the previous literature regarding nursing sources was derived from studies that were conducted before the widespread use of electronic medical records for the documentation and storage of information.

Further research is needed in order to develop consistent research-based sources that fit into the workflow and time constraints of nursing care and the current electronic documentation systems. Marshall et al. (2011) reported that nursing participants in their study felt that electronic evidence based protocols were accessible and useful. However, nursing participants were not observed actually utilizing them during practice. Knowledge in the areas of information delivery and clinical workflow integration can help provide nurses with pertinent and accurate electronic information sources at the point of patient care (Anton et al., 2014; Kelley et al., 2013). Better understanding of this workflow can allow information sources to be pushed or sent to the nurses when needed to support patient care (Randell, Mitchell, Thompson, McCaughan, & Dowding, 2009).

Health information technology has the potential to impact and improve the accessibility of information to practicing nurses (Shekelle, Morton, & Keeler, 2006). However, designers and implementers of technology must have an understanding of how nurses access and utilize information in order to design systems that meet user needs. Training that is reflective of user needs can have a positive impact on nursing use of

electronic sources to retrieve information. Nurses who had received training and were comfortable with technology reported utilizing electronic sources more frequently and with increased ease (Collins, Bakken, Cimino, & Currie, 2008; Dee & Stanley, 2005a; Newman & Doran, 2012). Further studies into the type and depth of training needed to support nursing use of electronic sources could improve actual utilization of these sources.

Much of the available literature regarding the information needs and information behaviors of acute care nurses focuses on nurses practicing on a critical care unit or in specialty areas (Anton et al., 2014; Corcoran-Perry & Graves, 1990; Doran et al., 2007; Kelley & Brandon, 2012; Lange, 1992; Newman et al., 2014; Newman & Doran, 2012; Reddy et al., 2002; Secco et al., 2006). Medical-surgical nurses practice under different time and physical constraints than nurses practicing in an intensive care unit. In a study by Hendrich, Chow, Skierczynski, and Lu (2008), medical-surgical nurses were found to spend 43.3% of their time at the nurses desk and 37.4% of their time in the patient room. In addition, individual nurses often travel between 1 mile and 5 miles during a 10-hour shift on the nursing floor (Hendrich et al., 2008). Therefore, the challenge is determining how to meet the information needs of these nurses in such a physically demanding work environment and the best format to deliver the information to such a mobile clinician. In order to meet the information needs of medical-surgical nurses, there must be a better understanding of the context of their practice and the locations and types of patient care activities that may prompt an information-seeking episode.

Many of the studies in the areas of nursing information needs and information-seeking behaviors have employed the use of self-report data collection methods and have

been designed without the structural guidance of a theoretical framework. There is a need for more rigorous studies examining nursing specific needs and the impact these needs have on the utilization of certain information sources. Studies employing structured real-time observational methods, in different nursing work environments, can provide high quality data which will add to the nursing information needs and information-seeking body of knowledge. In addition, there is a lack of theoretical models specifically focusing on the information-seeking behaviors of clinicians. Development of clinician/nurse specific information-seeking theoretical models could provide more structure to future information needs and information-seeking behaviors studies.

Study Designs Used in Information Needs and Information-Seeking Behaviors Research

A variety of study designs and data collection methods have been utilized in the study of nursing information needs and sources and information-seeking behaviors. Self-report questionnaires/surveys were the data collection method of choice for a large majority of the studies utilizing a quantitative study design. Quantitative studies utilizing this type of data collection method focused on the areas of information needs, access to resources, information-seeking and retrieval skills, and perceptions of nurses in regards to the routineness of a task (Farokhzadian, Khajouei, & Ahmadian, 2015; Lundgren-Laine, Kalafati, Kontio, Kauko, & Salantera, 2013; Newman et al., 2014; Secco et al., 2006; Spath & Buttlar, 1996; Tannery et al., 2007). In a study by Tannery et al. (2007), surveys were sent to nurses pre-implementation and post implementation of library resources in order to solicit changes in behavior related to the implementation of the new resources. Hunt et al. (2013) analyzed the information-seeking activities of clinicians through the

computer log file and subsequent statistical analysis of the electronic records. Similarly, Xu et al. (2005) studied the interaction of nurses with collaborative practice guideline tools through monitoring infrastructure. Following interactions with the tool, a questionnaire was presented to the nurse to further describe the information session.

Qualitative research studies have also been utilized to explore clinician information needs, preferred information sources, perceived accessibility and usability of information, and information-seeking behaviors. Qualitative researchers have most often employed real time observations to better understand these areas of research (Anton et al., 2014; Blythe & Royle, 1993; Forsythe, Buchanan, Osheroff, & Miller, 1992; Keenan, Yakel, Dunn Lopez, Tschannen, & Ford, 2013; Kelley & Brandon, 2012; Koch et al., 2012; Lange, 1992; Reddy et al., 2002; Valenta & Wigger, 1997). In study by Allen et al. (2003), videotaping was utilized during observations in order to capture the computer screen being seen by nurses. Simultaneous audio recordings of the nurses were also collected in order to capture the explanations of nurses regarding the need for additional information with each screen. Findings from interviews conducted in a qualitative study by Kelley et al. (2013) subsequently informed the development of an observational tool used in a later information needs study (Kelley & Brandon, 2012). Several qualitative studies utilized multiple types of qualitative data collection methods (such as interviews, observations, thinking aloud, document analysis, and Q methodology) within a single study to better understand the complex topics of nursing information needs. Individual interviews, focus group interviews, and document analysis were utilized in conjunction with observations in order to better identify barriers to acquiring information, perceived

usefulness of information, and accessibility of information sources (Estabrooks et al., 2005; Marshall et al., 2011; McKnight, 2006; Thompson et al., 2001).

In light of the complexity of describing nursing information needs and information-seeking behaviors, mixed methods study designs with both qualitative and quantitative data collection techniques have also been utilized throughout the literature. Covell et al. (1985) utilized a mixed methods design in an early study focused on the needs of physicians in office practice. Self-report questionnaires and in-office interviews were chosen as data collection methods in this seminal work in the area of information needs. Corcoran-Perry and Graves (1990) employed the use of observations, interviews, and questionnaires in order to better understand nursing specific information needs and information-seeking behaviors on a cardiovascular floor. In more recent studies, mixed methods designs have also been used in variety of ways. Interviews and focus groups have been conducted in order to provide further clarification of questionnaire/survey responses or observations (Collins et al., 2007; Dee & Stanley, 2005a; McKnight et al., 2001). In a study by Dee and Stanley (2005a), observations provided data to compare the database searching skills of the nurse with their perceived skills as reported in interviews and surveys. In a sequential mixed methods study, O'Leary and Mhaolrúnaigh (2012) first collected data through semi-structured interviews in order to develop a questionnaire for the quantitative phase of the study.

Data Collection Methods Used in Information Needs and Information-Seeking Behaviors Research

Self-report data collection techniques such as interviews, surveys, and questionnaires have been utilized extensively throughout the information needs and

information-seeking behaviors literature. Self-report methods can allow for the collection of retrospective data and the collection of data pertinent to behaviors that can't be observed (Creswell, 2013; Shadish, Cook, & Cambell, 2002). Interviews, surveys, and questionnaires can provide researchers with valuable insight regarding nursing perceptions of accessibility and usability of information sources which would otherwise be impossible to gather by other data collection techniques (Newman et al., 2014). Self-report techniques can be very efficient and versatile. However, issues of validity and accuracy may arise with this type of data collection. As outlined by Forsythe et al. (1992) self-report data is often inaccurate or incomplete because individuals perceive and remember information selectively. In addition, the researcher has a limited capacity to understand the context of the answers of the respondent in relation to the information need. Covell et al. (1985) utilized multiple data collection strategies and found that the number of observed questions and information needs generated by physicians during the day greatly exceeded the frequency of information needs as reported by post-hoc self-report questionnaire.

Observational methods can yield better data than self-reports in instances where the participants may be unaware of their own behaviors or in complex situations where it is difficult to describe one's own behavior (Creswell, 2013). Observation as a data collection method has been successfully utilized for multiple studies in the information needs and information-seeking literature (Anton et al., 2014; Currie et al., 2003; Kelley & Brandon, 2012; McKnight, 2006; Reddy et al., 2002). Structured observational data collection tools have also been developed to further categorize and explain nursing workflow and nursing information and communication needs (Kelley & Brandon, 2012;

Moss et al., 2007; Moss & Xiao, 2002; Moss, Xiao, & Zubaidah, 2002). These tools allow researchers to document specific actions, behaviors, and events using a formal instrument or protocol. Due to the complex nature of nursing work practices and the potential for discrepancies between reported and actual work practices, direct observations are the most reliable method for data collection in studies examining nursing information needs and information-seeking behaviors (Beuscart-Zéphir, Brender, Beuscart, & Ménager-Depriester, 1997; Forsythe et al., 1992).

Conclusion

In conclusion, future research is needed to further clarify the following areas: categories of information needs specific to medical-surgical nurses, nursing practice specific parameters that impact the choice of information sources, contexts that impact information-seeking behaviors specific to nursing practice and medical-surgical nursing care, and potential barriers and facilitators to information-seeking processes during normal nursing workflow. Better understanding of the types of tasks that trigger the need for information and workflow challenges can inform the development of information sources and information delivery systems that fit the needs of medical-surgical nurses in contemporary practice. Use of more rigorous methodological approaches and theoretical models can provide structure to future studies in the areas of nursing information needs and information-seeking behaviors. The study utilized a mixed methods design in order to obtain quantitative and qualitative data to better describe the complex phenomenon of the information needs of nurses and the behaviors they undertake to search for needed

information. Further explanation of the study design and study methodology can be found in chapter 3.

CHAPTER 3

METHODOLOGY

Introduction

Lack of available information and inadequate transfer of information to providers have been cited extensively in the literature as major contributing causes of unsafe care and errors in practice (Cheragi et al., 2013; Kim & GyeongAe, 2014; Kopp et al., 2006; Leape et al., 1995; Wilson et al., 1995). CDSS are a type of health information technology that can be utilized to deliver information pertinent to patient care in a timely manner to providers (Osheroff, 2009; Saba & McCormick, 2011). Customization of CDSS to meet the specific information needs of nurses without interrupting patient care workflow is imperative for nursing acceptance and use of the system (Berner, 2009; Karsh, 2009). Understanding the information needs and the workflow practices of nurses prior to CDSS design can improve the usability and utilization of CDSS in clinical practice. The purpose of this descriptive mixed methods study was to explore the information-seeking behaviors of nurses during the course of patient care on medical-surgical units to inform the development CDSS for medical-surgical acute care nurses.

Specific Aim

The specific aim for this dissertation was to observe and describe the information-seeking behaviors of medical-surgical nurses in an acute care facility to inform and guide the development of CDSS.

Research Questions

The following research questions were used for this study:

1. What are the observed information-seeking behaviors of medical-surgical nurses in an acute care facility when delivering patient care across an entire shift?
2. What are the observed purposes for medical-surgical nurses seeking information in an acute care facility when delivering patient care across an entire shift?
3. What are the sources of information accessed by medical-surgical nurses in an acute care facility when seeking information when delivering patient care across an entire shift?
4. What is the format of information accessed by medical-surgical nurses in an acute care facility when seeking information when delivering patient care across an entire shift?
5. What is the observed duration of individual information-seeking episodes utilized by medical-surgical nurses in an acute care facility when delivering patient care across an entire shift?
6. What are the observed times that medical-surgical nurses' access information when delivering patient care across an entire shift?

Study Design

A mixed methods research approach was utilized for this study. Mixed methods research involves the collection and integration of both qualitative and quantitative data

to arrive at meta-inferences (Plano Clark & Ivankova, 2016). A concurrent mixed method design allows for simultaneous collection of quantitative and qualitative data and gives equal priority to both types of data (Plano Clark & Ivankova, 2016). Data collection for this study included structured observations of nurses in their work environment recording their use of information during patient care, individual post observation semi-structured interviews, and descriptions of information artifacts utilized by the nurses during the observations. A mixed methods approach was appropriate for this study because it allowed the researcher to complement quantitative categorical data with qualitative data derived from the interview responses and information artifacts utilized by nurses.

Study Approval

This study was approved through the UAB Institutional Review Board and assigned Protocol number X179330003. A copy of the approval paperwork and informed consent have been provided in Appendix C.

Setting

This study was conducted on five medical-surgical units at a large teaching hospital located in the southeastern United States. The use of five units provided a broader view of the information-seeking episodes of nurses in five different settings that all shared the same distinction of a medical-surgical floor. Because the units are in the same facility, there were similarities in patient acuity levels and patient/nurse assignment ratios. Permission to conduct observations on the medical-surgical units was obtained from the chief nursing officer and unit managers. This researcher's co-investigator

(dissertation chair) had conducted previous studies at this institution and had a developed network of collaborators at this particular hospital.

Participants

The participants for this study were registered nurses working at the bedside in an acute care facility on medical-surgical floors.

Recruitment

A convenience sample of medical-surgical nurses working at the bedside in an acute care facility were recruited for participation in this study. This sample was identified based on the position of nurses as direct patient care providers in an acute care setting. Initially, the primary researcher met with the nurse managers of the five medical-surgical floors to discuss the participation of nurses from their units in the study. Flyers containing information regarding the study and contact information were posted on the units (Appendix D). The primary researcher attended two staff meetings or "shift huddles" on each floor in order to meet potential participants. During these meetings, information was distributed regarding the study and questions were answered regarding study participation. Informed consent forms were made available to the potential participants at least 24 hours in advance of the staff meeting. Following the initial contact with potential participants in the staff meeting and "shift huddles", the primary researcher was available two separate days on each floor for 3 hours each day to allow time for private one-on-one discussions with nurses interested in participating in the study. Consent forms were signed in a private setting on each floor so that nurses felt

comfortable asking questions prior to beginning the study. Study participants were given a $20 Visa gift card as compensation for participating in the study. Recruitment of participants continued during phase 1 and phase 2 of the study until the needed sample size was obtained.

Inclusion and Exclusion Criteria

Inclusion criteria for the study were (a) registered nurses, (b) engaged in bedside care on medical-surgical units, and (c) completion of the orientation process to the facility and unit. The following are exclusion criteria for potential participants: (a) nurses still in the orientation process, (b) staffing pool and agency nurses, and (c) nurses reallocated from other units.

Sample Size

Because the unit of analysis for this study was an information-seeking episode by the nurse, the numbers of observations of nurses were considered in the determination of the sample size. Previous observational studies concerning nursing communication and information behaviors have completed 100-200 hours of direct observation of study participants to yield generalizable results (Keenan et al., 2013; Moss & Xiao, 2002, 2004; Moss et al., 2002; Thompson et al., 2001). Similar studies exploring the information exchange patterns of intensive care and operating room nurses found that consistent patterns in communication episodes emerged at approximately 500 episodes (Moss & Elias, 2010; Moss et al., 2002). As reported by Moss and Xiao (2004), 2,074 communication episodes were observed during 100 hours of observations of nurses in

four operating room suites. Another observational study by Moss and Elias (2010) in an intensive care unit yielded 459 information exchange episodes through 3 hour observations of seven nurses. During phase 1 of the study, it was determined that nurses typically averaged 5 to 10 information-seeking episodes per hour depending on the unit and the time of day. Therefore, following the phase 1 observations, it was estimated that a sample of 25 nurses observed individually for 4-hour increments would yield the number of information-seeking episodes necessary for generalizable data. Each observation session only involved one participant who was individually observed for 4 hours. The total amount of time required for each participant was 4 hours.

Data Collection

The study consisted of two separate phases. Phase 1 consisted of preliminary pilot observations to determine the frequency of information-seeking episodes that medical-surgical nurses have during care and to validate the data collection categories. The frequency of information-seeking episodes during this phase helped the researcher determine the total amount of observation hours that need to be completed in order to obtain the desired 500 information-seeking episodes. These pilot observations also provided an opportunity for the researcher to validate the data collection categories for the observational tool that was utilized during the observations of nurses in phase 2. No data were collected during phase 1 of the study. These preliminary observations only served to inform the researcher regarding the frequency of information-seeking episodes and tool categories.

Phase 2 involved actual data collection which included the observations of nurses, the conduction of semi-structured interviews, and the gathering of information artifacts. The data collected during this phase were analyzed through quantitative and qualitative data analysis. A full report of findings from phase 2 of the study are located in chapter 4. The primary researcher conducted all observations during phase 2, and each participant was observed individually. Following the observation session, the researcher conducted a brief semi-structured individual interview focusing on source preferences, perceptions of information availability, ease of use and accessibility of information sources, deferred information needs, unmet information needs, and use of internal information sources. Interview responses were analyzed through qualitative content analysis. Information artifacts, such as personal notes, report sheets, white boards, and print outs, that are utilized by participants during observations were described through written notes which were analyzed through qualitative content analysis.

Demographic Form

A brief demographic form was developed for participants to complete prior to observation. Participants provided information in the following areas: age (in years), gender, educational level, experience as a nurse (in years and months), and experience on the current floor (in years and months). A copy of the demographic form can be found in Appendix E.

Methods

The mixed methods design of this proposed allowed for the collection and integration of qualitative and quantitative data to measure the identified study variables. The research questions for this study focused on the purpose or need-creating event for information-seeking episodes and the sources and mode/format of information accessed by nurses during patient care.

Observational data collection tool. The electronic observational data collection tool utilized for this study built on previous work to develop a data collection tool by Moss et al. (2002) and Moss et al. (2007). Previously this tool has been utilized and modified to determine the information needs of nurses in the operating room and cardiac intensive care unit. This tool was modified and expanded in order to characterize the nursing care of patients on a medical-surgical unit and the information needs of medical-surgical nurses.

Categories were developed and validated by observing nurses on each of the five units for 30 hours during phase 1 of the study. Based on Krikelas' Model of Information-Seeking Behavior and the previous tool, a set of logical categories were first established to describe each episode in terms of the study variables; purpose/need-creating event, type of information, source, and mode/format. Additional categories for each variable were then further defined. For example, under the "source of information" for the episodes, initial logical codes included patients, family members of the patients, written notes, electronic records, white boards, other nurses, and other health care professionals. Categories under each variable were then added, combined, modified, and deleted as

necessary based on the observations. Nurses were observed until a set of reliable categories and attributes were determined with no new categories emerging. Through this process, a stable set of categories were developed for each descriptive area of the episode (purpose/need-creating event, type, source, and mode/format of information during each information-seeking episode). Once this stable set was established, nurses from the unit were asked to review the categories and make suggestions regarding the addition or deletion of additional categorical behaviors. When suggestions were made, further observations occurred. This process was continued until no new categories arose. Repeated observations by the primary researcher to refine the observation tool, in addition to the refinement of categories by nurses on the medical-surgical floor, validated the categories utilized to describe the information-seeking episode. Numerical codes were assigned to each category for easier documentation during observations. The variable with the subcategories were then assigned numerical code labels and programmed into a computerized template on Microsoft Access. A portable tablet was utilized for the mobile collection of data during phase 2.

To ensure the reliability of data collection, several steps were taken through the course of the proposed study. The primary researcher who conducted observations is a registered nurse with experience on medical-surgical floors. Operational definitions of each of the study variables and categories being observed were established prior to data collection. The primary researcher functioning as a non-participant observer was utilized to make data collection unobtrusive and to help diminish the reactivity of the subject to practice observations. Concurrent observation, including the primary researcher and

another trained researcher occurred for 14.41% of all observations to establish inter-rater reliability with an 85.82% agreement of coded data.

Semi-structured interview questions. Krikelas' Model of Information-Seeking Behaviors guided the development of interview questions to gather further qualitative data in the areas of unmet information needs, information source preferences, perceptions of accessibility and ease of use of sources, and personal experiences with information-seeking. Nurses were also able to further clarify any potential deferred information needs and the use of any internal sources that were not directly observable to the researcher. The interview questions have been provided in the next section.

Data Collection Timeline

Validation of the categories for data collection occurred during the phase 1 pilot portion of the study which lasted 3 weeks. Phase 2 included the observations of nurses, the conduction of semi-structured interviews, and the examination of information artifacts. Data collection utilizing the categorical data collection tool and semi-structured interviews occurred over a one-month period of time during phase 2. The sample of 25 nurses and 100 hours of direct observations yielded 818 information-seeking episodes. As supported by Moss and Elias (2010), the information needs of nurses and the patterns in which nurses use information is driven by the type of clinical care they are providing to the patient. Therefore, observations were made throughout the day from 0700 to 1900 in 4-hour increments in order to capture various activities and various information needs that occur throughout a typical nursing day shift (Moss et al., 2007).

Observations

For the purposes of this study, information-seeking behaviors were activities that are undertaken to identify relevant information to satisfy a perceived immediate need (Krikelas, 1983; Wilson, 1999). The unit of analysis for this study was an information-seeking episode, which begins when the nurse undertakes information-seeking behaviors to satisfy a perceived information need, and ends when the information is found or when the nurse determines that the information is not available. Data were collected on each information-seeking episode in terms of the purpose/need-creating event, type of information, source, and mode/format. For example, if a nurse sought a lab value from the electronic record to proceed with administration of a medication this was classified as an information-seeking episode. The need-creating event was to obtain a lab value to safely administer a medication. The type of information was patient laboratory data. The source of the information was the computer and the format was electronic. In addition, the duration of each event was timed by an internal timer that was built into the Access template. This timer not only recorded the duration but also the start time and end time of the episode.

Only those information-seeking episodes by the nurse directly related to patient care were recorded during the observation period. If the observer/researcher was unclear about the purpose/need-creating event, type of information, source, or mode/format sought in an episode, the nurse was asked to clarify. For example, if a nurse began to look for information in the medical record during documentation and the researcher was unsure of the need-creating event of this episode, the researcher asked the nurse what triggered the need to search for information. During data collection, the observer

recorded the observed category during the episode onto the computerized tablet through a drop-down menu on the template. The Access template assigned numerical codes to each of the categories. Each episode was timed, and the duration was recorded in seconds. A timer was started at the initiation of the episode and stopped at the completion or abandonment of the information-seeking task.

Post Observation Semi-Structured Interviews

Following each observation session, a brief semi-structured interview was conducted by the primary researcher. In a quiet and private setting, the researcher asked the nurse five interview questions with probes. The primary researcher took handwritten notes and the sessions were not to be recorded. The following questions were utilized during the semi-structured interviews:

1. Tell me about any information that you felt was not available during the course of observations.

   Probing question: Why did you feel that the information was not available?

   Probing question: What factors made you search or not search for information that you felt was not available?

2. Can you describe how you access and obtain information during the course of patient care?

   Probing question: How convenient are your current information sources?

   Probing questions: How accessible are your current information sources?

3. What types of information formats best fit into your nursing practice and workflow?

4. Tell me about information that you did not feel the need to search for based on your own personal knowledge. (For example, knowledge based on previous experiences or knowledge derived from physical assessment of the patient)
5. Is there anything you would like to tell me about your experiences accessing and using information during patient care?

Data Analysis

This mixed methods study entailed both quantitative and qualitative data analysis. Demographic and categorical data were entered into a statistical package program (SPSS) for analysis. Demographic data were analyzed through descriptive statistics including frequencies and percentages. Correlations between the variables and demographic data (age, experience as a nurse, and experience on the floor) were performed. The duration of the episodes and frequencies of categories for each variable were analyzed through one-way ANOVA statistical testing to compare the mean duration of episodes based on the variable (purpose/need-creating event, type, source, and mode/format). Nominal level categorical data (units and start times of episodes) and the study variables were analyzed through chi-square measures of association.

Semi-structured interview responses and information artifact documents were gathered from participants during data collection and were analyzed through a qualitative content analysis approach. Qualitative analysis involves the careful review of data with the identification of emerging themes evolving into categories to describe a phenomenon (Creswell, 2013). For this researcher study, conventional content analysis was utilized for analysis of the qualitative data (Hsieh & Shannon, 2005). This method of data analysis

allowed for the interpretation of text data (verbal, print, or electronic format) to be systematically classified and coded. This classification and coding process helped identify themes and patterns that arose in the data (Hsieh & Shannon, 2005). Handwritten notes from the interview sessions were read in their entirety multiple times prior to the beginning of data analysis so the researcher was fully immersed in the analysis process. While reading the interviews, the researcher made notes in the margins and identified key words and phrases. Key words that appeared to capture integral thoughts of concepts were highlighted (Creswell, 2013; Hsieh & Shannon, 2005). Once all interviews were read, the process of coding occurred. Researchers code data by grouping together key texts into smaller categories of information with a label or key word to describe the code (Creswell, 2013). Initially, five to six categories derived from the short hand coding were identified. Categories were expanded and categories were added as the qualitative data was reviewed multiple times (Creswell, 2013). Codes were clustered together to form themes. As defined by Creswell (2013), themes are broad units of information that consist of codes that have been aggregated together to form a common idea. Once the themes were identified, interpretation of the results followed. Themes that arose were compared and contrasted to the quantitative data derived from the observations.

Assumptions

1. Nurses value and need accurate and timely patient information when caring for patients.

2. Nurses use a variety of sources for information retrieval during patient care and have a variety of information-seeking behaviors.
3. Accurate data and timely delivery of data are important when developing CDSS that fit into nursing workflow. Understanding the information needs of nurses can provide a better basis for the development of CDSS.

The underlying assumptions for this study were supported by literature in the areas of nursing information needs, information sources, and information-seeking behaviors. Nurses value information and recognize the importance of accurate information during the course of patient care (Thompson et al., 2013; Thompson et al., 2001). Nurses typically access and pursue information to support the provision of direct patient care and in direct response to a sense of responsibility to the patient (Blythe & Royle, 1993; Corcoran-Perry & Graves, 1990; McKnight, 2006). Nurses seek information from a number of sources and tend to prefer sources that are verbal or written in nature (Corcoran-Perry & Graves, 1990; Estabrooks et al., 2005; McKnight, 2006). Nurses value CDSS that directly support nursing activities and that are integrated into routine workflow providing information at the point of decision making (Choi et al., 2011; Roukema et al., 2008).

Limitations

The setting and population for this study could be viewed as potential limitations for this study. The setting was a large teaching/academic hospital with a well-integrated electronic medical record system. All of the participants had received similar training regarding information retrieval through electronic formats. In addition, other healthcare

professionals (such as doctors, dieticians, physical therapists, speech therapists, and pharmacists) were readily available in this teaching environment. Therefore, there may be limits on the generalizability of the results to nurses working in smaller, non-academic hospitals.

Plan for the Protection of Human Subjects

There were no identifiable substantial risks to participants of this study. The potential risks to the participants were minimal and were not expected to be more than risks encountered during normal routine practice. Potential risks for the participants involved the potential loss of confidentiality, threats to beneficence, perceived coercion to participate in the study, and fear of retribution for non-participation.

Potential for Loss of Confidentiality and Threats to Beneficence

Research participants of any research study should be afforded the protection of confidentiality and privacy in relation to their participation in a research study and subsequent findings resulting from study participation (Polit & Beck, 2012; Shamoo & Resnik, 2009). Nurses participating in research have a right to know about the storage of data, steps the researcher is taking to ensure confidentiality, access to data and future usage of the data (Griffiths, 2006). When research is conducted in the employment setting, nurses may be reluctant to participate due to the potential for the identification of findings to a particular participant (Broyles, Rodriguez, Price, Bayliss, & Sevick, 2011).

Beneficence refers to the obligation of the researcher to minimize harm to the participants and to maximize the benefits (Emanuel, Crouch, Arras, Moreno, & Grady,

2003; Polit & Beck, 2012). Despite the low risk of actual physical harm, nursing participants in this study have the potential for psychological and social risks due to participation in the research study. Nurses may become self-conscious and doubtful of their own workplace practices leading to questions regarding their professional standing (Broyles et al., 2011; Griffiths, 2006). Nursing participants should also have the right to protection from exploitation, and the information gathered in study should not be used to place them at a disadvantage or cause them damages (Polit & Beck, 2012). Studies that describe workflow and documentation practices could potentially uncover practices in patient care that are less than optimal. Nurses that participate in research in the workplace should be protected from sanctioning and damages that may arise as a result of research. As employees, real or perceived retribution can arise be in the form of financial penalties or social sanctions (Broyles et al., 2011). There are very tangible risks to workplace research such as loss of employment, lack of promotion in the institution, and negative impacts on relationships with co-workers (Broyles et al., 2011; McDermid, Peters, Jackson, & Daly, 2014; Polit & Beck, 2012).

Strict confidentiality and privacy practices regarding subject participation were utilized to minimize the potential loss of confidentiality and threats to beneficence. Consent procedures with the potential participants were conducted in a private setting where the conversation was not overheard by others. Results were not identifiable to a particular individual and were reported in aggregate. Individual data was not reported to the employer. NO information with unique patient identifiers was collected. Electronic data obtained during data collection was stored on a laptop computer that is password

protected. Written consent forms, and any other paper-copy documents, were kept in a locked filing cabinet in a locked office.

Perceived Coercion and Fear of Retribution

As with any research participant, nurses should be given accurate information in order to make an informed consent and comprehension of the information should be determined by the researcher. The ethical principle of respect for persons can best be protected through a well outlined informed consent plan. Participants were given the correct information regarding the study and comprehension was evaluated. Alternatives to participation were explained to the participants so they were fully aware of available options other than the choice of study participation (Emanuel et al., 2003; Fisher, 2013; Polit & Beck, 2012). In order to prevent undue coercion, participants were informed that participation is not mandatory and those that choose not to participate would sanctioned or penalized. Participants were given a minimum of 24 hours to review the informed consent form prior to being asked to sign the form. Individual participation choices were not disclosed to those in supervisory roles. Participants were allowed to withdraw from the study at any time.

Summary

The purpose of this descriptive mixed methods study was to identify the information-seeking practices of medical-surgical nurses. Recruitment of medical-surgical nurses practicing in an acute care facility provided the researcher with the appropriate sample to answer the research questions regarding information-seeking

practices during bedside care in order to inform the development of CDSS for this population. The setting provided the researcher with appropriate subjects and practice environments to answer the proposed research questions. Data collection, through direct observations, allowed the researcher to categorize information-seeking practices in terms of purpose/need-creating event, type of information, source, and mode during each information-seeking episode. In addition, duration added an interval level data component that helped describe the amount of time nurses spend accessing specific types of information. Interview responses and information artifacts provided a qualitative component to further enhance descriptions of the sources of information, modes of information, perceptions of accessibility of information, deferred information needs, unmet information needs, and internal sources of information.

CHAPTER 4

RESULTS

Introduction

The purpose of this chapter is to provide a description of the setting, sample, and quantitative and qualitative findings from this study. The purpose of this study was to explore the information-seeking behaviors of nurses during the course of patient care on medical-surgical floors. These study findings can provide needed information to guide the development of CDSS that support the information needed by nurses during direct patient care. Structured observations and a post observation semi-structured interview were utilized to obtain quantitative and qualitative data to describe the information-seeking behaviors of nurses. Data collection was divided into two phases. During phase 1, pilot observations were performed to determine the frequency of information-seeking episodes and to validate the data collection categories for use in the observational tool. These observations were strictly for the determination of the frequency of the information-seeking episodes and the validation of the data collection tool categories. No data was collected in phase 1 to be included in quantitative and qualitative analysis. Phase 2 involved the actual collection of data through the observations of participants, description of the information artifacts, and interviews with participants. Following data collection, the demographic and quantitative data were entered and exported into SPSS and analyzed. Interview responses were transcribed by the researcher and analyzed through content analysis. Descriptions of the findings are presented in this chapter.

Setting

Five nursing units at a large teaching hospital system in the southeastern United States served as the setting for this mixed methods study. These units were chosen based on their similarities in patient acuity levels, nurse/patient care ratios, availability of electronic and technical support resources. All nurses in this hospital system receive the same training regarding the computerized information systems utilized by the hospital system. All new employees receive a live 8-hour training course during the first week of orientation regarding the electronic medical record documentations system. Following this training course new employees then complete a series of computer based training modules regarding electronic resources. During the next 30 days, employees receive on the job training directed by assigned preceptors. Approximately 30 days after beginning employment at the facility, the nurses participate in another 4-hour live training course. This course provides more in-depth training regarding resources such as order sets and smart pumps. Within the following 3 months, nurses will also participate in a second follow-up day of live training that involves completion of 20 minute to 25 minute modules. There are manuals available for each of the electronic resources to help clarify any questions that arise during care. In addition, there is a 24-hour helpdesk available to help support nurses regarding technical issues. The Information Technology department evaluates learning needs on individual units prior to the implementation of any new technology. This evaluation helps determine the project based learning needs of the nurses on the individual units. Operational learning needs can also be identified by nurses or nurse leaders on individual units. This type of training is handled on a unit level and

the Information Technology department works to develop and support the training programs.

All of the units chosen provide care to adult patients over the age of 18 years. Four of the units were located at the main hospital campus and one of the units was located a smaller satellite campus several blocks away from the main campus. Four of the units admitted surgical patients from different specialties and one of the units was a general medicine floor. Two of the five units had step down units which have higher acuity patients and lower nurse/patient ratios. All of the units had at least one large or two smaller desk areas. Every nurse on the units had their own mobile documentation carts which include a computer with a monitor, a key board, and a bar code scanner. Each of the units also had stationary computers for documentation or information retrieval at the desk. Nurses on all of the units worked 12-hour shifts beginning at 0700 and 1900. Shift report typically began approximately 30 minutes before the beginning of the next shift. One unit did not have patient care technicians. On this unit, nurses provided total patient care and had lower nurse/patient ratios. Table 1 provides a description of the number of beds in each unit and the care ratios.

Table 1
Description of the Units

Unit	No. of Beds	Care Ratio	Step-down Care Ratio
Unit One	27	1:4-5	
Unit Two	30	1:3-4	
Unit Three	32	1:4-5	
Unit Four	29	1:4-5	1:3
Unit Five	29	1:4-5	1:2-3

Description of Unit 1

Unit 1 was not located on the main campus of the hospital system. It was located on a smaller satellite hospital several blocks away from the main campus. This was a 27-bed surgical unit that specializes in the care of patients with wide variety of orthopedic problems. This unit cared for both pre-surgical and post-surgical patients. The nurse/patient ratio for this unit was 1:4-5. There was a central nursing desk with three halls that branch off from the desk.

Description of Unit 2

Unit 2 was a general medicine and infectious disease unit that provided care to adult patients with a variety of general medical problems and needs. This was a 30-bed unit and is staffed by the general medicine residency teaching service at the hospital. The nurse/patient ratio on this unit was 1:3-4 and the nurses provided total patient care. There were no patient care technicians on this unit. The unit had one large nursing desk that has halls that extending on both sides of the desk and a hall along the back portion of the unit.

Description of Unit 3

Unit 3 was a 32-bed unit that provides care to adult medical patients experiencing gastrointestinal disorders and surgical gastrointestinal and oncology patients. The nurse/patient ratio for this floor was 1:4-5. This unit had two long halls with a connecting back hall and a large nursing desk at the front of the unit that extends through to both halls. Patient care technicians were utilized on this floor and have a 1:10 ratio for patient care.

Description of Unit 4

Unit 4 was a medical and surgical unit that provides care to general surgical patients and surgical patients experiencing disorders of the gastrointestinal system. This was a 29-bed unit with four beds that serve as a step-down unit with higher acuity patients. The nurse patient ratio was 1:4-5 for the medical-surgical beds and 1:3 for the step down unit beds. This unit employed patient care technicians for the provision of patient care. This unit had two large nursing desks at the front and the back of the unit. The unit had two long halls with a connecting back hall. The step down unit was located on the back hall. The front nursing desk was typically utilized by nurses caring for the medical-surgical patients while the nursing desk located on the back hall was utilized by nurses and staff caring for the patients in the step down unit.

Description of Unit 5

Unit 5 was a 29-bed unit that provides care to pre-surgical and post-surgical patients followed by the otolaryngology, oral surgery, plastic surgery, and urology

services. This floor had four beds which could serve as a step down unit for higher acuity patients if needed. The step down beds were in semi-private rooms with two beds to each room. If there were no higher acuity patients, these beds were converted to semi-private rooms for medical-surgical patients. The nurse/patient ratio was 1:4-5 for the medical-surgical beds and 1-2:3 for the step down beds. This unit had two long halls with a back connecting hall. There was a large nursing desk located centrally on the floor that extends through to both halls. All nurses had mobile documentation carts. There was a stationary computer located in each of the two semi-private rooms that serve as the step down unit. Patient care technicians were utilized on this floor.

Observational Data Collection Tool

During phase 1 of this study, the researcher conducted informal two-hour observation sessions with three nurses on each floor. These pilot observations served several purposes in the development of the study. The observations allowed for the determination of the frequency of information-seeking episodes by medical-surgical nurses in order to determine the number of nursing participants needed to yield 500 information-seeking episodes. The informal observations also provided an opportunity for the researcher to develop an inventory of information sources for each unit and to develop and validate the categories for the data collection tool. An inventory of information resources found on the units is provided in Appendix F.

Prior to the initiation of the phase one observations, the researcher established logical categories for the data collection tool based on the study variables, a previous tool developed by Moss et al. (2002) and Moss et al. (2007), and Krikelas' Model of

Information-Seeking Behavior. Operational definitions for each of the study variables (purpose/need creating event, type of information, source of information, and mode/format) were then developed based on the observations (Appendix G). A paper Data Category Validation Tool (Appendix H) was developed with categories of behaviors for each of the variables. During observations, the researcher would make handwritten notes on the tool and would ask questions of the nurses during information-seeking episodes. Nurses on each unit were asked to review the categories and more observations were completed. The researcher observed nurses for approximately thirty hours during this process and continued observations until no new categories emerged. Once a reliable set of categories was established, the researcher developed operational definitions for each of the categories (Appendix I). These variables with their subcategories were then assigned numerical code labels and programmed into a Microsoft Access template on a tablet computer for mobile data collection during the observations. Screenshots of the electronic observational data collection tool template have been provided in Appendix J.

Interrater Reliability of the Tool

During phase two of data collection, concurrent observations by the researcher and two other trained researchers occurred for 127 of the 818 episodes (14.41% of all observations) in order to establish interrater reliability of the tool, operational definitions, and data collection. The primary researcher provided the secondary observers with the operational definitions of the categories prior to the observation sessions. A second portable table with the observational data collection tool was utilized for the concurrent

observations. There was an 85.82% agreement of the coding of data between the data collectors during the concurrent observations.

Sample

The sample for this study included registered nurses working on medical-surgical floors providing direct patient care. Inclusion criteria for the study were (a) registered nurses, (b) engaged in bedside care on medical-surgical units, and (c) completion of the orientation process to the facility and unit. The following were exclusion criteria for potential participants: (a) nurses still in the orientation process, (b) staffing pool and agency nurses, and (c) nurses reallocated from other units. Since four of the five floors chosen specialized in the care of surgical patients, the researcher felt it was necessary to recruit more participants from unit 2 since this was the only floor with strictly medical patients. Nine of the 25 total participants worked on unit 2 providing a better sample of nurses providing care to patients with a variety of medical illnesses and co-morbidities. The other 16 participants worked on floors that predominately cared for post-surgical patients with disorders of a specific body system. Due to the similarity of the patient populations for unit 3 and 4, less participants were chosen from each of these floors.

Sample Size

A convenience sample of 25 registered nurses were recruited for this study. The unit of analysis for this study was an information-seeking episode. For the purpose of this study, an information-seeking episode was defined as an event that begins in response to a perceived information need, proceeds to the initiation of information-seeking behaviors,

and ends when the need is believed to have been satisfied or the task is abandoned due to lack of available information (Krikelas, 1983). The study sample size was determined based on the number of information-seeking episodes needed for the emergence of consistent patterns of communication. As noted in chapter 3, similar studies examining and exploring communication and information behaviors completed 100-200 hours of observations to yield generalizable results (Keenan et al., 2013; Moss & Elias, 2010; Moss & Xiao, 2002, 2004; Moss et al., 2002). Studies by Moss and Elias (2010) and Moss et al. (2002) found that consistent patterns in communication episodes emerged at approximately 500 episodes. During phase one of data collection for this study, nurses on all five of the floors were observed for 2-hour increments. During these informal observations, nurses typically averaged 5-10 information-seeking episodes per hour depending on the times of day the nurse was observed. Therefore, the researcher estimated that a sample of 25 nurses would yield the needed number of information-seeking episodes.

Description of the Sample

A total of 25 participants were recruited from five medical-surgical floors. The participants completed a demographic form (Appendix E) and provided the following information: age, gender, educational level, experience as a nurse, and experience as a nurse on the current unit. The demographic data was entered into SPSS and analyzed through descriptive statistics. Twenty-four (96%) of the participants were female and one was male (4%). Twenty-one (84%) of the participants had a bachelor of science in nursing degree and four (16%) had an associate of science in nursing degree. None of the

participants had completed a master's degree or a doctoral degree. The mean age of the participants was 34.07 years with a minimum age of 22 years and a maximum age of 56 years. The participants had an average of 8.46 years of nursing experience with a minimum of 4 months and a maximum of 32.42 years. The average number of years of experience on the unit was 4.32 years with a minimum of 4 months and a maximum of 22 years. Tables 2 and 3 provide demographic characteristics for the sample (n = 25).

Table 2

*Gender and Education Demographic Characteristics of the Sample (*n = *25)*

Characteristics	Frequency	Percent (%)
Gender		
Male	1	4
Female	24	96
Education Level		
ASN	4	16
BSN	21	84

Table 3

*Age, Nursing Experience, and Experience on the Unit Demographic Characteristics of the Sample (*n = *25)*

Characteristics	Mean	Minimum	Maximum
Age (Years)	34.07	22	56
Nursing Experience (Years)	8.46	4	32.42
Experience on Unit (Years)	4.32	4	22

Description of the Sample by Unit

Demographic data including age, total years of nursing experience, and years of nursing experience on the floor were also analyzed based on the unit where the registered nurse worked. Unit 4 had the youngest mean age of the nurse at 29.33 years and unit 1

had the oldest mean age of the at 41.23 years. Unit 1 had the highest mean years of nursing experience at 15.82 years. Unit 5 also had a high mean of years of nursing experience at 15.3 while unit 3 (2.33 years) and unit 4 (3.25 years) had the lowest. Unit 5 had the highest mean number of years of experience on the floor at 9.1 years and unit 3 had the lowest at 1.92 years. Table 4 provides age, nursing experience, and experience on the unit demographic characteristics by unit.

Table 4

Age, Nursing Experience, and Experience on the Unit Demographic Characteristics of the Sample by Individual Units (Based on Years)

Characteristics	Mean	Minimum	Maximum
Unit 1 (n = 5)			
Age	41.23	27.42	55.25
Nursing Experience	15.82	2.5	25.92
Experience on Unit	2.1	1	2.5
Unit 2 (n = 5)			
Age	29.78	23	56
Nursing Experience	4.5	9 months	22
Experience on Unit	4.07	8 months	22
Unit 3 (n = 3)			
Age	32.33	26.17	40.42
Nursing Experience	2.33	6 months	4.92
Experience on Unit	1.92	4 months	4.92
Unit 4 (n = 3)			
Age	29.33	23.83	36.35
Nursing Experience	3.25	1	5.92
Experience on Unit	3.25	1	5.92
Unit 5 (n = 5)			
Age	38.51	22	54.83
Nursing Experience	15.3	4 months	32.42
Experience on Unit	9.1	4 months	20

Quantitative Variables

Variables for the quantitative portion of this study included: unit, purpose, information type, source, mode, start time, stop time, and duration. A Microsoft Access template with pre-programmed forms was utilized for mobile collection of data. Each episode was saved to an Access form. Once all observations were complete, the data were then exported from Microsoft Access to a Microsoft Excel spreadsheet and then into SPSS software for statistical analysis.

Descriptive Statistics

The sample of 25 nurses were observed for four-hour observation sessions yielding 100 hours of direct observations and 818 total information-seeking episodes. Episodes were categorized by the purpose/need-creating event, information type, information source, and mode/format of information exchange. Frequencies and percentages for each of the episode categories were calculated for the full sample, individual units, the four combined surgical units, mode/format, and start time. Findings are presented in the following sections.

Frequencies and Percentages of the Full Sample

Purpose/need creating event. For this study, the purpose/need-creating event for an information-seeking episode was defined as an event that causes uncertainty in the information seeker and leads to the perception that the current state of knowledge is not adequate to deal with an issue (Krikelas, 1983; Moss et al., 2007; Sawant, 2015). This event was the reason that the provider initiated the information task. Analysis findings

from the full sample indicate that nurses most frequently searched for information for the purpose of patient treatment and the provision of patient care (25.2%). Medication administration (19.9%) and order clarification/verification of new orders (15.2%) followed in frequency. Descriptive results of the frequencies and percentages of the purpose/need creating event prompting the participant to search for information are provided in Table 5.

Table 5

*Frequencies and Percentages of the Purpose/Need-creating Event for the Full Sample (*n = *818)*

Category	Frequency	Percentage (%)
Patient treatment/provision of care	206	25.2
Medication administration	163	19.9
Order clarification/new order verification	124	15.2
Review of current treatment plan	86	10.5
Patient hand-off of care or transfer	53	6.5
Patient discharge	48	5.9
Quantifying risk for adverse events	44	5.4
Patient admission	32	3.9
Change in patient status	21	2.6
Medication titration	18	2.2
Coordination of home care/discharge planning	12	1.5
Equipment management	8	1.0
Pre-admission medication reconciliation	3	0.4
Lack of Patient Knowledge/Patient request for information	0	0.0

Type of information. The operational definition utilized for the type of information for this study was the type of data accessed to reduce uncertainty (Krikelas, 1983; Wilson, 1999). Nurses most frequently sought information regarding current orders (19.7%) and new orders (13.6%). Scheduled patient care information closely followed at 11.6%. Nurses also frequently sought assessment information (15.5%) in the form of a

complete assessment, a focused assessment, a vital sign assessment, or a pain assessment. Descriptive results of the frequencies and percentages of the type of information sought by the participants are provided in Table 6.

Table 6

*Frequencies and Percentages of the Type of Information for the Full Sample (*n = *818)*

Category	Frequency	Percentage (%)
Current Orders	161	19.7
New Orders	111	13.6
Schedule of Patient Care	95	11.6
Patient progress	67	8.2
Patient laboratory data results	53	6.5
Pain assessment	48	5.9
Change of shift report	47	5.7
Risk assessment tools	42	5.1
Verbalized patient data	39	4.8
Vital sign assessment	39	4.8
Medication information	25	3.1
Complete assessment	22	2.7
Focused system assessment	22	2.7
Discharge orders	14	1.7
Patient medical history	13	1.6
Equipment specific information	12	1.5
Demographic data	4	0.5
Patient diagnostic test results	4	0.5
Patient education	4	0.5
Electronic standard of care reference tool	1	0.1
Hospital specific policies and procedures	0	0.0

Information Source. For this study, information sources were defined as suppliers or generators of information that are accessed in order to meet a perceived gap in knowledge or a perceived information need (Krikelas, 1983). The most frequent source of information for the nurses was the patient EMR (22.9%) followed by the patient (17.8%). Overall, nurses most frequently sought information from electronic sources

(58.8%) in the form of the above mentioned EMR, the electronic medication administration record, computerized medication resources, electronic patient main screen, and computerized information resources. The patient was the main source of non-electronic information sought by nurses. Nurses less frequently sought information from nursing peers (7.1%) in the form of other nurses providing direct patient care, nurse educators/leaders/charge/managers, and specialty nurses. Descriptive results of the frequencies and percentages of the sources of information utilized by the participants are provided in Table 7.

Table 7

*Frequencies and Percentages of the Source of Information for the Full Sample (*n = *818)*

Category	Frequency	Percentage (%)
Patient EMR	187	22.9
Patient	146	17.8
Patient main screen	139	17.0
MAR	135	16.5
Other nurses	50	6.1
Personal notes	33	4.0
Physician	29	3.5
Computerized medication resources	15	1.8
Patient care technician	14	1.7
Social worker	11	1.3
Interdisciplinary team	10	1.2
White boards	9	1.1
Patient family member	7	0.9
Physical therapist	7	0.9
Computerized information resources	5	0.6
Nurse educator/clinical nurse leader/charge nurse/nurse manager	4	0.5
Specialty nurse	4	0.5
Unit clerk	4	0.5
Written reference material	3	0.4
NP/PA/SA	2	0.2
Patient paper chart	2	0.2
Pharmacist	2	0.2

Information modes/formats. For this study, the mode/format of the information was defined as the means or the method by which the provider obtains information (Moss et al., 2007). Nurses most frequently sought information in a computerized mode/format (60.8%). Face to face verbal interactions were the next most frequently utilized mode/format at 30.7%. Less frequently nurses utilized written and telephone. Descriptive results of the frequencies and percentages of the type of mode/format utilized by the participants to gain information are provided in Table 8.

Table 8

*Frequencies and Percentages of the Mode/Format of Information for the Full Sample (*n = *818)*

Category	Frequency	Percentage (%)
Computerize	497	60.8
Face-to-face	251	30.7
Written	40	4.9
Telephone	30	3.7

Frequencies and Percentages of Individual Units

Frequencies and percentages of each of the episode categories were also analyzed based on the nursing unit and the type of unit (general medicine or surgical). There was one unit that specialized in the care of patients with general medical problems and needs. The other four units admitted surgical patients from different medical specialties. Table 9 provides a description of the total number of nurses and information-seeking episodes by unit and all surgical units combined. Descriptions of the frequencies and percentages of the purpose/need creating event, information type, source of information, and

mode/format of the information episode for each nurse on each unit and for all of the nurses on the surgical units combined are provided in the following sections.

Table 9

Number of Participants and Number of Information-seeking Episodes by Unit

Unit	No. of Participants	No. of Information-Seeking Episodes
Unit One	5	202
Unit Two	9	281
Unit Three	3	82
Unit Four	3	104
Unit Five	5	149
Combined Surgical Units	16	537

Purpose/need creating event. As noted in the analysis of the full sample, nurses most frequently searched for information to support patient treatment and the provision of care, medication administration, and order clarification/new order verification. Patient handoff of care or transfer (14.6%) and quantifying risk for adverse events (14.6%) information were also frequently searched for by nurses working on unit 2. Nurses on unit 1 and unit 5, which were surgical units, most frequently searched for information regarding medication administration. Unit 2, the general medicine unit, had the highest frequency of all of the units for searching for information regarding patient treatment and provision of care, and the lowest frequency of searching for information needed for the purpose of medication administration. Nurses on unit 3 most frequently verified and clarified orders, while unit 4 most frequently searched for information to support the provision of patient care and patient treatment. Unit 5 nurses also frequently reviewed the current treatment plan. The least frequent need creating events to cause nurses to initiate

information-seeking episodes included lack of patient knowledge, pre-admission medication reconciliation, equipment management. Information needed to support medication titration was infrequently sought by nurses on unit 3, unit 4, and unit 5. However, nurses on unit 1 sought this type of information for 4% of the episodes and unit 2 for 9%. Nurses on unit 3 and unit 4 had similar patient populations, general and gastrointestinal surgical patients, and more frequently sought information regarding changes in patient status.

When analyzing frequencies with the surgical units combined, the three most frequent need-creating events were medication administration (22.9%), patient treatment and the provision of care (21%), and order clarification/new order verification (12.7%). Unit 2, the general medicine unit, most frequently searched for the same three categories. However, the nurses on this unit most frequently searched for information to support the provision of patient care, then order clarification/verification of new orders, and lastly medication administration. Descriptive results of the frequencies of the purpose/need-creating events for each of the units are provided in Table 10. Table 11 provides results and a comparison of combined surgical units and the general medicine unit.

Table 10

Frequencies and Percentages of the Purpose/Need-creating Event for Information-seeking Episodes by Unit

Category	Unit One n = 202		Unit Two n = 281		Unit Three n = 82		Unit Four n = 104		Unit Five n = 149	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Patient treatment/provision of care	41	20.3	93	33.1	19	23.2	23	22.1	30	20.1
Medication administration	51	25.2	40	14.2	15	18.3	21	20.2	36	24.2
Order clarification/new order verification	21	10.4	56	19.9	22	26.8	16	15.4	9	6.0
Review of current treatment plan	28	10	23	11.4	4	4.9	9	8.7	22	14.8
Patient hand-off of care or transfer	12	5.9	13	14.6	7	8.5	8	7.7	13	8.7
Patient discharge	10	5.0	20	7.1	0	0	4	3.8	14	9.4
Quantifying risk for adverse events	12	5.9	13	14.6	7	8.5	5	4.8	7	4.7
Patient admission	6	3.0	3	1.1	3	3.7	8	7.7	12	8.1
Change in patient status	4	2.0	2	0.7	4	4.9	8	7.7	3	2.0
Medication titration	8	4.0	9	3.2	0	0	1	1.0	0	0
Coordination of home care/discharge planning	11	5.4	0	0	1	1.2	0	0.0	0	0
Equipment management	2	1.0	4	1.4	0	0	1	1.0	1	0.7
Pre-admission medication reconciliation	1	0.5	0	0	0	0	0	0.0	2	1.3
Lack of Patient Knowledge/Patient request for information	0	0	0	0	0	0	0	0.0	0	0

Table 11

Frequencies and Percentages of the Purpose/Need-creating Event by Combined Surgical Units and the General Medicine Unit

Category	Surgical Units Combined n = 537		General Med Unit n = 281	
	Freq	%	Freq	%
Patient treatment/provision of care	113	21	93	33.1
Medication administration	123	22.9	40	14.2
Order clarification/new order verification	68	12.7	56	19.9
Review of current treatment plan	58	10.8	28	10.0
Patient hand-off of care or transfer	40	7.4	13	4.6
Patient discharge	28	5.2	20	7.1
Quantifying risk for adverse events	31	5.8	13	4.6
Patient admission	29	5.4	3	1.1
Change in patient status	19	3.5	2	0.7
Medication titration	9	1.7	9	3.2
Coordination of home care/discharge planning	12	2.2	0	0.0
Equipment management	4	0.7	4	1.4
Pre-admission medication reconciliation	3	0.6	0	0.0
Lack of Patient Knowledge/Patient request for information	0	0.0	0	0.0

Type of information. Information regarding current orders was the most frequent type of information that nurses searched for on three of the five units, with the exception of unit 3 and unit 4, which most frequently searched for information regarding new orders. When analyzing the frequencies of the combined surgical units, information regarding current orders was most frequently searched (20.9%), followed by schedule of

patient care (13.4%) and new orders (11.7%). Nurses on the general medicine floor sought current order information, then new orders and patient progress. When combining all of the assessment categories, nurses on the surgical units and general medicine unit also frequently searched for some type of assessment information. The nurses on the general medicine unit more frequently searched for lab data than nurses on the surgical units. Nurses on both types of units similarly searched for information regarding medications. Table 12 provides the descriptive results of the frequencies for the types of information most frequently sought by nurses on each of the units. Table 13 provides results of the combined surgical units and the general medicine unit.

Table 12

Frequencies and Percentages of the Type of Information by Unit

Category	Unit One n = 202		Unit Two n = 281		Unit Three n = 82		Unit Four n = 104		Unit Five n = 149	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Current Orders	52	25.7	49	17.4	19	23.2	12	11.5	29	19.5
New Orders	14	6.9	48	17.1	21	25.6	17	16.3	11	7.4
Schedule of Patient Care	27	13.4	23	8.2	3	3.7	14	13.5	28	18.8
Patient progress	5	2.5	31	11.0	4	4.9	11	10.6	16	10.7
Patient laboratory data results	19	9.4	27	9.6	2	2.4	5	4.8	0	0.0
Pain assessment	14	6.9	14	5.0	4	4.9	8	7.7	8	5.4
Change of shift report	13	6.4	12	4.3	7	8.5	7	6.7	8	5.4
Risk assessment tools	10	5.0	13	4.6	7	8.5	5	4.8	7	4.7
Verbalized patient data	14	6.9	13	4.6	1	1.2	3	2.9	8	5.4
Vital sign assessment	10	5.0	16	5.7	3	3.7	6	5.8	4	2.7
Medication information	7	3.5	8	2.8	0	0	6	5.8	4	2.7
Complete assessment	4	2.0	2	0.7	3	3.7	1	1	12	8.1
Focused system assessment	4	2.0	3	1.1	3	3.7	5	4.8	2	1.3
Discharge orders	4	2.0	5	1.8	1	1.2	1	1.0	3	2.0
Patient medical history	1	0.5	6	2.1	0	0	1	1.0	5	3.4
Equipment specific information	3	1.5	6	2.1	0	0	1	1.0	2	1.3
Demographic data	0	0.0	3	1.1	0	0.0	0	0.0	1	0.7
Patient diagnostic test results	0	0.0	1	0.4	2	2.4	0	0	1	0.07
Patient education	1	0.5	1	0.4	2	2.4	0	0	0	0.0
Electronic standard of care reference tool	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0
Hospital specific policies and procedures	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

Table 13

Frequencies and Percentages of the Type of Information by Combined Surgical Units and the General Medicine Unit

Category	Surgical Units Combined n = 537		General Med Unit n = 281	
	Freq	%	Freq	%
Current Orders	112	20.9	49	17.4
New Orders	63	11.7	48	17.1
Schedule of Patient Care	72	13.4	23	8.2
Patient progress	36	6.7	31	11.0
Patient laboratory data results	26	4.8	27	9.6
Pain assessment	34	6.3	14	5.0
Change of shift report	35	6.5	12	4.3
Risk assessment tools	29	5.4	13	4.6
Verbalized patient data	26	4.8	13	4.6
Vital sign assessment	23	4.3	16	5.7
Medication information	17	3.2	8	2.8
Complete assessment	20	3.7	2	0.7
Focused system assessment	14	2.6	3	1.1
Discharge orders	9	1.7	5	1.8
Patient medical history	7	1.3	6	2.1
Equipment specific information	6	1.1	6	2.1
Demographic data	1	0.2	3	1.1
Patient diagnostic test results	3	0.6	1	0.4
Patient education	3	0.6	1	0.4
Electronic standard of care reference tool	1	0.2	0	0.0
Hospital specific policies and procedures	0	0.0	0	0.0

Information Source. The patient EMR was the most common source of information for unit two (24.9%), unit three (25.6%), and unit five (26.2%). Nurses on unit one most frequently consulted the MAR (22.3%) while nurses on unit four most commonly utilized the patient main screen (19.2%) as a patient information source. Patients also frequently served as information sources on all of the units. When combining the surgical units, nurses most frequently sought information from the patient EMR with similar frequency as the nurses on the general medicine unit. The second most

frequently utilized source of information for nurses on the surgical units was the MAR while the nurses on the general medicine unit utilized patient main screen. For both the surgical unit nurses and the nurses practicing on the general medicine unit, the third most frequently utilized source was the patient.

Table 14 provides descriptive results of the frequencies of the source of information for nurses on each of the units. A comparison of information sources utilized by nurses on the combined surgical units and the general medicine unit are provided in Table 15.

Table 14

Frequencies and Percentages of the Source of Information by Unit

Category	Unit One n = 202		Unit Two n = 281		Unit Three n = 82		Unit Four n = 104		Unit Five n = 149	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Patient EMR	42	20.8	70	24.9	21	25.6	15	14.4	39	26.2
Patient	37	18.3	45	16	13	15.9	20	19.2	31	20.8
Patient main screen	33	16.3	59	21.0	19	23.2	20	19.2	8	5.4
MAR	45	22.3	37	13.2	9	11	16	15.4	28	18.8
Other nurses	9	4.5	17	6	5	6.1	7	6.7	12	8.1
Personal notes	6	3.0	6	2.1	4	4.9	7	6.7	10	6.7
Physician	2	1	18	6.4	5	6.1	2	1.9	2	1.3
Computerized medication resources	6	3.0	3	1.1	0	0.0	4	3.8	2	1.3
Patient care technician	4	2.0	5	1.8	3	3.7	2	1.9	0	0.0
Social worker	4	2.0	6	2.1	0	0.0	0	0.0	1	0.7
Interdisciplinary team	2	1.0	1	0.4	1	1.2	3	2.9	3	2.0
White boards	1	0.5	2	0.7	0	0.0	2	1.9	4	2.7
Patient family member	1	0.5	0	0.0	0	0.0	0	0.0	6	4.0
Physical therapist	4	2.0	2	0.7	0	0.0	0	0.0	1	0.7
Computerized information resources	1	0.5	2	0.7	1	1.2	1	1.0	0	0.0
Nurse educator/clinical nurse leader/charge nurse/nurse manager	0	0.0	4	1.4	0	0.0	0	0.0	0	0.0
Specialty nurse	0	0.0	1	0.4	0	0.0	3	2.9	0	0.0
Unit clerk	2	1.0	0	0.0	0	0.0	1	1.0	1	0.7
Written reference material	2	1.0	0	0.0	1	1.2	0	0.0	0	0.0
NP/PA/SA	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0
Patient paper chart	0	0.0	1	0.4	0	0.0	0	0.0	1	0.7
Pharmacist	0	0.0	1	0.4	0	0.0	1	1.0	0	0.0

Table 15

Frequencies and Percentages of the Source of Information by Combined Surgical Units and the General Medicine Unit

Category	Surgical Units Combined n = 537		General Med Unit n = 281	
	Freq	%	Freq	%
Patient EMR	11	21.8	70	24.9
Patient	101	18	45	16
Patient main screen	80	14.9	59	21.0
MAR	98	18.2	37	13.2
Other nurses	33	6.1	17	6.0
Personal notes	27	5.0	6	2.1
Physician	11	2.0	18	6.4
Computerized medication resources	12	2.2	3	1.1
Patient care technician	9	1.7	5	1.8
Social worker	5	0.9	6	2.1
Interdisciplinary team	9	1.7	1	0.4
White boards	7	1.3	2	0.7
Patient family member	7	1.3	0	0.0
Physical therapist	5	0.9	2	0.7
Computerized information resources	3	0.6	2	0.7
Nurse educator/clinical nurse leader/charge nurse/nurse manager	0	0.0	4	1.4
Specialty nurse	3	0.6	0	0.0
Unit clerk	4	0.7	0	0.0
Written reference material	3	0.6	0	0.0
NP/PA/SA	1	0.2	1	0.4
Patient paper chart	1	0.2	1	0.4
Pharmacist	1	0.2	1	0.0

Information modes/formats. On all of the units, nurses most frequently utilized computerized information formats for over 50% of the information-seeking episodes. The nurses on the general medicine unit utilized information obtained in a computerized format 64.4% of the time while nurses on the combined surgical units utilized the same format 58.8% of the time. Face to face verbal interactions were the second most frequently utilized format with written formats in a distant third. Frequencies and

percentages of the mode/format of information utilized are provided by individual unit in Table 16 with comparison between the surgical and general medicine unit are provided in Table 17.

Table 16

Frequencies and Percentages of the Mode/Format of Information by Unit

Category	Unit One n = 202		Unit Two n = 281		Unit Three n = 81		Unit Four n = 104		Unit Five n = 149	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Computerize	128	63.4	181	64.4	50	61.0	58	55.8	80	53.7
Face-to-face	60	29.7	86	30.6	22	26.8	33	31.7	50	33.6
Written	9	4.5	6	2.1	6	7.3	7	6.7	12	8.1
Telephone	5	2.5	8	2.8	4	4.9	6	5.8	7	4.7

Table 17

Frequencies and Percentages of the Mode/Format of Information by Combined Surgical Units and the General Medicine Unit

Category	Surgical Units Combined n = 537		General Med Unit n = 281	
	Freq	%	Freq	%
Computerize	316	58.8	181	64.4
Face-to-face	165	30.7	86	30.6
Written	34	6.3	6	2.1
Telephone	22	4.1	8	2.8

Frequencies and Percentages Based on the Mode/Format of Information

Frequencies and percentages of each of the episode categories were analyzed based on the mode/format in which the nurse sought the information.

Purpose/need creating event. During observations, nurses most frequently utilized face-to-face verbal interactions for the patient treatment and provision of care. Information exchange via the telephone was most frequently utilized when searching for information to support patient treatment and provision of care and then for patient admission, patient discharge, patient handoff of care or transfer, and order clarification. Computerized formats were utilized most frequently for order clarification and medication administration. Written formats/modes were most frequently utilized for patient handoff of care or transfer.

Type of information. Face to face verbal interactions were most frequently utilized by nurses to obtain information regarding pain assessment and verbalized patient data. Current orders and new orders were the most frequent types of information obtained through a computerized format. Written formats of information were most frequently utilized to gather information for change of shift report and in finding information regarding the schedule of patient care. Patient progress, new orders, and discharge orders were the most frequently sought types of information utilizing a telephone format.

Information Source. The most frequent source of information utilizing a face to face format was overwhelmingly the patient (56.6%). Other nurses as a source through a face to face format was a distant second at 16.3%. Nurses most frequently utilized information from the patient EMR, the patient main screen, and the MAR through a computerized format. The most frequent source utilized in a written format was personal

notes. The physician and other nurses were the most frequently utilized sources in a telephone format.

Frequencies and Percentages based on the Start Time of the Information-Seeking Episode

Frequencies and percentages were analyzed based on the start times for the information-seeking episode to describe the different times of the shift that nurses initiate information-seeking episodes. Nurses most frequently sought information during the morning hours of 0701-0800, 0801-0900, and 0901-1000. Numbers of information-seeking episodes declined from 1001-1100 and continued to decline and then remain stable. There was a minimal increase to 8.4% in the 1601-1700 time frame. Descriptive results of the information-seeking episodes based on start time are provided in Table 18**.**

Table 18

Frequencies and Percentages of the Number of Information-seeking Episodes Based on Start Time of the Episode

Start Time	Freq.	Percentage (%)
0600-0700	30	3.7
0701-0800	111	13.6
0801-0900	97	11.9
0901-1000	92	11.2
1001-1100	75	9.2
1101-1200	51	6.2
1201-1300	49	6.0
1301-1400	54	6.6
1401-1500	40	4.9
1501-1600	51	6.2
1601-1700	69	8.4
1701-1800	51	6.2
1801-1900	44	5.4
1901-2000	4	0.5

Quantitative Statistical Analysis and Findings

In order to better describe the information-seeking behaviors of medical-surgical nurses while delivering care in the acute care setting, observational data was analyzed further through correlations, ANOVA, and Chi-square tests of independence statistical analyses. Statistical testing was performed to determine if the nurse's age, years of nursing experience on the floor, and the years of experience on the unit were correlated to the purpose of searching for information, the type of information sought, the information sources utilized, and the mode of information exchange. One-way ANOVAs were performed to compare the differences in the duration of the episode based on the purpose of the information-seeking episode, the type of information sought, the source of the information, and the mode in which the information was obtained. Chi-square analysis were performed to determine if there were differences in the observed frequencies of the purpose, type, source, and mode of information-seeking episodes among units and different start times. Findings are discussed in the following sections.

Age, Experience as a Nurse, and Experience on the Unit

There was no significant correlation found between the age, experience as a nurse, and experience on the unit and the three most frequent purposes/need creating events for an information-seeking episode. The was no significant correlation between age and patient treatment and provision of care ($p= .893$), medication administration ($p=.129$), and order clarification/verification ($p=.507$). No significant correlations were found between experience as a nurse and the same three variables: patient treatment and provision of care ($p= .887$), medication administration ($p=.154$), and order

clarification/verification (*p= -.279*). There were no significant correlations between experience on the unit and patient treatment and provision of care (*p= .464*), medication administration (*p=.804*), and order clarification/verification (*p=.139*). Similarly, there were no significant correlations found between the same demographic variables and the three most currently sought types of information. Age and the following types of information had no significant correlations current orders (*p= .687)*, new orders (*p= .528*), and schedule of patient care (*p= .770*). No significant correlations were found between experience as a nurse and the same three variables: current orders (*p= .829)*, new orders (*p= .178*), and schedule of patient care (*p= .301*). There were no significant correlations between experience on the unit and current orders (*p= .311)*, new orders (*p= .240*), and schedule of patient care
(*p= .817*).

There were statistically significant, positive correlations between age of the nurse and use of personal notes as a source (*r= .436, p < .05*) and nursing experience and use of personal notes as a source (*r= .406, p < .05*). These correlations indicated that more experienced and older nurses tended to rely more on personal notes. However, there were no other statistically significant correlations with other sources of information and age, experience as a nurse, and experience on the unit. When analyzing correlations of the mode of information and age, experience on the floor, and experience on the unit a statistically significant, negative correlation (*r= -.417, p < .05*) was found between experience on the unit and use of computerized format of information exchange. The longer the experience the nurse had on the unit, the less they accessed the computer for

information. No other statistically significant correlations were found between the demographic variables and the mode/format of information sought.

Duration of the Episode

One-way ANOVA statistical tests were performed to analyze the average duration of the information-episode based on the purpose/need-creating event, type of information, source of information, and mode/format.

Purpose/need creating event. There was an overall significant difference in the amount of time nurses spend searching for information among the need-creating categories ($F_{(12, 805)} = 42.76$, $p < .001$). The longest mean times were spent in the categories of patient handoff of care or transfer (M = 2 18.509 seconds, SD = 114.70) and patient admission (M = 134.781 seconds, SD = 159.03). These two categories have the most significant differences with the other categories of purpose/need-creating events for information-seeking episodes. Quantifying risk for adverse events had the shortest mean time of duration at 18.97 seconds. This category primarily included use of electronic risk assessment tools (i.e., sepsis risk).

Type of information. Based on the duration of the episode and the type of information sought by the nurse, there was also a statistically significant difference among categories ($F_{(19,798)} = 36.12$, $p < .001$). Nurses spent the most time gathering information in the areas of change of shift report (M = 225.702 seconds, SD = 111.59),

complete assessment (*M* = 192.05 seconds, *SD* = 149.90), and patient medical history (*M* = 145 seconds, *SD* = 147.16).

Information source. Duration of the episodes based on the source of information also had an overall significant different among groups ($F_{(21,796)}$= 13.714, $p < .001$). The sources with the highest mean episode durations included other nurses (*M*= 175.50 seconds, *SD* = 112.32), personal notes (*M* = 145.94 seconds, *SD* = 134.47), and written reference materials (*M* = 121.33 seconds, *SD* = 123.59). The information source with the shortest mean duration was the patient main screen (*M* = 26.34 seconds, *SD* = 15.29).

Information modes/formats. There was an overall statistically significant difference in the duration of the information-seeking episode and the mode of information exchange ($F_{(3,814)}$= 37.10, $p < .001$). Written information formats had the longest mean duration (*M* = 113.75 seconds, *SD* = 126.93) and computerized had the shortest mean duration (*M* = 40.439 seconds, *SD* = 43.58). One-way ANOVA results for the information modes/formats can be found in Table 19.

Table 19

ANOVA of Duration of Episode and Information Mode/Format

Category			Tukey's HSD Comparisons		
	Mean	SD	Written	Telephone	Face-to-Face
Computerize	113.75	126.93			
Face-to-face	96.70	86.08	.748		
Written	88.64	94.81	.155	.934	
Telephone	40.44	43.58	.000	.000	.000

Frequency Among Units

A chi-square analysis was performed to determine if there were differences in the purpose/need creating event, types of information, sources of information, and mode/format of information sought across the units.

Purpose/need creating event. Significant chi square differences were found between the purpose/need-creating event across units (x^2 =143.55, *df*=48, p < .001). Nurses on the general medicine floor more frequently searched for information in the categories of patient treatment and the provision of care (45.1%) and order clarification and verification of new orders. In comparison to other units, unit one accounted for 91.7% of the total episodes initiated to support the coordination of home care or discharge planning information-seeking episodes.

Type of information. The analysis of the type of information sought by nurses during an information-seeking episode also produced a significant x^2 value (161.962, *df*= 76, p < .001). Nurses on unit five, which was a surgical floor, more frequently gathered information regarding complete assessments (54.5%) while nurses on unit two, the general medicine unit, most frequently sought vital sign assessment data (41.0%). The nurses on the general medicine unit also more frequently searched for patient lab data (50.9%) and verification of new orders (43.2%) than the other units.

Information source. Significant chi square differences were found between the information sources utilized across units (x^2 =148.726, *df*=84, p < .001). Unit one most frequently utilized the MAR (33.3%), while unit five most frequently utilized personal

notes (30.3%). Unit two most frequently utilized colleagues as an information source in the form of nurse leaders (100%) and physicians (62.1%).

Information modes/formats. Analysis of the information modes/formats did not produce a statistically significant chi square value (15.90, *df*= 12, p=.196). Nurses on all of the units most frequently utilized computerized modes of information exchange.

Table 20

*Frequencies and Column Percentages for Mode/Format of Information by Unit (*N = *818)*

Mode	Unit One		Unit Two		Unit Three		Unit Four		Unit Five		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Computerize	128	25.8	181	36.4	50	10.1	58	11.7	80	16.1	497	60.8
Face-to-face	60	23.9	86	34.3	22	8.8	33	13.1	50	33.6	251	30.7
Written	9	22.5	6	15	6	15	7	17.5	12	30	40	4.9
Telephone	5	16.7	8	26.7	4	13.3	6	20.0	7	23.3	30	3.7
Total	202	24.7	281	34.4	82	10	104	12.7	149	18.2	818	100

$X^2_{(12)}$= 15.902, p = .196

Frequency Among Episode Start Times

A chi-square analysis was performed to determine if there were differences in the purpose/need creating event, types of information, sources of information, and mode/format of information sought during different times of the day.

Purpose/need-creating event. Significant chi square differences were found between the purpose/need-creating event and information-seeking episode start times (x^2 =565.467, *df*= 156, p < .001). Nurses most frequently sought information to support the

purpose of medication administration during the times of 0801-0900 (39.2%) and 0901-1000 (28.3%). During 0600-0700 and 1901-2000, nurses most frequently sought, information regarding patient handoff and transfer of care. From 1101-1400, patient treatment and the provision of care was the most frequent purpose nurses searched for information. Order clarification was the most frequent need-creating event from 1001-1100 and again from 1401-1500.

Type of information. The analysis of the type of information sought by nurses during an information-seeking episode based on the episode start time also produced a significant x^2 value (610, df= 247, $p < .001$). Information regarding new orders was frequently sought throughout the day with 1001-1100 and 1201-1300 having the highest frequencies. Information regarding current orders was frequently sought from 0701-0800 (29.7%) and 1501-1600 (27.5%).

Information source. There were significant chi square differences between the source and the start time of the episode (x^2 =692.02, df= 273, $p < .001$). The frequency of the use of other nurses as an information source was highest at 0600-0700 (56.7%) and the use of personal notes was highest at 1901-2000 (75%). The patient EMR served as a source most frequently in the morning and early afternoon hours until 1301-1400. The highest frequencies of the MAR as an information source occurred from 0801-1000 and then again at 1401-1500. Utilization of the patient as an information source occurred throughout the day with the highest frequencies occurring at 0701-0800 and 1101-1200.

Information modes/formats. Analysis of the mode of information produced significant x^2 value (153.20, df= 39, $p < .001$). Face to face verbal interactions had the highest frequency of use during the start time category of 0600-0700. Starting at 0701, computerized formats of information became the most frequently utilized mode for all start time until 1801-1900. During this start time category, nurses utilized face to face, computerized and written modes in similar frequencies. From 1901-2000 written formats became the most frequently utilized mode of information exchange (75%) with computerized formats at a distant second (25%).

Qualitative Findings

Following the observation session, nurses were asked to participate in a brief semi-structured interview. The interview questions were developed to further describe the information-seeking behaviors of the nurses through qualitative data. Krikelas' Model for Information-Seeking Behaviors guided the development of the interview questions and focused on the areas of unmet information needs, information source preferences, perceptions of accessibility and ease of use of sources, and personal experiences with information-seeking. The interview script and questions have been provided in Appendix K. The participant interviews lasted 5-10 minutes following the observations session. Since the interviews were conducted in patient care areas, the researcher manually wrote all participant responses rather than recording the interview to protect patient confidentiality.

Qualitative Analysis

The participant interview responses were analyzed using conventional content analysis (Hsieh & Shannon, 2005). The hand-written notes from the interviews were read in their entirety multiple times. The researcher then typed the written responses to the interview questions. Once the data was typed, the researcher began making notes in the margin and identified key words and phrases. Coding of the data then followed and the codes were then clustered and formed the following themes: information availability, computerized and electronic sources and formats, routine and non-routine tasks, supporting the patient, and technology failure.

Interview Themes

Information availability. Information availability emerged as a major theme with convenience, accessibility, and navigation arising as subthemes. Participants reported that there was little information that was not available during the course of observations. Participant #2 notes, "Everything I needed was available." Participant #19 stated, "There was no information that was not available. There are lots of resources." Multiple participants noted the large amount of information available to promote patient care along with the variety of information resources. As stated by Participant #7 "All of the information I need is on the computer." During interviews, nurses cited finding information on the MAR, in the patient EMR, on the patient main screen, the progress notes, and the drug reference manual. Nurses also noted the availability of online information references such as electronic evidence-based standards of care, the MAR drug reference, Micromedix, hospital specific policy manuals, and the medical library. As

reported by Participant #18, “The main thing I look up are meds on the MAR to make sure I know what they are for. So I look up stuff on the MAR. Everything is right here on the tool bar”. Participant #21 stated, “I use mostly power chart with the electronic standards of care or the drug reference manual. I ask my friends for help too”.

The interview responses support that nurses feel there is a large amount of information available and conveniently accessed during the course of patient care. Multiple participants commented on the convenience of information being on the computer. Participant #19 stated,” Information sources are very convenient with them being online. Of course, I am an older nurse so I remember having to go look stuff up in books”. However, difficult navigation of the resources and lack of time to search for the information often prevented them from finding necessary information. Participant #6 responded,” I feel like most of the information was available. I don’t feel like they teach you where to look during orientation…. you have to click a lot to find”. “Some of the information resources have hard search engines to use. If you don’t type in the exact thing you aren’t going to get what you are looking for”. As noted by Participant #18, “Everything is right here on the tool bar. Trying to think through where to go is sometimes hard and I have to think for a minute. All of the sources are right there”. Time to search for information can also be a factor as noted by Participant #3 who stated, “It takes a lot of time [looking for information]. Time consuming having to filter through all of the reports to get one main idea and plan of care. It is overwhelming and frustrating and takes so much to go through all of the documents to be able to care for the patient”. As noted by Participant #7, “[Information sources] are convenient once you know where to look”.

Computerized and electronic sources and formats. Most of the nursing participants reported that they utilized computerized and electronic sources to access information and that computerized and electronic sources and formats best fit into their nursing practice and workflow. Participant #6 reported, "I access information on the computer. The most accurate information is on the computer". As noted by Participant #24, "Nothing verbal. Too easily miscommunicated. Occasionally in an emergency situation we take a verbal order. Otherwise electronic [information formats] fit best".

Several nurses reported using a combination of sources during patient care but clarified the use of non-computerized or non-electronic sources in specific situations. Participant #2 stated, "I would say that I use written as far as discharge paperwork and my personal report sheets. Those are printed off the computer and I make hand written notes on them". When asked which formats best fit into workflow, Participant #11 responded, "It depends. There are certain things I write down. The stuff I write down is more for me to remember". Participant #23 stated, "Verbal, written, and electronic sources are used. For meds common to the floor, pharmacy has printed sheets for us".

Routine and non-routine tasks. Most of the nurses reported not feeling the need to look for information for routine tasks they perform on a regular basis. Participant #1 responded that she did not feel the need to search for information regarding "things we do every day". Participant #12 reported, "basic patient care I don't have to look up". Participant #16 stated, "I don't look up how often to get vitals, when to call MD. That is Nursing 101". Many nurses responded that they did not look up medications that they give on a regular basis or disease process that were familiar. Participant #20 reported,

"Meds I have already given I didn't look up". When asked about information not searched for based on personal knowledge, Participant #19 stated "Some of the meds we give…. we give them every day and I already know them. Some of the more common meds I know from experience".

The nurses that noted information that was not available typically prefaced their responses with the fact that they were looking for information regarding a non-routine task. Participant # 14 reported, "I would say that I couldn't find a clear definitive pharmacological treatment for SVT. I googled and looked at the internet and couldn't find the answer. We just don't treat that much on this floor". As stated by Participant #17 "I couldn't find where to get supplies for an out of the ordinary procedure. It is just not something we do frequently".

Supporting the patient. During the interview, nurses responded that the main reason they look for information, and continue to look if their information need is not met, is to support and better care for the patient. Participant #5 responded that she continued to search for the information because "the patient needed the prescription". As noted by Participant #12, "Communicating with the patient made me continue to search for the information. I finally talked to a resident who told me the information". Participant #2 stated, "If I am looking up something there is a reason why. If I look anything up, it is to take better care of the patient".

Technology failure. Nursing participants responded that failure of electronic technologies to work properly led to problems with accessing information and unmet

information needs. Participant #4 reported, “Since it is all electronic, it is bad if the computers go down”. When asked to tell more about experiences accessing and using information during patient care, Participant #8 responded “Something that is frustrating is getting in the room and having problems with connectivity. For example, being in a patient room and needing to look up the MAR”. Participant #9 stated, “Computer problems keep me from getting information”. Participant #11 responded, “It can be frustrating when the electronic system goes down. You feel like you are frozen and can’t get anything done”. Participant #24 reported that she was unable to obtain information because “The medication wasn’t scanning properly and there was not an alternative other than bypassing the barcode system”. Even though the nurses reported that electronic formats and sources were highly utilized and improved access to information, failures of these technologies lead to unmet needs and difficulty obtaining needed information.

Description of Information Artifacts

During observations, the researcher examined information artifacts utilized by the nurses during the course of patient care. For this study, information artifacts were defined as any source of information utilized by nurses to store or gather information pertinent to the delivery of patient care. Descriptions of information artifacts utilized by nursing participants are provided in the following sections and are organized by their format (written or computerized).

Written. The most common type of written information artifact utilized by nurses were personal notes. Personal notes took on a variety of formats and could be

handwritten, printed patient summaries from the patient EMR, or a combination of both. Personal notes were highly individualized and the organization of these notes varied greatly among participants. Four of the five units had sample personal notes templates that could be used by the nurses for the organization of personal notes. Examples of these notes have been provided in Appendix L. However, some nursing participants chose to develop their own personal notes in highly individualized formats. Regardless of the organization of the material in the personal notes, nurses most frequently utilized this source as reminders of scheduled patient care and quick reference guides for the delivery of report at the end of the day. Many participants developed written "checklists" of care to serve as reminders of upcoming medications and treatments. On two of the units, the nurses gave oncoming nurses the written report sheets that were passed on for multiple shifts with pertinent updates added throughout the previous shift.

Other than personal notes there were very few written information artifacts. Very infrequently there were printed reference materials on the floor. During observations, the majority of printed materials utilized were pre-printed patient diets that informed nurses of appropriate diet choices for specialized diets. Unit four and unit five were the only units with written white boards depicting the patient name, physician, nurse, and patient care technician. This written white board was the only white board available for use on unit four while unit five had both a written and computerized white board as information sources for the nurses. On unit four, the white board provided the patient name, physician, nurse caring for the patient, and patient care technician caring for the patient. Unit five utilized color coding of their written white board for attending physician names. Discharges and admissions of patients were noted with movement of the color coded

written labels to different areas on the board. This white board was highly utilized by the charge nurse on unit five for the management of beds and planning of discharges and admissions.

Computerized. During observations, nurses utilized many sources of electronic information. An inventory of information resources for the units has been provided in Appendix F. One of the most frequently utilized information source by nurses on all of the units was the patient main screen. This screen served as a base "home screen" for the nurses and a quick reference tool for nurses during the course of patient care. Nurses could individualize the list to their current patients. Icons beside patient names alerted nurses to upcoming scheduled tasks, tasks that had been missed or not completed, new orders, new lab results, and scheduled medications. A screen shot of this main screen has been provided in Appendix M. Nurses on all units frequently and rapidly consulted this screen throughout the day. This was one of the most frequently consulted sources (N = 139) and had the lowest mean information-seeking episode duration at 26.34 seconds.

Computerized white boards were also utilized by nurses on four of the five units. Nurses could access this white board from their mobile documentation carts. Each of the units also had a large television monitor on the wall across from the main nursing desks. These electronic white boards denoted information such as patient names, discharges, transfers, attending physician, nurses caring for the patients, scheduled labs, isolation, and stages of discharge and transfer. Despite the availability of large amounts of information provided on these white board, nurses less frequently utilized them as a source of information, only 1.1%, as compared to other sources.

During observations, an unexpected computerized information artifact arose. Nurses frequently paged physicians through the hospital paging system. However, rather than simply paging the physician with a return telephone number, the page actually turned in to more of a texting episode. Nurses would write short notes to the physician informing them of a need. Many times, new orders notifications would then appear on the main screen several minutes later. For example, a nurse paged a doctor with the following message *"Patient XXX in Room XXX has c/o nausea"*. A short while later the nurse was alerted of a new medication order on the patient main screen for an anti-nausea medication. These episodes were frequent and were difficult for the researcher to capture with the current observational tool. However, they served as an information artifact in the communication patterns of the nurse and the physician and provided information for the nurse to support the provision of patient care.

Summary

The purpose of this descriptive mixed methods study was to explore the information-seeking behaviors of nurses during the course of patient care on medical-surgical units to inform the development of CDSS for medical-surgical acute care nurses. Five nursing units at a large teaching hospital were utilized to recruit 25 medical-surgical nursing participants for the study. An observational data collection tool was developed by the researcher and 100 hours of structured observations lead to the collection of data on 818 information-seeking episodes. Each episode was categorized based on the purpose/need-creating event, type of information, source of information, and mode/format of the delivery of the information. Semi-structured interviews and

descriptions of information artifacts provided qualitative data to further describe the information-seeking behaviors of nurses.

Summary of Quantitative Findings

Analysis of descriptive statistics for the full sample indicated that the most frequent need-creating events causing nurses to search for information were the patient treatment and provision of care, medication administration, and verification/clarification of new orders. Nurses most frequently sought information regarding current order, new orders, scheduled patient care, and assessment information. The most frequently utilized source of information was the EMR which was closely followed by the patient. When combined, electronic resources accounted for the source of information for nurses for 58.8% of the episodes. Nurses utilized computerized information formats the majority of the time at 60.8%. Nurses most frequently initiated information-seeking episodes during the morning hours from 0701-1100. Correlations between age, experience as a nurse, and experience on the unit had no significant correlations with the most frequent need-creating events and types of information sought. There was a significant positive correlation between the age of the nurse and the use of personal notes as a source. A significantly negative correlation was found between the use of computerized formats of information exchange and experience on the unit. The more experience nurses had on a unit, the less they accessed computerized formats of information. No other statistically significant correlations were found between the demographic variables and the nurse.

Statistical analysis (one-way ANOVAs) of the duration of the episode and the study variables provided information regarding the amount of time nurses spent when

searching for types of information for different purposes and from different sources and formats. Patient handoff of care and patient admission were the most time-consuming need-creating events for the instigation of an information-seeking episode. Nurses spent the most time gathering information concerning change of shift report, complete assessment, and patient medical history. Other nurses served as the source with the highest episode duration followed by personal notes, and written reference materials. The patient main screen served as the source with the source with the shortest mean episode duration time. Episodes utilizing written information formats had the longest mean duration in seconds while episodes utilizing computerized formats had the shortest.

Chi square analysis were performed to determine differences among units and episode start times for each of the variable categories. There were some differences among the purpose/need-creating event and types of information sought by nurses on different units. Source differences arose among the general medicine unit (unit two) and the other surgical units with unit two more frequently utilizing nurse leaders and physicians. There were not statistical differences among the unit and the mode/format of information. Nurses on all of the units most frequently utilized the computerized mode. When analyzing the purposes or need-creating event by start time of the episode, nurses most frequently sought information to support medication administration in the morning hours and patient handoff of care in the early hours of the shift and late in the shift. Throughout the day, nurses most frequently sought information regarding new orders and current orders. Other nurses were most frequently utilized as a source from 0600-0700 while personal notes had the highest frequency of use in the timeframe of 1901-2000. The patient EMR was frequently utilized in the morning and early afternoon hours while

the MAR was utilized frequently form 0801-1000 and 1401-1500. Computerized formats were the most frequently utilized format for all start time categories except face-to-face verbal formats from 0600-0700 and written notes 1902-2000.

Summary of Qualitative Findings

Qualitative data was obtained from nursing responses to the semi-structured interview questions and the description of information artifacts. Five interview themes arose from the participant responses: information availability, computerized and electronic sources and formats, routine and non-routine tasks, supporting the patient, and technology failure. Nurses reported that information was readily available and accessible. However, multiple participants reported problems with the overwhelming amounts of information and difficult navigation to find the information. Nurses reported the use of electronic and computerized formats for the retrieval of information. Additionally, they responded that these sources and formats best fit into their nursing workflow. Most nurses reported that they did not feel the need to search for information regarding routine tasks. In turn, nurses reported that it was difficult to find information regarding non-routine tasks. During the interviews, nurses indicated that supporting the patient was the most important reason they initiated an information search and that they continued to look for information. The failure of technology to work properly was a major problem when trying to access and obtain information. This failure was reported to lead to unmet information needs.

Both written and computerized information artifacts were analyzed in order to better describe the sources of information that nurses utilized in the clinical setting.

Personal notes served as the main written information artifact and were found to be highly individualized to the nursing participants. These artifacts were frequently utilized to serve as checklists and reminders of patient care. Nurses similarly use the patient main screen as a computerized source of reminders. This artifact provided quick access for nurses to updates regarding new orders, scheduled care and medications, and new laboratory results. An unexpected texting format of information exchange also arose and was utilized by nurses on all five of the units.

CHAPTER 5

DISCUSSION

Introduction

The purpose of this descriptive mixed methods study was to explore the information-seeking behaviors of nurses when delivering patient care across an entire shift. The setting for the study was five medical-surgical units in a large teaching hospital in the southeastern United States. A sample of 25 medical-surgical nurses were recruited for the study. Structured observations and post observation semi-structured interviews were utilized to describe the information-seeking behaviors of the nurses through quantitative and qualitative data. Each of the 25 nurses was observed individually for 4-hour observation sessions resulting in 100 hours of direct observations. The structured observations yielded 818 information-seeking episodes. Following each observation session, nurses participated individually in semi-structured interviews. A discussion of the quantitative and qualitative findings from the study with comparisons to findings in the literature, strengths of the study, limitations of the study, implications of the findings, and recommendations for future research are provided in this chapter.

In order to answer the proposed research questions, four quantitative study variables were defined and measured utilizing the observational data collection tool. The semi-structured interview questions were developed to provide additional data to describe the information-seeking behaviors of nurses in terms of unmet information needs, purpose/need-creating event, source and format preferences, perceptions of accessibility

and ease of use of sources, and personal experiences with information-seeking. Krikelas' Model of Information-Seeking Behaviors served as a guiding framework for the design of this study. The following sections will provide a discussion of the study findings and are presented and organized according the components of Krikelas' model.

Components of Krikelas' Model of Information-Seeking Behavior

Through his model, Krikelas' proposed that information-seeking begins once a person perceives uncertainty and recognizes that the current state of knowledge is not adequate to meet an information need (Krikelas, 1983; Sawant, 2015). For the purposes of this study, an information need was defined as a subjective experience occurring in the mind of the person and is a representation of a future goal that is desired. Once an information-seeker recognizes an immediate need, sources of information are utilized to generate or supply information to meet the perceived gap in knowledge (Krikelas, 1983). Findings from this study provided descriptions of the information-seeking behaviors of the nursing participants. The observed purposes of the information-seeking episodes described the need-creating event, while the categorization of the type of information accessed described the information need. Source preferences were described through both observational data and semi-structured interview responses. Observations of the format of information delivery from the source further described external information sources and interview responses provided insight into the use of internal sources of information to meet a perceived information need.

Purpose/Need-creating Event

For this study, the purpose/need-creating event was defined an event that causes uncertainty in the information seeker and leads to the perception that the current state of knowledge is not adequate to deal with an issue (Krikelas, 1983; Moss et al., 2007; Sawant, 2015). This event was the reason that the provider initiated the information task. Analysis of descriptive statistics for the full sample indicated that nurses most frequently search for information to support patient treatment and the provision of patient care followed by medication administration and order clarification and verification. These findings are similar to findings from previous studies regarding nursing information-seeking behaviors. In a seminal study by Corcoran-Perry and Graves (1990), nurses most frequently sought information to support the provision of direct patient care. Studies in subsequent years also found that provision of nursing care to the patient accounts for the most frequent reason nurses seek information (Blythe & Royle, 1993; Currie et al., 2003; Kelley et al., 2013; McKnight, 2006; Moss & Elias, 2010). Therefore, the frequency findings regarding the purpose/need-creating event from this study are congruent with findings from earlier studies.

During the semi-structured interviews, participants responded that the reason they searched for information was to support the patient and to provide better nursing care of the patient. This self-report data obtained from the interview responses was supported by the observed frequency of patient treatment and provision of care as a need-creating event for an information-seeking episode. This sense of responsibility to the patient that arose as a theme during patient interviews is congruent with findings in previous studies (Blythe & Royle, 1993; McKnight, 2006).

Type of Information Accessed to Meet the Information Need

For the purposes of this study, information types were defined as the type of data accessed to reduce uncertainty (Krikelas, 1983; Wilson, 1999). During observations, nurses most frequently sought information regarding current and new orders closely followed by the schedule of patient care. Nurses also frequently sought assessment data in the form of complete, focused, vital sign, and pain assessment. Earlier studies have found that patient specific data and information regarding the plan of patient care were some of the most frequently accessed types of information by nurses (Corcoran-Perry & Graves, 1990; Lange, 1992; Reddy et al., 2002). However, in contrast to findings from previous studies, nursing participants in this study less frequently sought information regarding medications with only 3.1% of the information-seeking episodes focusing on medication information (n = 25). Corcoran-Perry and Graves (1990) and Lange (1992) found that nurses searched more frequently for medication information than current/new orders. In a study by Reddy et al. (2002), intensive care nurses were found to search for medication information 12.9% of the time. Of note, many of the participants in this study indicated that they often did not feel the need to search for information regarding medications that they frequently or routinely administered.

Sources Preferences of Information

As outlined by Krikelas (1983), having a potential source of information that is accessible and available to the information-seeker is a fundamental requirement of an information-seeking episode. For this study, an information source was defined as suppliers or generators of information that are accessed in order to meet a perceived gap

in knowledge or a perceived information need (Krikelas, 1983). Internal sources are generated by the information-seeker and include personal stored experiences and knowledge or direct personal observations. External sources are categorized as interpersonal interactions or recorded literature/information (Krikelas, 1983).

The most frequently utilized external sources by participants in this study were the patient EMR and the patient. Overall, nurses utilized an electronic source of information 58.8% of the time. The patient was the main non-electronic source of information (17.8%). Nursing peers in the forms of other nurses, clinical nurse educators/leaders/charge/manager, and specialty nurses served as a source of information during this study for only 7.1% of the information-seeking episodes. When asked how they accessed and obtained information during the course of patient care every nursing participant cited electronic sources as the main source of information during patient care.

The findings from this study illustrate a stark contrast to findings from previous studies in the area of nursing information needs. Multiple earlier studies have cited interpersonal interactions with other nurses and colleagues as the most significant and frequently utilized external source of information (Estabrooks et al., 2005; Marshall et al., 2011; O'Leary & Mhaolrúnaigh, 2012; Spenceley, O'Leary, Chizawsky, Ross, & Estabrooks, 2008a; Thompson et al., 2004). However, a recent study by Kelley et al. (2013) found that nurses also place heavy emphasis on verbal interactions with patients and significantly use other sources such as the electronic medical record and personal paper-based report sheets. Nursing participants in this study sought information from the patient 17.8% of the time. Though personal notes were utilized less frequently in this study, during observations it was also noted by the researcher that all of the nursing

participants developed some type of personal notes to support the care of the patient. These highly individualized written or printed notes were commonly utilized as a source of reminders throughout the day and a reference source when giving hand-off of care report to others.

Nursing participants in this study indicated in interview responses that they did not search for information from external sources regarding events or tasks that were perceived as routine in nature. Nurses reported that they often relied on memory and previous experiences as internal sources of information to support information needs in response to a routine task. The participants also felt that information regarding non-routine tasks was difficult to obtain from external sources and often led to unmet information needs. As defined, by Newman et al. (2014) nurses can define routine tasks as those tasks that are familiar and perceived as simple where non-routine tasks may be considered complex. This concept of routine tasks failing to serve as a trigger for an information-seeking episode is supported by early research in the area of information needs. As demonstrated in this study and in earlier studies, nurses often do not recognize the need for more information and do not seek information for perceived routine tasks (Newman et al., 2014; Newman & Doran, 2012; Ward et al., 2011).

Overconfidence in Internal Sources of Information

Overconfidence in personal clinical knowledge has been cited in the literature as a contributing factor to errors in diagnostic reasoning and clinical decision making and can have detrimental consequences impacting patient outcomes (Berner & Graber, 2008; Croskerry & Norman, 2008; Kissinger, 1998). As outlined by Kissinger (1998),

overconfidence in clinical practice can be correlated with unwarranted certainty and has a defining attribute of the failure to consider alternative perspectives when making clinical decisions. Several reasons for overconfidence have been cited in the literature including failing to consider alternative perspectives, failing to distinguish inferences from assertions, and favoring positive over negative information (Dunning, Griffin, Milojkovic, & Ross, 1990; Kissinger, 1998). Cognitive bias and the inability to be able to "know what you don't know" can lead to overconfidence in clinical practice (Berner & Graber, 2008; Croskerry & Norman, 2008). As reported by Berner and Graber (2008), lack of knowledge is seldom the reason for not knowing how to respond in a clinical situation. Cognitive errors that occur due to overconfidence are more commonly due to failure to elicit accurate information, failure to recognize significant data, or failure to synthesize all of the data correctly (Berner & Graber, 2008).

Integrating External Sources of Information into Workflow to Support Information Delivery

Overconfidence can lead to intuitive decision making relying on personal experiences and memory (Arkes, 1981). As supported by the CCT, clinicians who utilize intuition for decision making typically have a low confidence in method but a high confidence in outcome (Hammond, 1996). Using this intuitive approach to decision making the decision maker typically has low cognitive consistency (Dunwoody et al., 2000; Hammond, 1996). Analytical decision making is defined as the decision maker having a high level of cognitive control and a high confidence in the decision making method. This type of decision making is deductive, slow, rational, based in rules, and low in emotional investment (Cader et al., 2005; Croskerry & Norman, 2008). As outlined by

Hammond (1981), the decision making process is highly contingent on the properties of the task which can range from ill-structured to well-structured. Ill-structured tasks lead to more intuitive decision making and well-structured tasks lead to more analytical decision making processes. Therefore, there is a need in healthcare to promote well-structured tasks that elicit the use of analytical decision making by the clinician to promote consistent decision making methods and high quality clinical decisions.

A systems approach to changing the healthcare environment can be a potential solution to the problem of overconfidence and the use of intuitive decision making by clinicians. This type of approach assumes that the clinician has adequate cognition to make clinical decisions but needs more accurate and accessible patient specific information to support diagnostic accuracy (Berner & Graber, 2008). Through improving the structure of the task and by providing the right information to the clinician during the decision making process, there is the potential for the clinician to use a higher analytical mode for clinical decision making (Standing, 2008). The delivery of information through well-developed computerized CDSS can deliver information to the nurse and simplify and structure the information gathering tasks of nurses (Dowding, Mitchell, et al., 2009; Thompson et al., 2004).

Pushing Information Sources to Nursing During Workflow

Overconfidence in personal knowledge, in addition to failure to recognize a lack of information and the need for additional information, supports the necessity for decision support information sources that automatically push needed information to the nurse at the point of care. Clinical decision support systems can be defined as any

electronic system designed to aid directly in decision making by providing pertinent patient specific information at the appropriate time during patient care (Bright et al., 2012; Kawamoto, Houlihan, Balas, & Lobach, 2005). Information can be delivered through tools such as alerts, reminders, risk assessment tools, infobuttons, order sets, drug-dose calculations, and algorithms to augment clinical decision making (Berner, 2009; Bright et al., 2012; Karsh, 2009).

As reported in the literature, nurses value the importance of research knowledge and accurate patient information delivery during patient care (Thompson et al., 2013; Thompson et al., 2001). The effectiveness and utilization of electronic CDSS depends on the implementation context and usability in a complex workflow (Yuan et al., 2013). Studies have frequently cited failure of the systems to integrate into workflow, lack of time, and lack of navigational skills as barriers to utilizing electronic sources of information (Dee & Stanley, 2005b; Hunt et al., 2013; Koch et al., 2012; McKnight, 2006). The findings from this study indicate that nurses feel that information is available, they just have difficulty knowing how to access the information at the right time during normal workflow. Participants reported that large amounts of information and multiple information sources were readily available and accessible during patient care. However, nurses participating in this study cited difficulty with navigating systems, difficulty searching for information about non-routine tasks, overwhelming amounts of information, and technology failures as the major barriers with accessing and finding information. Despite the reported availability, participants were often unsure of where or how to search for the information. Difficult navigation with systems has been reported throughout the literature as a barrier to the utilization of electronic sources to support

nursing care (Dowding, Mitchell, et al., 2009; McKnight, 2006; Yuan et al., 2013). Even in studies with findings supporting a positive nursing response to electronic sources of information, there was still a desire for more specificity in terms of nursing workflow and navigation skills (Choi et al., 2011; Kossman & Scheidenhelm, 2008).

During the interviews, nursing participants frequently responded that there were multiple resources available to support patient care and nursing practice. Nurses specifically discussed references such as the computerized medication resources and computerized information resources as available supplemental information sources to support nursing care. However, frequent utilization of these sources was not observed during observation sessions. Computerized medication resources, which could be accessed through the patient MAR, were only utilized as an information source for 15 (1.8%) information-seeking episodes and computerized information resources for 5 (0.6%) information-seeking episodes. These findings are similar to findings from a study by Marshall et al. (2011) in which participants reported accessible and useful evidence-based tools which were not utilized during practice.

A solution to this problem of underutilization of available resources may be the implementation of active CDSS that are triggered automatically. These systems present tailored, context specific information without the nurse having to recognize an event to stimulate an information-seeking episode (O'Sullivan, Fraccaro, Carson, & Weller, 2014). The literature supports the implementation of tailored information in decision support formats to meet nursing information needs and to support the provision of care. As reported by Choi et al. (2011), nurses desire CDSS that provide reminders of care, risk assessments, and notification of changes in patient status. CDSS algorithms that are

activated based on specific patient parameters have also been successfully implemented into clinical practice and have improved the treatment of patients with alterations in glucose and potassium (Harrison, Stalker, Henderson, & Lyerla, 2013; Hoekstra et al., 2010). In addition, success has been shown with CDSS reminders that are automatically triggered to provide recommended care guidelines specific to the patient population (Lyerla et al., 2010). CDSS that automatically pushes information based on a triggering event can provide context specific tailored information to nurses at the point of care (Randell et al., 2009).

Similar to the reported literature, participants in this study frequently and efficiently utilized reminders of care and built in risk assessment tools. The patient main screen was accessed as an information source for 17% of the information-seeking episodes with a mean episode duration of 26.34 seconds. This screen served as an electronic resource that provided icons to alert nurses of upcoming scheduled medications and tasks and new orders of lab results. Nurses observed on the units frequently and rapidly utilized this information source. Risk assessment tools that provided early warning for sepsis risk based on the patient's vital signs were also a frequently accessed information type (5.1%).

Mode/Format of Information Delivery from Information Sources

For this study, the mode/format of information was defined as the means or the method by which the provider obtains information (Moss et al., 2007). Nurses in this study overwhelmingly utilized computerized formats for 60.8% of information-seeking episodes. Face-to-face formats was second at 30.7%. Early work by Corcoran-Perry and

Graves (1990) conducted prior to the integration of electronic medical records into practice reported that nurses utilized verbal and written sources of information for 90% of information-seeking episodes. More recent studies have continued to cite the use of interpersonal verbal interactions as the most commonly identified and preferred information sources (Marshall et al., 2011; Newman & Doran, 2012; Secco et al., 2006; Wahoush & Banfield, 2014). The findings from the observational data from this study indicate that in the present clinical practice environment nurses utilize computerized formats of information much more frequently than other modes/formats of clinical information. Interview responses also supported the frequent use of computerized formats for information retrieval. In contrast to findings reported in the literature, the majority of participants stated that computerized formats best fit into their workflow. Previous studies have reported interpersonal verbal interactions as the most convenient and accessible source of information (Marshall et al., 2011; Newman & Doran, 2012; Secco et al., 2006; Wahoush & Banfield, 2014). The literature has supported the fact that nurses typically utilize sources based on accessibility and ease of use (Doran et al., 2007; Estabrooks et al., 2005; McCaughan et al., 2005). Nurses in this study reported through interview responses that information in clinical practice was accessible and convenient

Duration of Information Episodes

There were significant differences in the amount of time that nurses spent searching for information. Nurses spent the longest mean time in seconds searching for information to support patient handoff of care or transfer and patient admission. They spent the shortest amount of time quantifying risk for adverse events through electronic

risk assessment tools. In terms of the types of information, nurses spent the longest amount of time gathering information regarding change of shift report, complete assessment, and patient medical history. Written reference materials and personal notes were the sources with the longest duration while the patient main screen, which provided electronic care updates through icons, was the shortest mean duration. Computerized formats had the shortest mean duration and written formats had the longest duration. As reported in earlier studies, nurses typically utilize sources of information based on perceived accessibility and perceived efficiency (Doran et al., 2007; Marshall et al., 2011; McCaughan et al., 2005). In the past studies have found that conversing with colleagues allowed for the efficient use of time while gathering information during patient care (Marshall et al., 2011; Thompson et al., 2001). The findings from this study support that electronic sources and computerized formats provide information to nurses with a more efficient use of time during patient care. Types of information and sources of information that utilized written or face to face verbal formats were the most time-consuming information-seeking episodes. Therefore, integrating information through electronic sources and computerized formats can provide nurses with time efficient methods to search for and gather information.

Initiation Times of Information-Seeking Episodes

In the past, few studies have focused on the times of the shift that nurses most frequently search for information and the types of information most frequently accessed based on times. This study analyzed the frequency of information-seeking episodes based on episode initiation start times and the frequency of the purpose/need-creating event,

type of information, source of information, and mode/format of information based on the episode start time. Nurses most frequently initiated information-seeking episodes in the morning hours from 0700-1000. The number of information-seeking episodes declined during 1001-1200 period and then remained stable throughout the afternoon. There was a minimal increase at 1601-1700 with the following frequencies remaining stable through the end of the shift.

As reported by Moss and Elias (2010), nursing patterns of information use are based on the information needs for the type of clinical care they are providing. Nurses participating in this study frequently sought information to support medication administration during the times of 0801-1000 and patient treatment and provision of care 1101-1400. Nurses most frequently clarified new orders during 1001-1100 and again 1401-1500. Information regarding current orders was most frequently sought at the beginning of the shift 0701-0800 and then again at 1501-1600. New order information was frequently sought throughout the day with the highest frequencies 1001-1100 and 1201-1300. Based on these findings, electronic sources can be developed to push types of information to nurses at certain times throughout the day. As reported by Randell et al. (2009) nurses are more likely to utilize information sent to them at the point of decision making through tools such as info-buttons that contain context specific evidence. As supported by the literature, nurses desire information support systems that have built in reminders, assessment tools, and evidence-based information links that are delivered at the appropriate time and in a format that is easily integrated into clinical workflow (Alvey et al., 2012; Bakken et al., 2008; Choi et al., 2011; Fick et al., 2011). The findings from this study provide the times of day that medical-surgical nurses are most frequently

searching for different types of information based on the types of information and need-creating events. Based on these findings, information such as pertinent lab values, vital signs, or medication information to support medication administration could be pushed to the nurses during the times of 0801-1000. Lists of current orders for review could be provided at the beginning of the shift from 0701-0800 and again during 1401-1500. During the hours that nurses most frequently clarified new orders, push alerts could be sent to mobile devices.

Electronic sources and computerized formats were the most frequently utilized sources of information throughout the shift except for the hours of 0600-0700 and 1901-2000 which corresponded to change of shift handoff report. During early morning handoff report, nurses most often utilized other nurses as sources and the format of verbal interactions, while written personal notes were the most frequently utilized source and format 1901-2000. Therefore, observations from the study support the use of electronic sources and computerized formats to deliver information throughout the shift to nurses at times other than shift handoff report.

Strengths of the Study

The primary strength of this study was the utilization of observational study methods to describe the information-seeking behaviors of nurses in a technology rich practice environment. The researcher was immersed in the clinical practice of medical-surgical nurses on the floor by conducting approximately 130 hours of direct clinical observations. In addition, the mixed method study design served as a strength of the study. The use of observations was a reliable method to describe the quantitative

variables of the study while the qualitative data from interviews and information artifacts allowed for individual participants to describe non-observable items such as unmet needs and source/format preferences. The mobile observational data collection tool allowed for the rapid documentation of the episodes in a computerized format. The programmed timer in the tool led to accurate measurement of the duration of the episode.

Limitations of the Study

Despite the methodological strengths of the study, there were several limitations. This study was conducted during the month when new medical residents at the hospital were rotating into the clinical care areas. Therefore, new residents just completing medical school and residents rotating to specialized surgical residency programs were new to the units. This could have impacted the patterns of communication between the nurses and the physicians providing medical care. Another limitation of the study involved the data collection tool. This tool only allowed for the collection of categorical data and episode duration time for one information-seeking episode at a time. Therefore, it was difficult to capture episodes that were occurring simultaneously. Durations of episodes that took longer periods of time, such as episodes where physicians were paged and nurses had to wait for a return call, were difficult to capture. During the episode of longer duration, nurses were often initiating multiple additional episodes of a much shorter duration. A more complex observational data collection tool with multiple timers might prove beneficial in subsequent studies.

Implications of Findings

Findings from this study in the areas of the information needs of nurses and the types of information accessed by nurses are consistent with findings in the literature. However, substantial differences between this study and previous literature were found in the observed and reported sources and formats of information utilized by nurses during clinical practice. This research study provides findings that support a considerable shift in the preferred and observed formats and sources of information utilized by nurses in clinical environments with fully integrated electronic medical records. Previous studies have extensively cited the use of interpersonal interactions with other nurses and colleagues as the most frequently utilized sources of information and the most preferred sources of information. Observational data from this study revealed that participants utilized computerized formats for 60.8% of the information-seeking episodes observed and electronic sources for 58.8% of the information-seeking episodes. During the semi-structured interviews, nurses reported more frequently utilizing computerized formats of information and electronic sources during practice than other formats and sources. In addition, the participants also felt that computerized format best fit into their normal daily workflow. Findings from this study support that nurses actually utilize computerized formats of information exchange and that electronic sources are considered accessible and fit well into nursing workflow.

The findings from this study also provide information regarding the times of day that medical-surgical nurses most frequently search for certain types of information which can inform the development of usable and needed clinical decision support. By understanding the information needs of nurses as they arise in response to clinical

workflow, CDSS that meet the information needs of nurses can be integrated into workflow at the correct time. As demonstrated through the interview responses, nurses typically do not search for information that is considered routine. Technology that pushes information, even regarding perceived routine care, at the correct time to the nurse can improve the utilization of information at the point of care. This study was unique in its study methodology, participant population, and the recording of the initiation times of information-seeking episodes. Through observing medical-surgical nurses in clinical practice, the study generated findings that nurses need and search for medication information from 0801-1000 and current orders from 0701-0800 and 1501-1600. Information regarding new orders is frequently sought throughout the day with the highest frequencies at 1001-1100 and 1201-1300. Frequencies throughout the day support the use of computerized formats to gather information. By understanding the times nurses search for different types of information, better electronic information delivery through clinical decision support systems can be integrated into clinical practice.

Recommendations for Future Research

Following the conduction of this research study, there were several recommendations for future research in the areas of nursing information need and information-seeking behaviors. Future research needs to generate data to better define the triggering tasks for information-seeking episodes. This study provided an updated and current explanation of the need-creating events, information types, sources of information, and modes/formats of information-seeking episodes. However, further research is needed to delineate and define the reasons nurses decide to initiate a search

for information. A better understanding is needed of the perception of routine tasks that do not stimulate nurses to initiate information-seeking episodes and the overconfidence experienced by nurses when making clinical decisions.

Future observational studies with multiple timers on the data collection tool could allow for the collection of data for concurrent information-seeking episodes. Observations revealed that nurses are frequently and often concurrently seeking information during the course of clinical care. Modifications to the observational tool could capture these concurrent episodes. During interviews, nursing participants in this study reported the availability of multiple electronic resources that were not actually utilized during observations. Future research is needed to determine why nurses are not actually accessing resources with perceived availability and accessibility during patient care. Lastly, the setting for this study was a technology rich practice environment at a large academic teaching hospital with a fully integrated electronic medical record and individual mobilized documentation carts available for each participant. Future studies could compare and contrast the differences in the information-seeking behaviors in clinical settings with less access to electronic sources and individualized technology.

Conclusion

The purpose of this descriptive mixed methods study was to explore the information-seeking behaviors of nurses when delivering patient care on medical-surgical units to inform the delivery of CDSS for medical-surgical acute care nurses. An observational data collection tool was utilized to categorize the purpose/need-creating event, type of information, source of information, and mode/format of information,

duration, and start time for 818 information-seeking episodes initiated by twenty-five nurses on five medical-surgical units. Similar to findings in the literature, nursing participants were found to initiate episodes most often to support the provision of patient care and information regarding current or new orders and schedules of patient care. In contrast to the existing literature, nurses in this study most often accessed electronic sources and utilized information in a computerized format. In addition, qualitative data derived from interview responses further supported the use of computerized information exchange in clinical practice. The nursing participants cited computerized formats of information as the format that best fit into nursing practice and workflow. Frequencies of information types were analyzed based on episode initiation start times and can inform the delivery of the right type of information at the right time into clinical workflow. Findings from this study can support the development of electronic sources of information and CDSS that can be integrated into the workflow of nurses practicing on an acute care medical-surgical floor.

LIST OF REFERENCES

Allen, M., Currie, L. M., Graham, M., Bakken, S., Patel, V. L., & Cimino, J. J. (2003). The classification of clinicians' information needs while using a clinical information system. *American Medical Informatics Association Annual Symposium Proceedings*, 2003, 26-30.

Alvey, B., Hennen, N., & Heard, H. (2012). Improving accuracy of pressure ulcer staging and documentation using a computerized clinical decision support system. *Journal of Wound, Ostomy, and Continence Nursing, 39*(6), 607-612. doi:10.1097/WON.0b013e31826a4b5c

Anton, B., Woodson, S. M., Twose, C., & Roderer, N. K. (2014). The persistence of clinical questions across shifts on an intensive care unit: an observational pilot study. *Journal of the Medical Library Association, 102*(3), 201-205. doi:10.3163/1536-5050.102.3.011

Arkes, H. R. (1981). Impediments to accurate clinical judgment and possible ways to minimize their impact. *Journal of Consulting and Clinical Psychology, 49*(3), 323-330.

Bakken, S., Currie, L. M., Lee, N. J., Roberts, W. D., Collins, S. A., & Cimino, J. J. (2008). Integrating evidence into clinical information systems for nursing decision support. *International Journal of Medical Informatics, 77*(6), 413-420. doi:10.1016/j.ijmedinf.2007.08.006

Banning, M. (2008). A review of clinical decision making: models and current research. *Journal of Clinical Nursing, 17*(2), 187-195.

Berner, E. S. (2009). *Clinical Decision Support Systems: State of the Art*. Rockville, MD:: Agency for Healthcare Research and Quality.

Berner, E. S., & Graber, M. L. (2008). Overconfidence as a cause of diagnostic error in medicine. *American Journal of Medicine, 121*(5 Suppl), S2-23. doi:10.1016/j.amjmed.2008.01.001

Beuscart-Zéphir, M. C., Brender, J., Beuscart, R., & Ménager-Depriester, I. (1997). Cognitive evaluation: How to assess the usability of information technology in healthcare. *Computer Methods and Programs in Biomedicine, 54*(1), 19-28. doi:http://dx.doi.org/10.1016/S0169-2607(97)00030-8

Bjork, I. T., & Hamilton, G. A. (2011). Clinical decision making of nurses working in hospital settings. *Nursing Research and Practice, 2011*, 524918. doi:10.1155/2011/524918

Blythe, J., & Royle, J. A. (1993). Assessing nurses' information needs in the work environment. *Bulletin of the Medical Library Association, 81*(4), 433-435.

Bright, T. J., Wong, A., Dhurjati, R., Bristow, E., Bastian, L., Coeytaux, R. R., . . . Lobach, D. (2012). Effect of clinical decision-support systems: a systematic review. *Annals of Internal Medicine, 157*(1), 29-43. doi:10.7326/0003-4819-157-1-201207030-00450

Broyles, L. M., Rodriguez, K. L., Price, P. A., Bayliss, N. K., & Sevick, M. A. (2011). Overcoming Barriers to the Recruitment of Nurses as Participants in Health Care Research. *Qualitative Health Research, 21*(12), 1705-1718. doi:10.1177/1049732311417727

Bucknall, T. K. (2000). Critical care nurses' decision-making activities in the natural clinical setting. *Journal of Clinical Nursing, 9*(1), 25-35.

Burnkrant, R. E. (1976). A motivational model of information-processing intensity. *Journal of Consumer Research, 3*, 21-30.

Cader, R., Campbell, S., & Watson, D. (2005). Cognitive Continuum Theory in nursing decision-making. *Journal of Advanced Nursing, 49*(4), 397-405. doi:10.1111/j.1365-2648.2004.03303.x

Campion, T. R., Jr., Waitman, L. R., Lorenzi, N. M., May, A. K., & Gadd, C. S. (2011). Barriers and facilitators to the use of computer-based intensive insulin therapy. *International Journal of Medical Informatics, 80*(12), 863-871. doi:10.1016/j.ijmedinf.2011.10.003

Cheragi, M. A., Manoocheri, H., Mohammadnejad, E., & Ehsani, S. R. (2013). Types and causes of medication errors from nurse's viewpoint. *Iran Journal of Nursing and Midwifery Research, 18*(3), 228-231.

Choi, M., Choi, R., Bae, Y. R., & Lee, S. M. (2011). Clinical decision support systems for patient safety: a focus group needs assessment with Korean ICU nurses. *CIN: Computers, Informatics, Nursing, 29*(11), 671-678. doi:10.1097/NCN.0b013e3182148c18

Collins, S., Bakken, S., Cimino, J. J., & Currie, L. (2007). A methodology for meeting context-specific information needs related to nursing orders. *American Medical Informatics Association Annual Symposium Proceedings*, 2007 , 155-159.

Collins, S., Bakken, S., Cimino, J. J., & Currie, L. M. (2008). Identifying logical clinical context clusters in nursing orders for the purpose of information retrieval. *AMIA Annual Symposium Proceedings*, 131-135.

Corcoran-Perry, S., & Graves, J. (1990). Supplemental-information-seeking behavior of cardiovascular nurses. *Research in Nursing & Health, 13*(2), 119-127.

Covell, D. G., Uman, G. C., & Manning, P. R. (1985). Information needs in office practice: are they being met? *Annals of Internal Med, 103*(4), 596-599.

Creswell, J. W. (2013). *Qualitative inquiry reserach and design: Choosing among five sources* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Croskerry, P., & Norman, G. (2008). Overconfidence in clinical decision making. *American Journal of Medicine, 121*(5 Suppl), S24-29. doi:10.1016/j.amjmed.2008.02.001

Currie, L. M., Graham, M., Allen, M., Bakken, S., Patel, V., & Cimino, J. J. (2003). Clinical information needs in context: an observational study of clinicians while using a clinical information system. *American Medical Informatics Association Annual Symposium Proceedings*, 190-194.

Custers, E. J. (2013). Medical education and cognitive continuum theory: an alternative perspective on medical problem solving and clinical reasoning. *Academic Medicine, 88*(8), 1074-1080. doi:10.1097/ACM.0b013e31829a3b10

Dee, C., & Stanley, E. E. (2005a). Information-seeking behavior of nursing students and clinical nurses: implications for health sciences librarians. *Journal of the Medical Library Association, 93*(2), 213-221.

Dee, C. R., & Stanley, E. E. (2005b). Nurses' information needs: nurses' and hospital librarians' perspective. *Journal of Hospital Librarianship, 5*(2), 1-13.

Doran, D. M., Mylopoulos, J., Kushniruk, A., Nagle, L., Laurie-Shaw, B., Sidani, S., . . . McArthur, G. (2007). Evidence in the palm of your hand: development of an outcomes-focused knowledge translation intervention. *Worldviews on Evidence-Based Nursing, 4*(2), 69-77. doi:10.1111/j.1741-6787.2007.00084.x

Dowding, D., Mitchell, N., Randell, R., Foster, R., Lattimer, V., & Thompson, C. (2009). Nurses' use of computerised clinical decision support systems: a case site analysis. *Journal of Clinical Nursing, 18*(8), 1159-1167. doi:10.1111/j.1365-2702.2008.02607.x

Dowding, D., Spilsbury, K., Thompson, C., Brownlow, R., & Pattenden, J. (2009). The decision making of heart failure specialist nurses in clinical practice. *Journal of Clinical Nursing, 18*(9), 1313-1324. doi:10.1111/j.1365-2702.2008.02700.x

Dunning, D., Griffin, D. W., Milojkovic, J. D., & Ross, L. (1990). The overconfidence effect in social prediction. *Journal of Personality and Social Psychology, 58*(4), 568-581.

Dunwoody, D., Spilsbury, K., Thompson, C., Brownlow, R., & Pattenden, J. (2000). Cognitive adaptation and its consequences: A test of the cognitive continuum theory. *Journal of Behavioral Decision Making, 13*, 35-54.

Ebright, P. R., Patterson, E. S., Chalko, B. A., & Render, M. L. (2003). Understanding the complexity of registered nurse work in acute care settings. *Journal of Nursing Administration, 33*(12), 630-638.

Ellis, N. (2017). Decision making in practice: influences, management and reflection. *British Journal of Nursing, 26*(2), 109-112.

Emanuel, E. J., Crouch, R. A., Arras, J. D., Moreno, J. D., & Grady, C. (2003). *Ethical and regulatory aspects of clinical research: Readings and commentary*. Baltimore, MD: The Johns Hopkins University Press.

Embi, P. J., Weir, C., Efthimiadis, E. N., Thielke, S. M., Hedeen, A. N., & Hammond, K. W. (2013). Computerized provider documentation: findings and implications of a multisite study of clinicians and administrators. *Journal of the American Medical Informatics Association, 20*(4), 718-726. doi:10.1136/amiajnl-2012-000946

Estabrooks, C. A., Rutakumwa, W., O'Leary, K. A., Profetto-McGrath, J., Milner, M., Levers, M. J., & Scott-Findlay, S. (2005). Sources of practice knowledge among nurses. *Qualitative Health Research, 15*(4), 460-476.

Farokhzadian, J., Khajouei, R., & Ahmadian, L. (2015). Information seeking and retrieval skills of nurses: Nurses readiness for evidence based practice in hospitals of a medical university in Iran. *International Journal of Medical Informatics, 84*(8), 570-577. doi:10.1016/j.ijmedinf.2015.03.008

Fick, D. M., Steis, M. R., Mion, L. C., & Walls, J. L. (2011). Computerized decision support for delirium superimposed on dementia in older adults. *Journal of Gerontological Nursing, 37*(4), 39-47. doi:10.3928/00989134-20100930-01

Fisher, J. A. (2013). Expanding the frame of "voluntariness" in informed consent: structural coercion and the power of social and economic context. *Kennedy Institute of Ethics Journal, 23*(4), 355-379.

Forsythe, D. E., Buchanan, B. G., Osheroff, J. A., & Miller, R. A. (1992). Expanding the concept of medical information: An observational study of physicians' information needs. *Computers and Biomedical Research, 25*(2), 181-200. doi:http://dx.doi.org/10.1016/0010-4809(92)90020-B

Fossum, M., Ehnfors, M., Svensson, E., Hansen, L. M., & Ehrenberg, A. (2013). Effects of a computerized decision support system on care planning for pressure ulcers and malnutrition in nursing homes: an intervention study. *International Journal of Medical Informatics, 82*(10), 911-921. doi:10.1016/j.ijmedinf.2013.05.009

Galanter, W., Liu, X. F., & Lambert, B. L. (2010). Analysis of computer alerts suggesting oral medication use during computerized order entry of i.v. medications. *American Journal of Health-System Pharmacy, 67*(13), 1101-1105. doi:10.2146/ajhp090357

Griffiths, P. (2006). Being a research participant: the nurse's ethical and legal rights. *British Journal of Nursing, 15*(7), 386-390.

Hamm, R. M. (1988). Clinical intuition and clinical analysis expertise and the cognitive continuum. In J. Dowie & A. Elstein (Eds.), *Professional judgement: A reader in clinical decision making* (pp. pp. 78-104). Cambridge, United Kingdom: Cambridge University Press.

Hammond, K. R. (1981). *Principles of organization in intuitive and analytical cognition* (231). Retrieved from Boulder, CO:

Hammond, K. R. (1996). *Human judgment and social policy: Irreducible uncertainty, inevitable error, unavoidable justice.* New Yor, NY: University Press.

Harbison, J. (2001). Clinical decision making in nursing: theoretical perspectives and their relevance to practice...Thompson C. (1999) A conceptual treadmill: the need for middle ground in clinical decision making theory. *Journal of Advanced Nursing, 35*(1), 126-133. doi:10.1046/j.1365-2648.2001.01816.x

Härkänen, M., Ahonen, J., Kervinen, M., Turunen, H., & Vehviläinen-Julkunen, K. (2015). The factors associated with medication errors in adult medical and surgical inpatients: a direct observation approach with medication record reviews. *Scandinavian Journal of Caring Sciences, 29*(2), 297-306. doi:10.1111/scs.12163

Harrison, R. L., Stalker, S. L., Henderson, R., & Lyerla, F. (2013). Use of a clinical decision support system to improve hypoglycemia management. *Medsurg Nursing, 22*(4), 250-254, 263.

Hendrich, A., Chow, M. P., Skierczynski, B. A., & Lu, Z. (2008). A 36-hospital time and motion study: how do medical-surgical nurses spend their time? *The Permanente Journal, 12*(3), 25-34.

Hoekstra, M., Vogelzang, M., Drost, J. T., Janse, M., Loef, B. G., van der Horst, I. C., . . . Nijsten, M. W. (2010). Implementation and evaluation of a nurse-centered computerized potassium regulation protocol in the intensive care unit--a before and after analysis. *BMC Medical Informatics and Decision Making, 10*, 5. doi:10.1186/1472-6947-10-5

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277-1288. doi:10.1177/1049732305276687

Hunt, S., Cimino, J. J., & Koziol, D. E. (2013). A comparison of clinicians' access to online knowledge resources using two types of information retrieval applications

in an academic hospital setting. *Journal of the Medical Library Association, 101*(1), 26-31. doi:10.3163/1536-5050.101.1.005

Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century.* . Washington, D.C.: The National Academies Press.

James, J. T. (2013). A new, evidence-based estimate of patient harms associated with hospital care. *Journal of Patient Safety, 9*(3), 122-128. doi:10.1097/PTS.0b013e3182948a69

Jaspers, M. W., Smeulers, M., Vermeulen, H., & Peute, L. W. (2011). Effects of clinical decision-support systems on practitioner performance and patient outcomes: a synthesis of high-quality systematic review findings. *Journal of the American Medical Informatics Association, 18*(3), 327-334. doi:10.1136/amiajnl-2011-000094

Johansen, M. L., & O'Brien, J. L. (2016). Decision Making in Nursing Practice: A Concept Analysis. *Nursing Forum, 51*(1), 40-48. doi:10.1111/nuf.12119

Karsh, B. T. (2009). *Clinical practice improvement and redesign: How change in workflow can be supported by clinical decision support.* (AHRQ Publication No. 09.0054-EF). Retrieved from http://healthit.ahrq.gov/sites/default/files/docs/page/09-0054-EF-Updated_0.pdf.

Kautz, D. D., Kuiper, R., Pesut, D. J., Knight-Brown, P., & Daneker, D. (2005). Promoting clinical reasoning in undergraduate nursing students: application and evaluation of the Outcome Present State Test (OPT) model of clinical reasoning. *International Journal of Nursing Education Scholarship, 2*(1), 21p-21p.

Kawamoto, K., Houlihan, C. A., Balas, E. A., & Lobach, D. F. (2005). Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. *BMJ, 330*(7494), 765. doi:10.1136/bmj.38398.500764.8F

Keenan, G., Yakel, E., Dunn Lopez, K., Tschannen, D., & Ford, Y. B. (2013). Challenges to nurses' efforts of retrieving, documenting, and communicating patient care information. *Journal of the American Medical Informatics Association, 20*(2), 245-251. doi:10.1136/amiajnl-2012-000894

Keers, R. N., Williams, S. D., Cooke, J., & Ashcroft, D. M. (2013a). Causes of medication administration errors in hospitals: a systematic review of quantitative and qualitative evidence. *Drug Safety, 36*(11), 1045-1067. doi:10.1007/s40264-013-0090-2

Keers, R. N., Williams, S. D., Cooke, J., & Ashcroft, D. M. (2013b). Prevalence and nature of medication administration errors in health care settings: a systematic review of direct observational evidence. *Annals of Pharmacotherapy, 47*(2), 237-256. doi:10.1345/aph.1R147

Kelley, T., Docherty, S., & Brandon, D. (2013). Information needed to support knowing the patient. *ANS Advances in Nursing Science, 36*(4), 351-363. doi:10.1097/ANS.0000000000000006

Kelley, T. F., & Brandon, D. (2012). Development of an observational tool to measure nurses' information needs. *International Congress on Nursing Informatics Proceedings*, 209.

Kim, M., & GyeongAe, S. (2014). Errors in high-risk intravenous injections administered by nurses: The causes according to healthcare professionals. *Health Science Journal, 8*(2), 249-261.

Kissinger, J. A. (1998). Overconfidence: a concept analysis. *Nursing Forum, 33*(2), 18-26.

Koch, S. H., Weir, C., Haar, M., Staggers, N., Agutter, J., Görges, M., & Westenskow, D. (2012). Intensive care unit nurses' information needs and recommendations for integrated displays to improve nurses' situation awareness. *Journal of the American Medical Informatics Association, 19*(4), 583-590. doi:10.1136/amiajnl-2011-000678

Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. E. (2000). *To err is human: Building a safer health system.* Washington, D.C.: The National Academies Press.

Kopp, B. J., Erstad, B. L., Allen, M. E., Theodorou, A. A., & Priestley, G. (2006). Medication errors and adverse drug events in an intensive care unit: direct observation approach for detection. *Critical Care Medicine, 34*(2), 415-425.

Kossman, S. P., & Scheidenhelm, S. L. (2008). Nurses' perceptions of the impact of electronic health records on work and patient outcomes. *CIN: Computers, Informatics, Nursing, 26*(2), 69-77. doi:10.1097/01.NCN.0000304775.40531.67

Krikelas, J. (1983). Information-seeking behavior: Patterns and concepts. *Drexel Library Quarterly, 19*(2), 5-20.

Lange, L. L. (1992). Information seeking by nurses during beginning-of-shift activities. *Proceedings from the Annual Symposium on Computer Application in Medical Care*, 317-321.

Lauri, S., Salanterä, S., Chalmers, K., Ekman, S., Kim, H. S., Käppeli, S., & MacLeod, M. (2001). Profession and society. An exploratory study of clinical decision-making in five countries. *Journal of Nursing Scholarship, 33*(1), 83-90. doi:10.1111/j.1547-5069.2001.00083.x

Leape, L. L. (1995). Preventing adverse drug events. *American Journal of Health-System Pharmacy, 52*(4), 379-382.

Leape, L. L., Bates, D. W., Cullen, D. J., Cooper, J., Demonaco, H. J., Gallivan, T., . . . et al. (1995). Systems analysis of adverse drug events. ADE Prevention Study Group. *Journal of the American Medical Association, 274*(1), 35-43.

Leape, L. L., Brennan, T. A., Laird, N., Lawthers, A. G., Localio, A. R., Barnes, B. A., . . . Hiatt, H. (1991). The nature of adverse events in hospitalized patients. Results of the Harvard Medical Practice Study II. *New England Journal of Medicine, 324*(6), 377-384. doi:10.1056/nejm199102073240605

Lee, S. M. (2013). Features of Computerized Clinical Decision Support Systems Supportive of Nursing Practice. *CIN: Computers, Informatics, Nursing, 31*(10), 477-497. doi:10.1097/01.NCN.0000432127.99644.25

Lundgren-Laine, H., Kalafati, M., Kontio, E., Kauko, T., & Salantera, S. (2013). Crucial information needs of ICU charge nurses in Finland and Greece. *Nursing in Critical Care, 18*(3), 142-153. doi:10.1111/nicc.12004

Lyerla, F., LeRouge, C., Cooke, D. A., Turpin, D., & Wilson, L. (2010). A nursing clinical decision support system and potential predictors of head-of-bed position for patients receiving mechanical ventilation. *American Journal of Critical Care, 19*(1), 39-47. doi:10.4037/ajcc2010836

Makary, M. A., & Daniel, M. (2016). Medical error-the third leading cause of death in the US. *British Medical Journal, 353*, i2139. doi:10.1136/bmj.i2139

Marshall, A. P., West, S. H., & Aitken, L. M. (2011). Preferred Information Sources for Clinical Decision Making: Critical Care Nurses' Perceptions of Information Accessibility and Usefulness. *Worldviews on Evidence-Based Nursing, 8*(4), 224-235. doi:10.1111/j.1741-6787.2011.00221.x

McCaughan, D., Thompson, C., Cullum, N., Sheldon, T., & Raynor, P. (2005). Nurse practitioner and practice nurses' use of research information in clinical decision making: findings from an exploratory study. *Family Practice, 22*(5), 490-497. doi:10.1093/fampra/cmi042

McDermid, F., Peters, K., Jackson, D., & Daly, J. (2014). Conducting qualitative research in the context of pre-existing peer and collegial relationships. *Nurse Researcher, 21*(5), 28-33. doi:10.7748/nr.21.5.28.e1232

McKnight, L., Stetson, P. D., Bakken, S., Curran, C., & Cimino, J. J. (2001). Perceived information needs and communication difficulties of inpatient physicians and nurses. *Proceeding of the American Medical Informatics Association Symposium*, 453-457.

McKnight, M. (2006). The information seeking of on-duty critical care nurses: evidence from participant observation and in-context interviews. *Journal of the Medical Library Association, 94*(2), 145-151.

Moss, J., Berner, E. S., & Savell, K. (2007). A mobile data collection tool for workflow analysis. *Studies in Health Technology and Informatics, 129*(Pt 1), 48-52.

Moss, J., & Elias, B. (2010). Information networks in intensive care: a network analysis of information exchange patterns. *American Medical Informatics Association Annual Symposium Proceedings, 2010*, 522-526.

Moss, J., & Xiao, Y. (2002). A comparison of communication needs of charge nurses in two operating room suites. *American Medical Informatics Association Annual Symposium Proceedings*, 2002, 543-547.

Moss, J., & Xiao, Y. (2004). Improving operating room coordination: communication pattern assessment. *Journal of Nursing Administration, 34*(2), 93-100.

Moss, J., Xiao, Y., & Zubaidah, S. (2002). The operating room charge nurse: coordinator and communicator...reprinted from the proceedings of the 2001 AMIA Annual Symposium, with permission. *Journal of the American Medical Informatics Association, 9*, S70-74.

National Quality Forum (2010). *Clinical decision support driving quality and performance measurment- A foundation for clinical decision support.* Retrieved from Washington, D.C.:: http://www.qualityforum.org/Publications/2010/12/Driving_Quality_and_Performance_Measurement_-_A_Foundation_for_Clinical_Decision_Support.aspx

Ndosi, M., & Newell, R. (2010). Medicine information sources used by nurses at the point of care. *Journal of Clinical Nursing, 19*(17/18), 2659-2661. doi:10.1111/j.1365-2702.2010.03266.x

Newman, K., Doran, D., & Nagle, L. M. (2014). The relation of critical care nurses' information-seeking behaviour with perception of personal control, training, and non-routineness of the task. *Dynamics, 25*(1), 13-18.

Newman, K. M., & Doran, D. (2012). Critical care nurses' information-seeking behaviour during an unfamiliar patient care task. *Dynamics, 23*(1), 12-17.

O'Leary, D. F., & Mhaolrúnaigh, S. N. (2012). Information-seeking behaviour of nurses: where is information sought and what processes are followed? *Journal of Advanced Nursing, 68*(2), 379-390. doi:10.1111/j.1365-2648.2011.05750.x

O'Neill, E. S., Dluhy, N. M., & Chin, E. (2005). Modelling novice clinical reasoning for a computerized decision support system. *Journal of Advanced Nursing, 49*(1), 68-77. doi:10.1111/j.1365-2648.2004.03265.x

O'Sullivan, D., Fraccaro, P., Carson, E., & Weller, P. (2014). Decision time for clinical decision support systems. *Clinical Medicine (London), 14*(4), 338-341. doi:10.7861/clinmedicine.14-4-338

Osheroff, J. A. (2009). *Improving medication use and outcomes with clinical decision support: A step-by-step guide.* Chicago, IL: The Healthcare Information and Management Systems Society.

Pham, J. C., Story, J. L., Hicks, R. W., Shore, A. D., Morlock, L. L., Cheung, D. S., . . . Pronovost, P. J. (2011). National study on the frequency, types, causes, and consequences of voluntarily reported emergency department medication errors. *Journal of Emergency Medicine (0736-4679), 40*(5), 485-492. doi:10.1016/j.jemermed.2008.02.059

Plano Clark, V. L., & Ivankova, N. V. (2016). *Mixed methods research: A guide to the field*. Thousand Oaks, CA: Sage Publications, Inc.

Potnis, D. (2015). Wilson's information seeking behavior models 1981, 1996, 1999. In Al-

Randell, R., Mitchell, N., Thompson, C., McCaughan, D., & Dowding, D. (2009). From pull to push: understanding nurses' information needs. *Health Informatics Journal, 15*(2), 75-85. doi:10.1177/1460458209102969

Reddy, M. C., Pratt, W., Dourish, P., & Shabot, M. (2002). Asking questions: information needs in a surgical intensive care unit. *American Medical Informatics Association Annual Symposium Proceedings*, *2002*, 647-651.

Ricks, E., & ten Ham, W. (2015). Health information needs of professional nurses required at the point of care. *Curationis, 38*(1). doi:10.4102/curationis.v38i1.1432

Roukema, J., Steyerberg, E. W., van der Lei, J., & Moll, H. A. (2008). Randomized trial of a clinical decision support system: impact on the management of children with fever without apparent source. *Journal of the American Medical Informatics Association, 15*(1), 107-113. doi:10.1197/jamia.M2164

Saba, V. K., & McCormick, K. A. (2011). *Essentials of nursing informatics.* New York, NY: McGraw-Hill.

Sawant, S. (2015). Krikelas' model of information seeking behaviors. In Al-Suqri, M.N. & Al-Aufi, A.S. Information seeking behavior and technology Adoption: Theories and Trends. Hershey, PA: IGI Global.

Secco, M. L., Woodgate, R. L., Hodgson, A., Kowalski, S., Plouffe, J., Rothney, P. R., . . . Suderman, E. (2006). A survey study of pediatric nurses' use of information sources. *CIN: Computers, Informatics, Nursing, 24*(2), 105-112.

Shadish, W. R., Cook, T. D., & Cambell, D. T. (2002). *Experimental and quasi-experimental designs for generalized cause inference.* Belmont, CA: Wadsworth Cengage Learning.

Shamoo, A. E., & Resnik, D. B. (2009). *Responsible conduct of research*. New York, NY: Oxford University Press.

Shekelle, P. G., Morton, S. C., & Keeler, E. B. (2006). *Costs and benefits of health information technology* (Evidence Report/Technology Assessment No. 132). Retrieved from http://www.ahrq.gov/research/findings/evidence-based-reports/hitsystp.html

Simmons, B. (2010). Clinical reasoning: concept analysis. *Journal of Advanced Nursing, 66*(5), 1151-1158. doi:10.1111/j.1365-2648.2010.05262.x

Spath, M., & Buttlar, L. (1996). Information and research needs of acute-care clinical nurses. *Bulletin of the Medical Library Association, 84*(1), 112-116.

Spenceley, S. M., O'Leary, K. A., Chizawsky, L. L., Ross, A. J., & Estabrooks, C. A. (2008a). Sources of information used by nurses to inform practice: An integrative review. *International Journal of Nursing Studies, 45*(6), 954-970.

Spenceley, S. M., O'Leary, K. A., Chizawsky, L. L. K., Ross, A. J., & Estabrooks, C. A. (2008b). Sources of information used by nurses to inform practice: an integrative review. *International Journal of Nursing Studies, 45*(6), 954-970.

Standing, M. (2008). Clinical judgement and decision-making in nursing - nine modes of practice in a revised cognitive continuum. *Journal of Advanced Nursing, 62*(1), 124-134. doi:10.1111/j.1365-2648.2007.04583.x

Stetson, P. D., McKnight, L. K., Bakken, S., Curran, C., Kubose, T. T., & Cimino, J. J. (2001). Development of an ontology to model medical errors, information needs, and the clinical communication space. *American Medical Informatics Association Annual Symposium Proceedings*, 2001, 672-676.

Stevenson, J. E., & Nilsson, G. (2012). Nurses' perceptions of an electronic patient record from a patient safety perspective: a qualitative study. *Journal of Advanced Nursing, 68*(3), 667-676. doi:10.1111/j.1365-2648.2011.05786.x

Tannery, N. H., Wessel, C. B., Epstein, B. A., & Gadd, C. S. (2007). Hospital nurses' use of knowledge-based information resources. *Nursing Outlook, 55*(1), 15-19. doi:http://dx.doi.org/10.1016/j.outlook.2006.04.006

The Joint Commission. (2015). Sentinel event data: Root causes by event type 2004-2015. Retrieved from Retrieved from:https://www.jointcommission.org/assets/1/18/Root_Causes_by_Event_Type_2004-2015.pdf

The Joint Commission. (2016). National Patient Safety Goals. Retrieved from Retrieved from: https://www.jointcommission.org/assets/1/6/2016_NPSG_HAP.pdf

Thompson, C., Aitken, L., Doran, D., & Dowding, D. (2013). An agenda for clinical decision making and judgement in nursing research and education. *Internationa Journal of Nursing Studies, 50*(12), 1720-1726. doi:10.1016/j.ijnurstu.2013.05.003

Thompson, C., Cullum, N., McCaughan, D., Sheldon, T., & Raynor, P. (2004). Nurses, information use, and clinical decision making--the real world potential for evidence-based decisions in nursing. *Evidence-Based Nursing, 7*(3), 68-72.

Thompson, C., McCaughan, D., Cullum, N., Sheldon, T. A., Mulhall, A., & Thompson, D. R. (2001). Research information in nurses' clinical decision making: what is useful? *Journal of Advanced Nursing, 36*(3), 376-388. doi:10.1046/j.1365-2648.2001.01985.x

Tiffen, J., Corbridge, S. J., & Slimmer, L. (2014). Enhancing clinical decision making: Development of a contiguous definition and conceptual framework. *Journal of Professional Nursing, 30*(5), 399-405. doi:10.1016/j.profnurs.2014.01.006

Tower, M., Chaboyer, W., Green, Q., Dyer, K., & Wallis, M. (2012). Registered nurses' decision-making regarding documentation in patients' progress notes. *Journal of Clinical Nursing, 21*(19-20), 2917-2929. doi:10.1111/j.1365-2702.2012.04135.x

Valenta, A. L., & Wigger, U. (1997). Q-methodology: definition and application in health care informatics. *Journal of the American Medical Informatics Association, 4*(6), 501-510.

Van de Velde, S., Roshanov, P., Kortteisto, T., Kunnamo, I., Aertgeerts, B., Vandvik, P. O., & Flottorp, S. (2016). Tailoring implementation strategies for evidence-based recommendations using computerised clinical decision support systems: protocol for the development of the GUIDES tools. *Implement Science, 11*, 29. doi:10.1186/s13012-016-0393-7

Wahoush, O., & Banfield, L. (2014). Information literacy during entry to practice: Information-seeking behaviors in student nurses and recent nurse graduates. *Nurse Education Today, 34*(2), 208-213. doi:10.1016/j.nedt.2013.04.009

Ward, M. M., Vartak, S., Schwichtenberg, T., & Wakefield, D. S. (2011). Nurses' perceptions of how clinical information system implementation affects workflow and patient care. *CIN: Computers, Informatics, Nursing, 29*(9), 502-511. doi:10.1097/NCN.0b013e31822b8798

Watson, S. (1994). An exploratory study into a methodology for the examination of decision making by nurses in the clinical area. *Journal of Advanced Nursing, 20*(2), 351-360. doi:10.1046/j.1365-2648.1994.20020351.x

Wilson, R. M., Runciman, W. B., Gibberd, R. W., Harrison, B. T., Newby, L., & Hamilton, J. D. (1995). The Quality in Australian Health Care Study. *The Medical Journal of Austrailia, 163*(9), 458-471.

Wilson, T. D. (1997). Information behavior: An interdisciplinary perspective. *Information Processing & Management, 33*(4), 551-572.

Wilson, T. D. (1999). Models in information behaviour research. *Journal of Documentation, 55*(3), 249-270. doi:10.1108/EUM000000007145

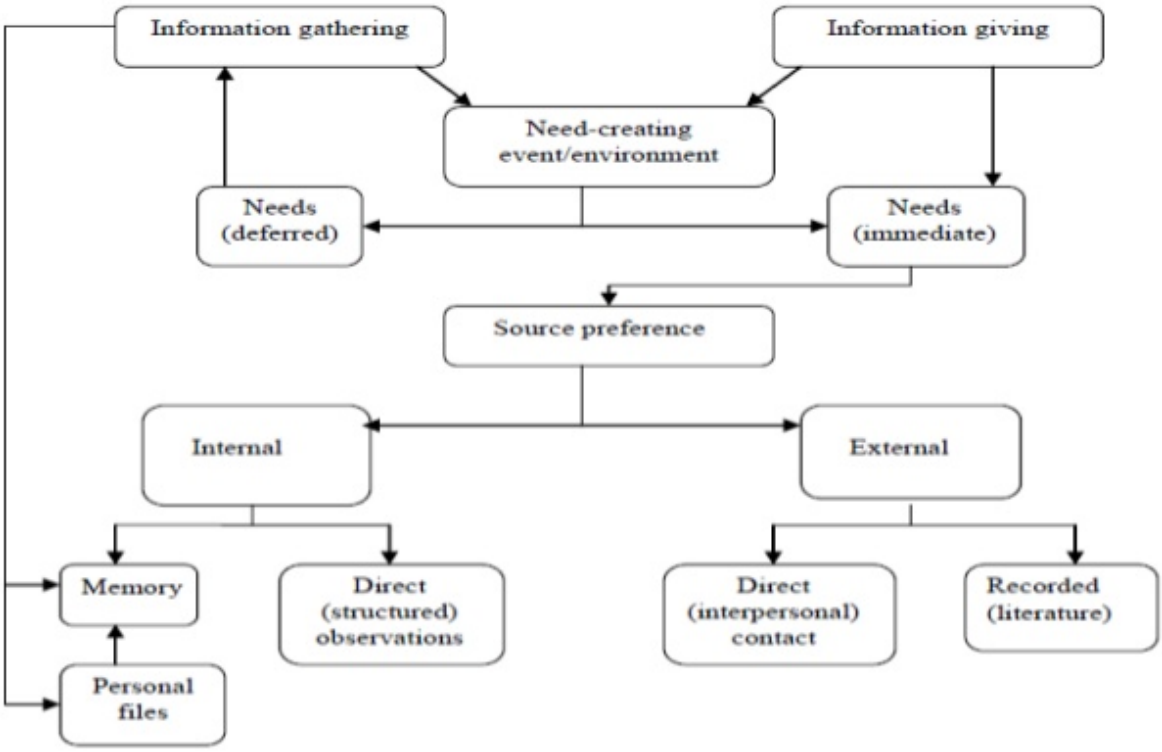
World Alliance for Patient Safety. (2008). *Summary of the evidence on patient safety: Implications for research.* Geneva, Switzerland: WHO Press.

Xu, X., Rocha, R. A., Bigelow, S. M., Wallace, C. J., Hanna, T., & Roemer, L. K. (2005). Understanding nurses' information needs and searching behaviour in acute care settings., *American Medical Informatics Association Annual Symposium Proceedings*, 2005, 839-843.

Yuan, M. J., Finley, G. M., Long, J., Mills, C., & Johnson, R. K. (2013). Evaluation of user interface and workflow design of a bedside nursing clinical decision support system. *Interactive Journal of Medical Research, 2*(1), e4. doi:10.2196/ijmr.2402

APPENDIX A

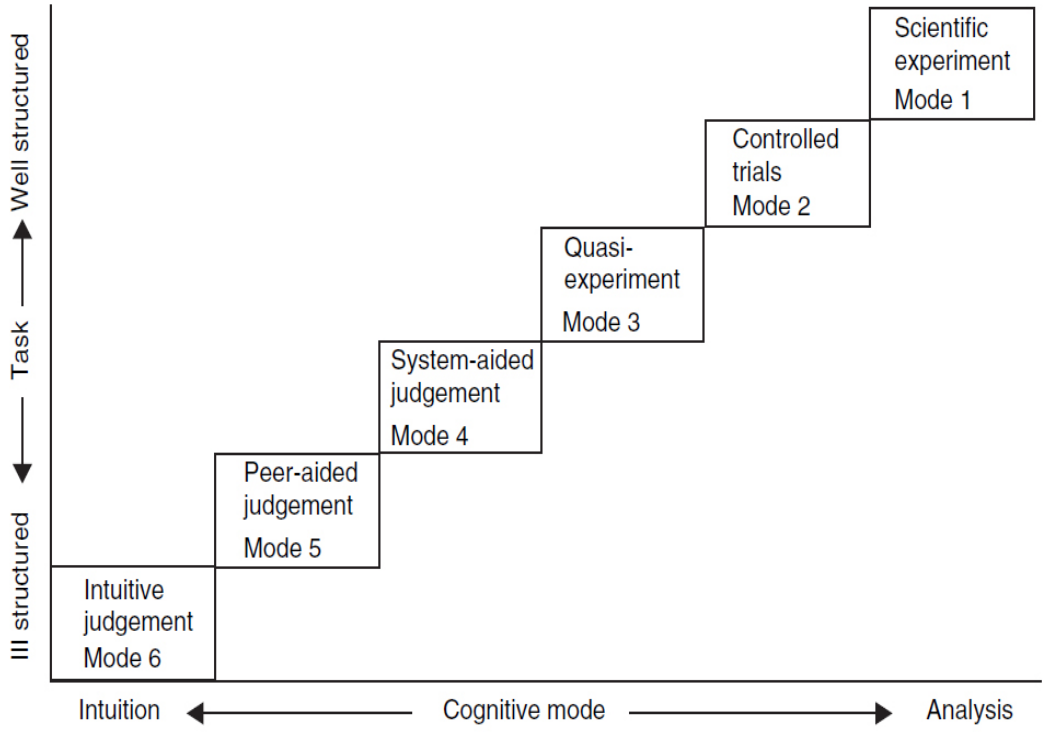
KRIKELAS' MODEL OF INFORMATION-SEEKING BEHAVIOR



Note. From —Information Seeking Behavior: Patterns and Concepts,// by K. Krikelas, 1983, Drexel Library Quarterly, 19, p. 17.

APPENDIX B

COGNITIVE CONTINUUM THEORY


Well structured
Task
Ill structured
Scientific experiment
Mode 1
Controlled trials
Mode 2
Quasi-experiment
Mode 3
System-aided judgement
Mode 4
Peer-aided judgement
Mode 5
Intuitive judgement
Mode 6
Intuition
Cognitive mode
Analysis

APPENDIX C

INSTITUTIONAL REVIEW BOARD APPROVAL FORMS

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on November 8, 2021. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator: Gardner, Carrie Lee

Co-Investigator(s):

Protocol Number: **X170330003**

Protocol Title: *Identification and Exploration of the Information Needs and Information-Seeking Behaviors of Medical-Surgical Nurses During Patient Care*

The IRB reviewed and approved the above named project on 4/21/17. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 4-21-17

Date IRB Approval Issued: 4/21/17

IRB Approval No Longer Valid On: 4/21/18

Marilyn Doss

Expedited Reviewer
Member - Institutional Review Board
for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building
701 20th Street South
205.934.3789
Fax 205.934.1301
irb@uab.edu

The University of
Alabama at Birmingham
Mailing Address:
AB 470
1720 2ND AVE S
BIRMINGHAM AL 35294-0104

UAB

Project Revision/Amendment Form

Form version: June 26, 2012

34608

In MS Word, click in the white boxes and type your text; double-click checkboxes to check/uncheck.

- **Federal regulations require IRB approval before implementing proposed changes. See Section 14 of the IRB Guidebook for Investigators for additional information.**
- **Change means any change, in content or form, to the protocol, consent form, or any supportive materials (such as the Investigator's Brochure, questionnaires, surveys, advertisements, etc.). See Item 4 for more examples.**

1. Today's Date	6/4/17

2. Principal Investigator (PI)

Name (with degree)	Carrie Lee Gardner	**Blazer ID**	csgard
Department	Nursing	**Division (if applicable)**	
Office Address	223 Palos Verdes Drive Troy, AL 36079	**Office Phone**	334-268-3817
E-mail	csgard@uab.edu	**Fax Number**	

Contact person who should receive copies of IRB correspondence (Optional)

Name		**E-Mail**	
Phone		**Fax Number**	
Office Address (if different from PI)			

3. UAB IRB Protocol Identification

3.a. Protocol Number	X170330003
3.b. Protocol Title	Identification and Exploration of the Information Needs and Information-Seeking Behaviors of Medical-Surgical Nurses During Patient Care

3.c. Current Status of Protocol—Check ONE box at left; provide numbers and dates where applicable

- ☐ **Study has not yet begun** — **No participants, data, or specimens have been entered.**
- ☒ **In progress, open to accrual** — **Number of participants, data, or specimens entered:** 2
- ☐ **Enrollment temporarily suspended by sponsor**
- ☐ **Closed to accrual, but procedures continue as defined in the protocol (therapy, intervention, follow-up visits, etc.)**
  - **Date closed:**
  - **Number of participants receiving interventions:**
  - **Number of participants in long-term follow-up only:**
- ☐ **Closed to accrual, and only data analysis continues**
  - **Date closed:**
  - **Total number of participants entered:**

4. Types of Change

Check all types of change that apply, and describe the changes in Item 5.c. or 5.d. as applicable. To help avoid delay in IRB review, please ensure that you provide the required materials and/or information for each type of change checked.

- ☐ **Protocol revision (change in the IRB-approved protocol)**
  In Item 5.c., if applicable, provide sponsor's protocol version number, amendment number, update number, etc.
- ☒ **Protocol amendment (addition to the IRB-approved protocol)**
  In Item 5.c., if applicable, provide funding application document from sponsor, as well as sponsor's protocol version number, amendment number, update number, etc.
- ☐ **Add or remove personnel**
  In Item 5.c., include name, title/degree, department/division, institutional affiliation, and role(s) in research, and address whether new personnel have any conflict of interest. See "Change in Principal Investigator" in the IRB Guidebook if the principal investigator is being changed.
  - ☐ **Add graduate student(s) or postdoctoral fellow(s) working toward thesis, dissertation, or publication**
    In Item 5.c., (a) identify these individuals by name; (b) provide the working title of the thesis, dissertation, or publication; and (c) indicate whether or not the student's analysis differs in any way from the purpose of the research described in the IRB-approved HSP (e.g., a secondary analysis of data obtained under this HSP).
- ☐ **Change in source of funding; change or add funding**
  In Item 5.c., describe the change or addition in detail, include the applicable OSP proposal number(s), and provide a copy of the application as funded (or as submitted to the sponsor if pending). Note that some changes in funding may require a new IRB application.

☒ **Add or remove performance sites**
In Item 5.c., identify the site and location, and describe the research-related procedures performed there. If adding site(s), attach notification of permission or IRB approval to perform research there. Also include copy of subcontract, if applicable. If this protocol includes acting as the Coordinating Center for a study, attach IRB approval from any non-UAB site added.

☐ **Add or change a genetic component or storage of samples and/or data component—this could include data submissions for Genome-Wide Association Studies (GWAS)**
To assist you in revising or preparing your submission, please see the IRB Guidebook for Investigators or call the IRB office at 934-3789.

☐ **Suspend, re-open, or permanently close protocol to accrual of individuals, data, or samples (IRB approval to remain active)**
In Item 5.c., indicate the action, provide applicable dates and reasons for action; attach supporting documentation.

☐ **Report being forwarded to IRB (e.g., DSMB, sponsor or other monitor)**
In Item 5.c., include date and source of report, summarize findings, and indicate any recommendations.

☐ **Revise or amend consent, assent form(s)**
Complete Item 5.d.

☐ **Addendum (new) consent form**
Complete Item 5.d.

☐ **Add or revise recruitment materials**
Complete Item 5.d.

☐ **Other (e.g., investigator brochure)**
Indicate the type of change in the space below, and provide details in Item 5.c. or 5.d. as applicable.
Include a copy of all affected documents, with revisions highlighted as applicable.

▶

5. Description and Rationale

In Item 5.a. and 5.b, check Yes or No and see instructions for Yes responses.
In Item 5.c. and 5.d, describe—and explain the reason for—the change(s) noted in Item 4.

☐Yes ☐No **5.a. Are any of the participants enrolled as normal, healthy controls?**
If yes, describe in detail in Item 5.c. how this change will affect those participants.

☐Yes ☐No **5.b. Does the change affect subject participation, such as procedures, risks, costs, location of services, etc.?**
If yes, FAP-designated units complete a FAP submission and send to fap@uab.edu. Identify the FAP-designated unit in Item 5.c.
For more details on the UAB FAP, see www.uab.edu/cto.

5.c. Protocol Changes: In the space below, briefly describe—and explain the reason for—all change(s) to the protocol.

▶ In the initial HSP participants were to be recruited from UAB Hospital on 3 medical-surgical floors. A revision is being requested to include up to 5 medical-surgical floors and to add UAB Highlands as a performance site. These revisions will allow for the recruitment of the needed sample size of 30. ✓

▶ As outlined in the original protocol HSP, a screenshot of the computerized observational data collection tool to be utilized in phase two of the study has also been provided. Categories for the computerized tool were established and refined during phase one of the study.

5.d. Consent and Recruitment Changes: In the space below,
(a) describe all changes to IRB-approved forms or recruitment materials and the reasons for them;
(b) describe the reasons for the addition of any materials (e.g., addendum consent, recruitment); and
(c) indicate either how and when you will reconsent enrolled participants or why reconsenting is not necessary (not applicable for recruitment materials).

Also, indicate the number of forms changed or added. For new forms, provide 1 copy. For revised documents, provide 3 copies:
- **a copy of the currently approved document (showing the IRB approval stamp, if applicable)**
- **a revised copy highlighting all proposed changes with "tracked" changes**
- **a revised copy for the IRB approval stamp.**

▶

Signature of Principal Investigator [signature] Date 6/4/17

FOR IRB USE ONLY

☐ Received & Noted ☑ Approved Expedited* ☐ To Convened IRB

C Bowell — 6/8/2017

Signature (Chair, Vice-Chair, Designee) Date

DOLA 4/21/17

Change to Expedited Category Y / (N) / NA

*No change to IRB's previous determination of approval criteria at 45 CFR 46.111 or 21 CFR 56.111

UAB Project Revision/Amendment Form

Form version: June 26, 2012

RECEIVED IRB JUN 09 2017 OFFICE OF INSTITUTIONAL REVIEW BOARD

34750

In MS Word, click in the white boxes and type your text; double-click checkboxes to check/uncheck.

- Federal regulations require IRB approval before implementing proposed changes. See Section 14 of the IRB Guidebook for investigators for additional information.
- Change means any change, in content or form, to the protocol, consent form, or any supportive materials (such as the Investigator's Brochure, questionnaires, surveys, advertisements, etc.). See Item 4 for more examples.

1. Today's Date 6/9/17

2. Principal Investigator (PI)

Name (with degree)	Carrie Lee Gardner	Blazer ID	csgard
Department	Nursing	Division (if applicable)	
Office Address	223 Palos Verdes Drive Troy, AL 36079	Office Phone	334-268-3817
E-mail	csgard@uab.edu	Fax Number	

Contact person who should receive copies of IRB correspondence (Optional)

Name		E-Mail	
Phone		Fax Number	
Office Address (if different from PI)			

3. UAB IRB Protocol Identification

3.a. Protocol Number: X170330003

3.b. Protocol Title: Identification and Exploration of the Information Needs and Information-Seeking Behaviors of Medical-Surgical Nurses During Patient Care

3.c. Current Status of Protocol—Check ONE box at left; provide numbers and dates where applicable

- ☐ Study has not yet begun — No participants, data, or specimens have been entered.
- ☒ In progress, open to accrual — Number of participants, data, or specimens entered: 2
- ☐ Enrollment temporarily suspended by sponsor
- ☐ Closed to accrual, but procedures continue as defined in the protocol (therapy, intervention, follow-up visits, etc.)
  - Date closed:
  - Number of participants receiving interventions:
  - Number of participants in long-term follow-up only:
- ☐ Closed to accrual, and only data analysis continues
  - Date closed:
  - Total number of participants entered:

4. Types of Change

Check all types of change that apply, and describe the changes in Item 5.c. or 5.d. as applicable. To help avoid delay in IRB review, please ensure that you provide the required materials and/or information for each type of change checked.

- ☐ **Protocol revision (change in the IRB-approved protocol)**
  In Item 5.c., if applicable, provide sponsor's protocol version number, amendment number, update number, etc.
- ☒ **Protocol amendment (addition to the IRB-approved protocol)**
  In Item 5.c., if applicable, provide funding application document from sponsor, as well as sponsor's protocol version number, amendment number, update number, etc.
- ☐ **Add or remove personnel**
  In Item 5.c., include name, title/degree, department/division, institutional affiliation, and role(s) in research, and address whether new personnel have any conflict of Interest. See "Change in Principal Investigator" in the IRB Guidebook if the principal investigator is being changed.
  - ☐ **Add graduate student(s) or postdoctoral fellow(s) working toward thesis, dissertation, or publication**
    In Item 5.c., (a) identify these individuals by name; (b) provide the working title of the thesis, dissertation, or publication; and (c) indicate whether or not the student's analysis differs in any way from the purpose of the research described in the IRB-approved HSP (e.g., a secondary analysis of data obtained under this HSP).
- ☐ **Change in source of funding; change or add funding**
  In Item 5.c., describe the change or addition in detail, include the applicable OSP proposal number(s), and provide a copy of the application as funded (or as submitted to the sponsor if pending). Note that some changes in funding may require a new IRB application.

☐ **Add or remove performance sites**
In Item 5.c., identify the site and location, and describe the research-related procedures performed there. If adding site(s), attach notification of permission or IRB approval to perform research there. Also include copy of subcontract, if applicable. If this protocol includes acting as the Coordinating Center for a study, attach IRB approval from any non-UAB site added.

☐ **Add or change a genetic component or storage of samples and/or data component—this could include data submissions for Genome-Wide Association Studies (GWAS)**
To assist you in revising or preparing your submission, please see the IRB Guidebook for Investigators or call the IRB office at 934-3789.

☐ **Suspend, re-open, or permanently close protocol to accrual of individuals, data, or samples (IRB approval to remain active)**
In Item 5.c., indicate the action, provide applicable dates and reasons for action; attach supporting documentation.

☐ **Report being forwarded to IRB (e.g., DSMB, sponsor or other monitor)**
In Item 5.c., include date and source of report, summarize findings, and indicate any recommendations.

☒ **Revise or amend consent, assent form(s)**
Complete Item 5.d.

☐ **Addendum (new) consent form**
Complete Item 5.d.

☒ **Add or revise recruitment materials**
Complete Item 5.d.

☐ **Other (e.g., investigator brochure)**
Indicate the type of change in the space below, and provide details in Item 5.c. or 5.d. as applicable.
Include a copy of all affected documents, with revisions highlighted as applicable.

▶

5. Description and Rationale
In Item 5.a. and 5.b, check Yes or No and see instructions for Yes responses.
In Item 5.c. and 5.d, describe—and explain the reason for—the change(s) noted in Item 4.

☐Yes ☐No **5.a. Are any of the participants enrolled as normal, healthy controls?**
If yes, describe in detail in Item 5.c. how this change will affect those participants.

☐Yes ☐No **5.b. Does the change affect subject participation, such as procedures, risks, costs, location of services, etc.?**
If yes, FAP-designated units complete a FAP submission and send to fap@uab.edu. Identify the FAP-designated unit in Item 5.c.
For more details on the UAB FAP, see www.uab.edu/cto.

5.c. Protocol Changes: In the space below, briefly describe—and explain the reason for—all change(s) to the protocol.

▶ In the initial HSP, an incentive was not being offered for participation. This protocol change is to request the approval to supply all study participants with a $20 Visa gift card.

5.d. Consent and Recruitment Changes: In the space below,
(a) describe all changes to IRB-approved forms or recruitment materials and the reasons for them;
(b) describe the reasons for the addition of any materials (e.g., addendum consent, recruitment); and
(c) indicate either how and when you will reconsent enrolled participants or why reconsenting is not necessary (not applicable for recruitment materials). email - will reconsent

Also, indicate the number of forms changed or added. For new forms, provide 1 copy. For revised documents, provide 3 copies:
- **a copy of the currently approved document (showing the IRB approval stamp, if applicable)**
- **a revised copy highlighting all proposed changes with "tracked" changes**
- **a revised copy for the IRB approval stamp.**

▶ During recruitment and consent all participants will be notified that participation in the study will result in receiving a $20 Visa gift card. This incentive will help compensate participants for time and effort to participate in the study. Any participants that have already been enrolled in the study will undergo a reconsent process and will be eligible for the incentive. The primary researcher has not performed actual data collection with any participants. Participants that are enrolled have only participated in the consent process.

Signature of Principal Investigator Connie Lee Davis Date 6/9/17

FOR IRB USE ONLY

☐ Received & Noted ☑ Approved Expedited* ☐ To Convened IRB

Sally Bake Headley, CIP — June 13, 2017

Signature (Chair, Vice-Chair, Designee) Date

DOLA 4/21/17

Change to Expedited Category Y / N / NA

*No change to IRB's previous determination of approval criteria at 45 CFR 46.111 or 21 CFR 56.111

CONSENT FORM

Title of Research:	Identification and Exploration of the Information Needs and Information-Seeking Behaviors of Medical-Surgical Nurses During Patient Care
UAB IRB Protocol #:	X1703300003
Principal Investigator:	Carrie Lee Gardner, RN, DNP, FNP-BC
Sponsor:	None

Purpose of the Research

We are asking you to take part in a research study. The purpose of this research study is to explore the types of information that nurses need during patient care and the sources nurses use to gather this information. This study will enroll thirty nurses on three medical-surgical units at UAB Hospital.

Explanation of Procedures

If you agree to join the study, you will be asked to allow a researcher to follow and observe you providing patient care for four hours during the course of a work day. The researcher will observe the types of information you use during patient care, the reasons you gather different types of information, and the sources you use to find the information. Following the four hour observation session, you will be asked to participate in a brief interview that should not last longer than 15 minutes. The interview will not be recorded and will allow you to further describe your information needs while providing patient care. After the observations and the interview, you will be asked to allow the researcher to inspect any personal notes, reminders, and white boards that you have used as sources of information during patient care.

Risks and Discomforts

There are no identifiable substantial risks to participants of this study. There is a minimal risk that you might suffer from a loss of confidentiality. However, every effort will be made to protect your confidentiality, and your individual information will not be shared with your employer. Study information will only be reported in aggregate.

Benefits

You may not benefit directly from taking part in this study. However, this study may help us better understand the type of information nurses need during patient care and the best way to deliver the information to nurses during patient care.

Alternatives

Your alternative is to not participate in this study.

UAB IRB
Date of Approval June 13, 2017
Not Valid On April 21, 2018

Confidentiality

Information obtained about you for this study will be kept confidential to the extent allowed by law. However, research information that identifies you may be shared with people or organizations for quality assurance or data analysis, or with those responsible for ensuring compliance with laws and regulations related to research. They include:

- the UAB Institutional Review Board (IRB). An IRB is a group that reviews the study to protect the rights and welfare of research participants.
- the Office for Human Research Protections (OHRP)

The information from the research may be published for scientific purposes; however, your identity will not be given out.

Voluntary Participation and Withdrawal

Whether or not you take part in this study is your choice. There will be no penalty if you decide not to be in the study. If you decide not to be in the study, you will not lose any benefits you are otherwise owed.

You are free to withdraw from this research study at any time. Your choice to leave the study will not affect your relationship with this institution.

If you are a UAB student or employee, taking part in this research is not a part of your UAB class work or duties. You can refuse to enroll, or withdraw after enrolling at any time before the study is over, with no effect on your class standing, grades, or job at UAB. You will not be offered or receive any special consideration if you take part in this research.

Cost of Participation

There will be no cost to you for taking part in this study.

Payment for Participation in Research

You will be paid a $20 gift card following completion of the observation session and the semi-structured interview. This money is to reimburse you for your time and your contribution that you made to the study.

Questions

If you have any questions, concerns, or complaints about the research, please contact the study doctor. You may contact Dr. Carrie Lee Gardner at 334-268-3817.

If you have questions about your rights as a research participant, or concerns or complaints about the research, you may contact the UAB Office of the IRB (OIRB) at (205) 934-3789 or toll free at 1-855-860-3789. Regular hours for the OIRB are 8:00 a.m. to 5:00 p.m. CT, Monday through Friday.

Legal Rights

You are not waiving any of your legal rights by signing this consent form.

Signatures

Your signature below indicates that you have read (or been read) the information provided above and agree to participate in this study. You will receive a copy of this signed consent form.

_____

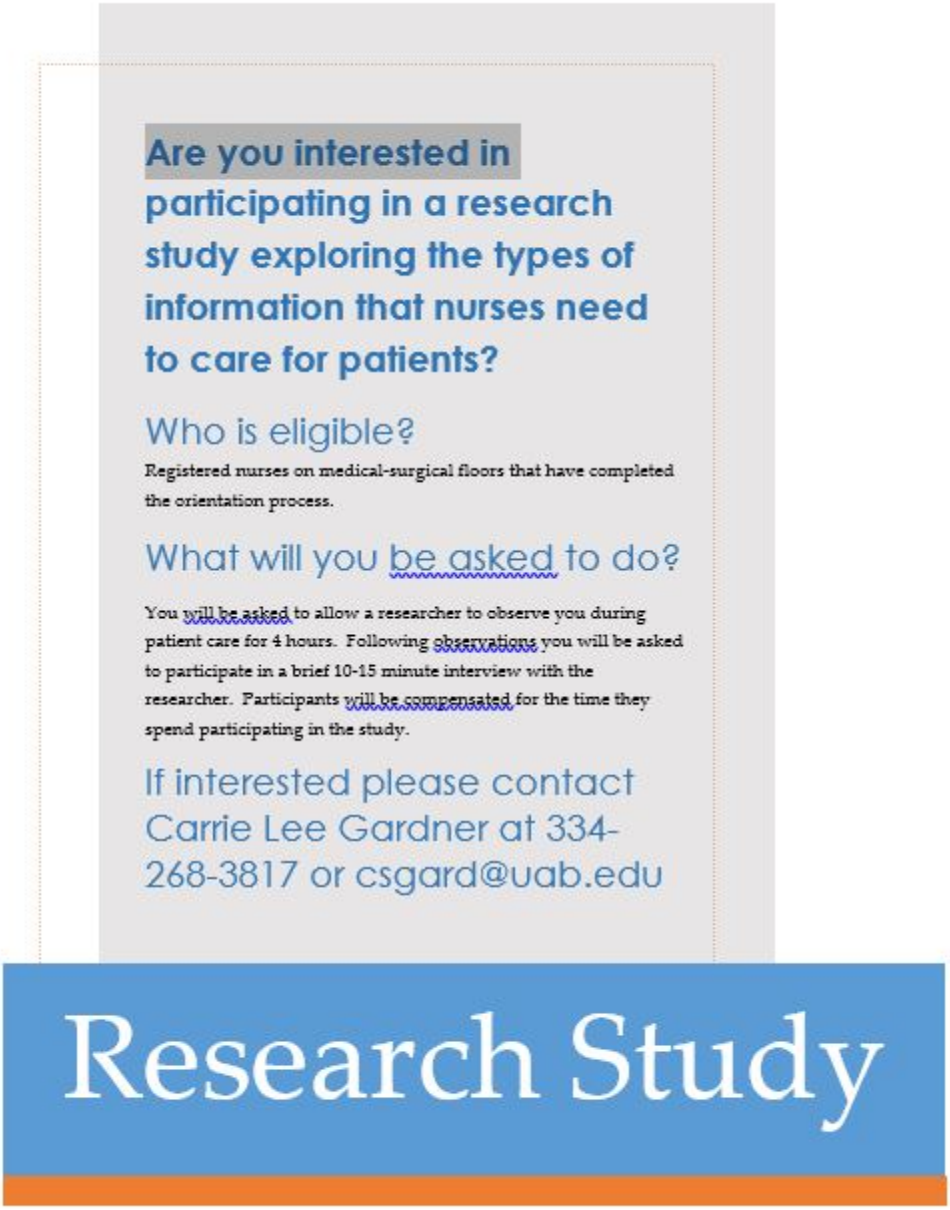
Signature of Participant Date

_____

Signature of Person Obtaining Consent Date

APPENDIX D

RECRUITMENT FLYER


Are you interested in participating in a research study exploring the types of information that nurses need to care for patients?
Who is eligible?
Registered nurses on medical-surgical floors that have completed the orientation process.
What will you be asked to do?
You will be asked to allow a researcher to observe you during patient care for 4 hours. Following observations you will be asked to participate in a brief 10-15 minute interview with the researcher. Participants will be compensated for the time they spend participating in the study.
If interested please contact Carrie Lee Gardner at 334-268-3817 or csgard@uab.edu
Research Study

APPENDIX E

PARTICIPANT DEMOGRAPHIC INFORMATION FORM

Participant Demographic Information Form

Primary Investigator: Carrie Lee Gardner

Study Title: Identification and Exploration of the Information Needs and Information-Seeking Behaviors of Medical-Surgical Nurses During Patient Care

Instructions: Please do not write your name on this form. Your responses will allow us to provide an accurate description of the sample.

1. What is your age? Please provide in years and months.

_____ years _____ months

2. What is your gender? Female ☐ Male ☐

3. How many years of experience do you have as a nurse? Please provide in years and months.

_____ years _____ months

4. How many years of experience do you have on your current floor. Please provide in years and months.

_____ years _____ months

5. What is your highest level of nursing education?

Associate's Degree ☐

Bachelor's Degree ☐

Master's Degree ☐

Doctoral Degree ☐

APPENDIX F

INFORMATION RESOURCE INVENTORY FOR THE UNITS

Information Resource Inventory for the Units

1. Electronic or written white board- These denote things such as patient names, discharges, transfers, physician, nurse, transport, needed blood sugar checks, and isolation. Electronic versions had more information and showed stages of discharge and transfer.
2. Paper chart- includes outside records, EKGs, labels, and official copies of advanced directives
3. Electronic Resources- Resources found in the patient electronic medical record or in the hospital electronic information system
    a. Patient Main Screen- Provides a list of the nurse's current patients. Icons alert nurses of scheduled tasks, new orders, new lab results, and scheduled medications.
    b. Current orders- Provides a list of current orders for the care of the patient
    c. Patient electronic medical record- Provides information such as a history and physical, progress notes, operation/procedure notes, diagnostic test results, etc.
    d. MAR drug reference- Embedded in the electronic MAR. When a nurse clicks on a medication this reference will provide a drug description and information regarding dosage, pharmacokinetics, administration, etc.
    e. Micromedix- Gives information regarding IV drug compatibility
    f. Alerts- are triggered when patients have certain parameters and give nurses suggestions to improve care
        i. EWS/qSepsis- when you enter vital signs, WBC count, orientation this gives you a number and an early warning sepsis score. New orders will arise if the score is greater than or equal to 5
        ii. CIWA- triggered if the patient has the potential for ETOH or drug withdrawals; Clinical Institution Withdrawal Assessment; tells you the needed dose for Ativan based on the patient's agitation level
    g. Electronic Standards of Care Reference- Provides evidence based standards of care and standards for procedures and skills for nursing. This reference also included information regarding specialty diets
    h. Hospital Specific Policies and Procedures- Provides hospital specific protocols
    i. Lab Source- Provides information on lab procedures

APPENDIX G

OPERATIONAL DEFINITIONS OF THE STUDY VARIABLES FOR THE OBSERVATIONAL TOOL

1. Information- A stimulus that reduces uncertainty (Krikelas, 1983).

2. Information need- A subjective experience occurring in the mind of the person in need and is a representation of a future goal that is desired (Burnkrant, 1976; Wilson, 1999).

3. Information-seeking behaviors- Activities that are undertaken to identify relevant information to satisfy a perceived immediate need (Krikelas, 1983; Wilson, 1999).

4. Health information-seeking behavior- Activities that are undertaken by health care providers in order to identify relevant information to satisfy a perceived need that arises during the provision of direct patient care.

5. Information-seeking episode- An event that begins in response to a perceived information need, proceeds to the initiation of information-seeking behaviors, and ends when the need is believed to have been satisfied or the task is abandoned due to lack of available information (Krikelas, 1983).

6. Purpose of the information-seeking episode/need-creating event- An event that causes uncertainty in the information seeker and leads to the perception that the current state of knowledge is not adequate to deal with an issue. The reason that the provider initiates the information task (Krikelas, 1983; Moss, Berner, & Savell, 2007; Sawant, 2015).

7. Information Type- The type of data accessed to reduce uncertainty (Krikelas, 1983; Wilson, 1999).

8. Information source- Suppliers or generators of information that are accessed in order to meet a perceived gap in knowledge or a perceived information need (Krikelas, 1983).

9. Information mode/format- The means or the method by which the provider obtains information (Moss et al., 2007).

10. Information-seeking episode duration- The amount of time that elapses from the beginning or initiation of an information-seeking episode to the completion or abandonment of the task (Moss et al., 2007).

APPENDIX H

PHASE ONE DATA CATEGORY VALIDATION TOOL

Primary Investigator: Carrie Lee Gardner

Study Title: Identification and Exploration of the Information Needs and Information-Seeking Behaviors of Medical-Surgical Nurses During Patient Care

Type of Information

Type of Information	Frequency of Observations
Demographic Data	
Admission Data	
Patient Medical History	
Assessment Data	
Patient Treatment/Diagnostic Results	
Patient Treatment Schedules	
Patient Laboratory Data Results	
Hospital Policies and Procedures	
Standards of Care	
Expected Normal Findings	
Current Orders	
(Blank lines have been provided in the chart to allow for the addition of categories that may arise during phase one observations)	

Purpose/Need Creating Event

Purpose Need Creating Event	Frequency of Observations
Medication Administration	
Medication Titration	
Patient Treatment	
Patient Assessment	
Patient Admission	
Patient Discharge	
Patient Handoff of Care	
Care Planning	
Coordination of Inpatient Care	
Equipment Management	
Coordination of Home Care/Discharge Planning	
Patient Education	
(Blank lines have been provided in the chart to allow for the addition of categories that may arise during phase one observations)	

Source

Information Source	Frequency of Observations
Other Nurses	
Nursing Assistants	
Nurse Practitioner	
PA/SA	
Physician	
Pharmacist	
Unit Clerk	
Laboratory Technician	
Physical Therapist	
Computerized Information Systems	
Patient Medical Record	
MAR	
Written reference materials	
Public Display Artifacts such as white boards	
Printed Notes	
Personal Notes	
(Blank lines have been provided in the chart to allow for the addition of categories that may arise during phase one observations)	

Mode/Format

Mode/Format	Frequency of Observations
Face to Face Verbal Interaction (Interpersonal)	
Telephone	
Computerized	
Written	
(Blank lines have been provided in the chart to allow for the addition of categories that may arise during phase one observations)	

APPENDIX I

DATA COLLECTION CATEGORIES WITH OPERATIONAL DEFINITIONS

Purpose/Need Creating Event

Purpose Need Creating Event	Operational Definition
Medication Administration	Administration of a medication to a patient in the acute care setting.
Medication Titration	Adjustment of a medication dosage based on the current status of the patient. This can include the titration of medications such as heparin or insulin.
Patient treatment and provision of care	The nurse determines a need for more information to inform the provision of care (can include assessment to verify things such as pain level, etc. to confirm the current plan of care).
Change in patient status	The nurse determines that a patient has a change in either mental or physical status and more information is needed to make patient care decisions.
Review of the current patient treatment plan	The verification of the current orders by the nurse to ensure that the current treatment plan is being followed.
Lack of Patient Knowledge/Patient Request for Information	Event where the nurse and/or the patient determine that the patient needs more information regarding a current situation arising during the provision of care.
Patient Admission	Admission of the patient to the floor or the facility.
Patient Discharge	Discharge of the patient to home, rehabilitation, or long term care.
Quantifying risk for adverse events	The nurse identifies the need to determine if the patient has a risk for the occurrence of possible adverse events.
Patient Handoff of Care/Patient Transfer	Handoff of care to a nurse on the same floor or transfer of a patient to a different floor in the hospital.
Equipment Management	Management of equipment that pertains to the direct provision of patient care (ie: IV pumps, beds, assistive devices)
Coordination of Home Care/Discharge Planning (Transition of Care)	Collaborative discussion of the patient discharge disposition.
Order Clarification and	When a situation arises and a nurse feels uncertain

Verification of new orders	regarding the current orders or feels the need to verify new orders that have been entered by providers
Pre-admission Medication Reconciliation	Information regarding the medications the patient was taken prior to admission to the facility.

Type of Information

Type of Information	Operational Definition
Medication Information regarding pharmacology, dosage, administration, and compatibility	Information pertinent to the safe administration of medications to the patient. Medication information regarding pharmacology, dosage, administration, and compatibility.
Complete Assessment	A complete systems assessment performed by the nurse (including beginning of shift and routine assessment) to support routine care of the patient
Focused System Assessment	An assessment performed by the nurse to obtain information regarding specific body systems
Vital Sign Assessment	The assessment of patient vital signs by the nurse to inform patient care. This assessment can be performed by the nurse or support staff.
Pain Assessment	The assessment of the patient's pain level in order to inform patient care.
Schedule of patient care including treatment, labs, and scheduled medications	Information regarding scheduled patient care items such as treatments, dressing changes, ordered labs, and scheduled medications. This is not a list of current orders. This refers to a schedule of when certain treatments and interventions should be performed. Nurses access this information in order to review the timing of certain patient care items.
Current Orders	Information that verifies the current orders pertaining to the patient and guiding the care the nurse should provide the patient.
Verbalized Patient Data	Information obtained from the patient or the patient family member (patient history, home medications, and other information obtained verbally from the patient and/or family

	to inform treatment, medication administration, and plan of care)
Patient Laboratory Data Results	Results of patient laboratory tests (ie: CBC, Metabolic Profiles, Culture and Sensitivities)
Patient Diagnostic Test Results	Results of diagnostic tests such as CT scans, MRI, etc.
Electronic Evidence-Based Standards of Care Reference Tool	Information regarding evidence-based practice standards of care for all patients.
Patient Medical History as found in the electronic record	Documented patient medical history (including home medications) and history and physicals as found in an electronic format in the EMR
Risk Assessment Tools	CIWA, qSepsis, EWS
Patient Education	Information regarding obtaining or maintaining the appropriate equipment to support care of the patient.
Change of shift report	Report to support the transition of care from one nurse to another on the same floor at the change of shift.
Discharge orders	Information regarding pertinent orders pertaining to the patient being discharged to home, rehabilitation, or long term care.
UAB Specific Hospital Policies and Procedures	Policies specific to UAB hospital
Demographic Data	Data concerning patient date of birth, place of residence, insurance, advanced directive, etc.
Equipment Specific Information	Information regarding obtaining, maintaining, or enabling the correct functioning of appropriate equipment to support the care of the patient
New Order	Information pertaining specifically to a new order recently received by the nurse
Patient Progress	Information sought by the nurse to describe the type of progress the patient is making during the hospital stay. This can include physical progress or decline or progression towards discharge. Progress can be determined by the nurse, other nurses, interdisciplinary staff, or support staff.

Source

Information Source	Operational Definitions
MAR	The medication administration record found in the electronic medical record which includes current medication orders.
Computerized Medication Resources	Electronic resources embedded in the electronic medical record that support the safe administration of medications. Include MAR reference and Micromedix.
Patient Main Screen	This main screen in the electronic medical record provides a list of the nurse's current patients. The page also displays icons pertaining to upcoming tasks, labs, and medications for the patients. In addition, new orders and new lab results are displayed by icons also.
Patient Medical Record	The electronic record of care the patient has received while admitted to the facility.
Patient	The person admitted to the facility to receive treatment and care.
Patient Family Member	Family or support persons of the patient
Other Nurses	Other registered nurses on the floor working with the nurse in the provision of patient care.
Personal Notes	Personal written notes with patient information. The format can be individual to nurses and can include information regarding schedules of care, shift change data, medication administration schedules, etc.
White Boards (electronic and written)	Boards located on the floor depicting information regarding the patient, discharge/transfer disposition, physician, nurse, etc.
Computerized Information Resources	Computerized resources provided for the nurse to support the provision of evidence-based care and to inform nurses of policies and procedures.
Nurse Educator/Clinical Nurse Leader/Charge Nurse/Nurse Manager	Registered nurses working on the unit who provide support to other floor nurses.
Specialty nurses such as wound care nurses and	Nurses who have received specialty training to support the

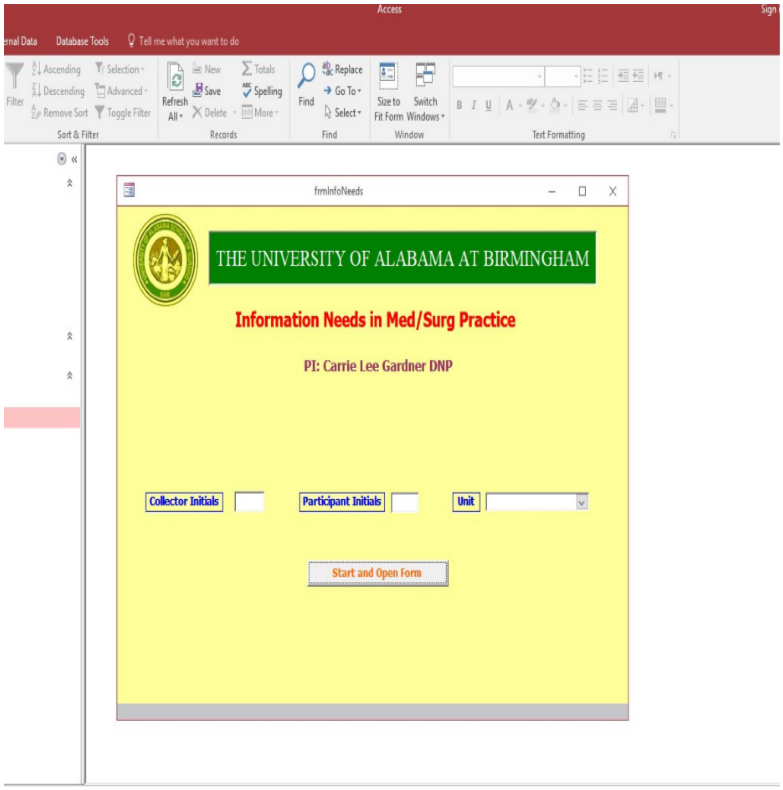
equipment/technology superusers	provision of patient care.
Pharmacist	Licensed pharmacist assigned to the unit.
Unit Clerk	Unlicensed clerical personnel on the unit.
Physical Therapist	Licensed physical therapist assigned to the unit.
Patient Care Technicians	The nursing assistants providing supportive care
Physician	Medical doctor assigned to the care of the patient.
Written reference materials	Written or published reference material found on the hospital floor.
NP/PA/SA	Licensed providers assigned to the care of the patient.
Social Worker	This is the social worker assigned to the patient.
Interdisciplinary Team	A group of people meeting to discuss and coordinate care of the patient from multiple disciplines.
Patient Paper Chart	The patients written medical record found on the hospital floor which includes documents such as outside records, EKG's, labels, and official copies of advanced directives.

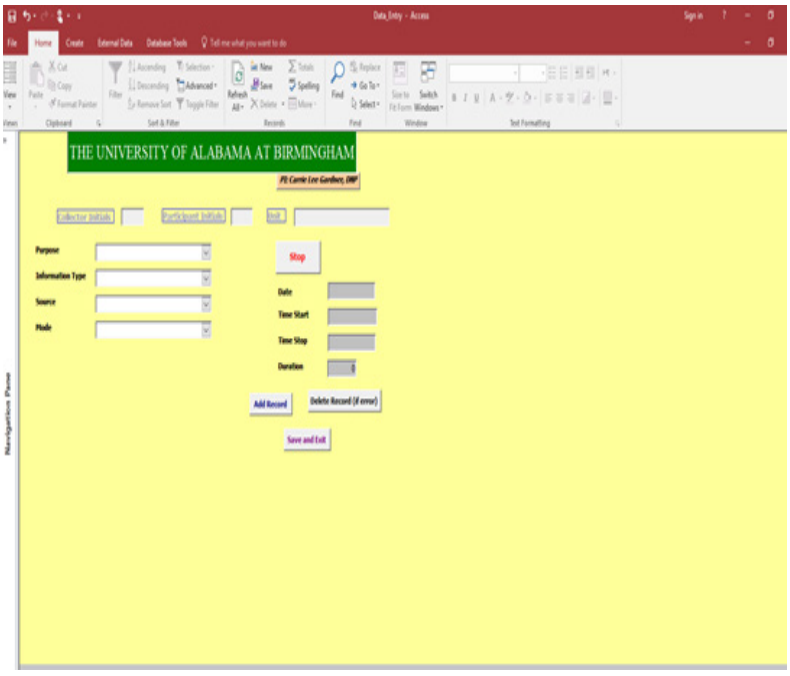
Mode/Format

Mode/Format	Operational Definition
Face to Face Verbal Interaction (Interpersonal)	A mode of information exchange where the nurse is conversing with an information source in a face to face format.
Telephone	A mode of information exchange where the nurse is gathering information an information source through a telephone format.
Computerized	A mode of information exchange where the nurse is gathering or receiving information from a computerized or electronic source.
Written	A mode of information exchange where the nurse is gathering information from either a handwritten or printed source found on the unit.

APPENDIX J

ELECTRONIC OBSERVATIONAL DATA COLLECTION TOOL


Access
Database Tools
Tell me what you want to do
Filter
Ascending
Descending
Remove Sort
Selection
Advanced
Toggle Filter
Sort & Filter
Refresh All
New
Save
Delete
Totals
Spelling
More
Records
Find
Replace
Go To
Select
Find
Size to Fit Form
Switch Windows
Window
Text Formatting
frmInfoNeeds
THE UNIVERSITY OF ALABAMA AT BIRMINGHAM
Information Needs in Med/Surg Practice
PI: Carrie Lee Gardner DNP
Collector Initials
Participant Initials
Unit
Start and Open Form


Data_Entry : Access
THE UNIVERSITY OF ALABAMA AT BIRMINGHAM
PI: Carrie Lee Gardner, DNP
Collector Initials
Participant Initials
Unit
Purpose
Information Type
Source
Mode
Stop
Date
Time Start
Time Stop
Duration
Add Record
Delete Record (if error)
Save and Exit

APPENDIX K

SEMI-STRUCTURED INTERVIEW SCRIPT

Primary Investigator: Carrie Lee Gardner

Study Title: Identification and Exploration of the Information Needs and Information-Seeking Behaviors of Medical-Surgical Nurses During Patient Care

Thank you for allowing me to observe you during your work day. I would like to ask a few brief questions to help further describe the types of information you need during patient care and the sources you do or don't use to gather this information.

This interview will be brief and should not last more than 10-15 minutes. I will be writing down your responses.

1. Tell me about any information that you felt was not available during the course of observations.

    a. Probing question: Why did you feel that the information was not available?

    b. Probing question: What factors made you search or not search for information that you felt was not available?

2. Can you describe how you access and obtain information during the course of patient care?

    a. Probing question: How convenient are your current information sources?

    b. Probing questions: How accessible are your current information sources?

3. What types of information formats best fit into your nursing practice and workflow?

4. Tell me about information that you did not feel the need to search for based on your own personal knowledge. (For example knowledge based on previous experiences or knowledge derived from physical assessment of the patient)

5. Is there anything you would like to tell me about your experiences accessing and using information during patient care?

Thank you so much for allowing me to observe you and for participating in the interview.

APPENDIX L

INDIVIDUAL UNIT PAPER BASED NOTES

Room # _____ Name: _____ Age/Sex: _____ Team/Service: _____ Patient of Dr. _____

Code status: _____ Isolation: _____ Precautions: _____ Allergies: _____

Admit date: _____ Current Dx: _____

PMH: _____

_____

_____

Plan of care: _____

Pending procedures/tests: _____

Pending labs: _____

Est. D/C date: _____ Barriers to D/C: ☐Anxious ☐Agitated ☐Crying ☐Caregiver support ☐Transportation ☐Failed Teachback ☐ Anxious

☐ Other: _____

Assessment

Neuro: A&Ox _____ CIWA: ___ Restraints: ___ Sitter: ___

CV: _____ Telemetry: Yes No

DVT prophylaxis: heparin / enoxaparin / other / SCDS _____

Resp: _____ % on _____ O2L _____

GI: Diet _____ LBM: _____

GI tubes/other _____

GU: Bedpan / Urinal / Diaper / BSC / Toilet / Foley; Indication _____

Strict I & O: Yes No Fluid Restriction? _____

Skin: Intact / Not Intact _____

_____

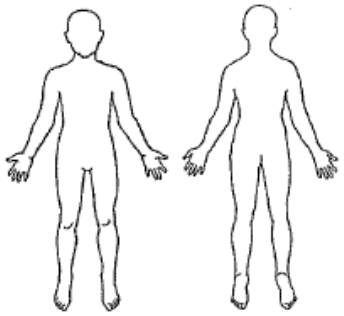
_____

_____

Drains: _____

MS: Steady / Unsteady / Unable to assess Equip _____

Bed alarm _____ Turn q2hr? _____ Hx of falls? _____



Best mobility: Walk 250+ ft; Walk 25+ ft; Walk 10+ft; Stand >1 min; Transfer to chair; Sit at edge of bed; Turn self in bed; Only lying in bed

Accuchek: Yes No Bfast _____ Lunch _____ Dinner _____ Night _____

IV access and insertion date: _____

Central line Yes / No _____ Insertion date: _____ CHG bath? _____

Family: _____

New Nursing Concerns / Social Issues: ☐ Mental Status Changes ☐ Tolerating diet ☐ N / V/ D ☐ Abd Pain ☐ Elimination ☐ Harm to Self

☐ Mobility ☐ Skin ☐ Other: _____

Vitals:

B/P:

HR:

Temp:

RR:

O2 Sat:

Pain score: _____ Pain goal: _____

Pain location/description: _____

IV Pain Med Y / N

PRN Meds:

Other:

Labs:

K+		WBC	
Na		Hgb	
Mag		Hct	
Ca		BUN	
Creat			

Room: _____ POD: _____ Name: _____ MD: _____ Procedure: _____ _____ Medical Hx: _____ _____ _____ Allergies: _____	**Skin Integrity/Wounds/Drains** HV: _____ → _____ HV: _____ → _____ WV: _____ → _____ JP : _____ → _____ Devices: _____ Dressing: _____	**Cognitive/Psychosocial** KATZ: _____ Date: _____ A&O: _____ CIWA: _____ ☐ 0800 ☐ 1000 ☐ 1200 ☐ 1400 ☐ 1600 ☐ 1800	**Vitals/ Tissue Perfusion** Telemetry #: _____ Night Rhythm: _____ Day Rhythm: _____ Pulse: UR _____ UL _____ LR _____ LL _____ TED: R L SCD: R L Waffle Boots: R L
IV/Central Lines PICC: R L Ins. Date: _____ Dsg Change Date: _____ Isolation: _____ IV: _____ @ _____ in _____ HL: _____	**Pain/PCA** Pain Score: ____ ____ ____ Pain Goal: ____ PCA: _____ @ _____ D/C @ _____ Used: _____ _____ @ _____ _____ @ _____ _____ @ _____ _____ @ _____ Q-Ball: _____ D/C @ _____	**Respiratory** O2 @ _____ L via _____ IS: _____ Lungs: _____ Nebs: Y N O2/PO: Y N	**Nutrition/Elimination** Diet: _____ App: G F P Last BM: _____ Foley: Y N Ins. Date: _____ D/C @ _____ Distention: Y N Elimination: _____ Bowel Sounds: P NP
Safety/Activity/Falls Armband: _____ ROM: UR _____ UL _____ LR _____ LL _____ Gait: _____ As. Device: _____ Weight Bearing Status: R: _____ L: _____ Bed / Stretcher	**Lab/Diagnostic Tests** Last Accu-Check: _____ _____ @ _____ _____ @ _____ _____ @ _____ Hct: _____ K+: _____ Mg: _____ Na+: _____ Abx: _____ AET: _____ To the floor: _____	Assessment/Education/Meds Wounds/Drains: 0830 1630 IVF/PCA: From surgery EOS IV: 0830 1230 1630 qSepsis: 0830 1230 1630 Pain: 0830 1230 1630 Neuro: 0830 1230 1630 Admission Assessment Plan of Care ☐ DC PCA POD 1 ☐ DC Foley POD 1 ☐ DC Q-Ball POD 2	**Miscellaneous:**

NAME:_____AGE:_____
MD:_____ADM DX_____
SX:_____
HX:_____

ROOM:

Report Given To:

Allergies:

Surgical Site:_____

Wounds:_____

Other:

Drains:

Vital Signs:

Oxygen:_____ O2Sat:_____
Resp Tx:_____ Foley/Vd/Ileo _____
Telemetry_____ BM/Ostomy:_____
TED/SCD:_____ Diet:_____
Daily Wts:_____ TF:_____

Accucheck/SSI:

Medications:
Times_____

IV Site:_____

IVF:_____

TPN@:_____

PCA:_____

Labs:

RM: _____ Name: _____

MD: _____ POD: _____

Procedure: _____

Est. D/C Date _____ Last BM: _____

Disposition: Home Health Rehab SNF Home

Potential Barriers to D/C: (ONLY report potential d/c barriers)

Pain control issues: Y/N Pain Score: _____

PICC: Y/N Ins. Date: _____

PICC Consult: Y/N Notified: Y/N

Foley Catheter: Y/N

PT/OT ordered: Y/N

O^2 L: _____ Sat %: _____

Pending Proc/Test: _____

Pending Labs: _____

Pending Consults: _____

Plan of Care/Goals/Medical Milestones:

(RN communicate to pt & update communication board)

1) _____

2) _____

3) _____

New Nursing Concerns/Social Issues

☐ Mental Status Changes ☐ Elimination ☐ Mobility

☐ Post op complications: _____

☐ Other: _____

Barriers to discharge: ☐ HH set up ☐ DME needs

☐ HH IV antibiotic set up ☐ Rehab/SNF placement

☐ PT/OT final recommendation ☐ Transportation

☐ Caregiver Support ☐ Social service issues

☐ Other: _____

05/02/17

ROOM: _____ NAME: _____ MD: _____ AGE: _____

Dx: _____

Surgery: _____

_____

PM Hx: _____

Allergy: _____ **DVT prophylaxis Yes/No** _____ IV Access: CVL/PICC/PIV

_____ **Yes/No** _____ **Fluids/PCA:** _____ PCO2 charted __

Diet/TF: _____ **Tolerating Yes/No** Drains/Wound Vac : _____

Stoma/Trach/Suction: _____ Resp./ O2/ Sats: _____

Restraints/Sitter: _____ Pumps: _____ Foley/SPCath/Neph/Ileo: _____

Activity/Mobility _____ Dressings/Incisions: _____

Skin: _____

Plan of care _____ **Disposition** _____ **EDD** _____

Dopplers/Problems: _____ Last BM: _____

Procedures / Consults: _____ Telemetry: _____

Med Times:	New Orders:
PRNS **IV Pain Meds Y/N**	Vitals:
Reasons for Delay **Transportation** **Pain Control** **Home Health Setup** **Placement** **Social Services Issues** **Weaning from O2** **Dialysis** **Restraint/Sitter** **BM/Voiding/JP drain removal** **Education** **Mental Changes** **Home IV Abx** **DME** **Not Tolerating TF** **plugging Trial**	Test/Labs

Accu checks: 0700 _____ 1100 _____ 1600 _____ 2100 _____

Notes: Reminders:

APPENDIX M

PATIENT MAIN SCREEN


PAL
Full screen
Print
0 minutes ago
ALAB """Encounter Specific"""
Shift: 04 February 2016 7:00 - 04 February 2016 18:59
Name
Location
Age
Sex
Attending
Alle
New Order
New Lab Result
PRN/Contin
Current
7:00 - 10:59
11:00 - 14:59
15:00 - 19:00
SBP
DBP
O2 Sat
O2 Sat Val
CHARGE, BUCKY
ALAB 12
32 years
M
Test, Docn
LOOSER, ANGELA *
ALAB
55 years
F
120 mmHg
78 mmHg
98 %
LOOSER, ANGELA *
ALAB
55 years
F
MOTHER, GIRL/ANN
ALAB 02
3 months
F
Abdul-Latir
OMNICELL, MOCK DANIELLE
35 years
F
Test, Docn
OMNICELL, MOCK SHEA
29 years
F
Test, Docn