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**Medication-related Information Needs of Point of Care Registered  
Nurses During Patient Transfer**

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Nurses During Patient Transfer**

**by**

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## **Dedication**

To my daughter, Grace, thank you for your patience and sacrifice while I was on this journey. You never questioned my choices, and your understanding and support is never ending. Thank you for your letters on difficult days. They carried me through to the end. Please keep learning something new every day.

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To my parents and family, I appreciate your encouragement and willingness to help when I needed it most. Your loving support helped me achieve this degree. Thank you, Elizabeth Perry, for your friendship and support from day one. Thank you for all the encouragement during this journey.

## **Abstract**

### **Medication-related Information Needs of Point of Care Registered Nurses During Patient Transfer**

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Medication errors are a major concern for the U.S. healthcare system with between 380,000 and 450,000 preventable adverse drug events in hospitals each year. Because half the medication errors occur at admission, transfer, or discharge, The Joint Commission requires collection of a medication history and performing medication reconciliation. The purpose of this study was to gain an understanding of registered nurses' (RNs) information needs during medication processes throughout the patient intrahospital transfer process. The following research questions were examined: what are RNs' perceptions of information needs while performing medication management throughout the patient intrahospital transfer process, what are the perceived facilitators and barriers to resolving RNs' information needs while performing medication management throughout the patient intrahospital transfer process, and do perceived RN information needs affect resulting communication and decision-making while performing medication management throughout the patient intrahospital transfer process?

A qualitative descriptive study design using content analysis methodology was implemented. Ten RNs participated in the study. Semi-structured interview questions

focused on the components of medication use processes: obtaining a patient's medication history, medication reconciliation, and administering the first dose of a medication order following a patient's intrahospital transfer.

Four themes and seven sub-themes emerged from the interviews. RNs have clinical knowledge and patient information needs during medication use processes. Registered nurses also said trust was an important element when collecting a patient's current medication list. Furthermore, colleagues were used as an information source to resolve information needs, depending on the colleague's experience. There are facilitators and barriers to resolving information needs, such as the patient and electronic health record. An additional facilitator was the importance of assigning task responsibility in the processes. Information needs affected nurses' decision-making abilities with respect to determining completion of patients' current medication lists and determining the appropriateness of holding specific doses of medication. Finally, RNs shared experiences where communication served as potentially dangerous workarounds to resolving information needs.

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## **Chapter 1: Introduction**

Decision-making is fundamental to the delivery of safe, effective, and reliable health care. Every care process from assessment and diagnosis through the application and evaluation of interventions requires that clinicians make decisions. Clinical decision-making "is a contextual, continuous, and evolving process, where data are gathered, interpreted, and evaluated in order to select an evidence-based choice of action" (Tiffen, Corbridge, & Slimmer, 2014, p. 399). Clinical decision-making is affected by the complexity of health problems, available interventions, and the healthcare environment (Kannampallil, Schauer, Cohen, & Patel, 2011; Plsek & Greenhalgh, 2001). Health problems and available treatments are dynamic, multidimensional, and interdependent. Some changes in health status due to disease processes and/or interventions are immediate while others develop over time. Problems in one body system are often affected by problems in another. Likewise, treatments for one problem can adversely affect other domains of health and/or interact with other treatments. Because health problems and associated treatments are multidimensional, multiple clinicians representing a variety of disciplines frequently participate in the care of each patient. The decisions made by each provider potentially effect decisions made by every other provider. Moreover, these clinicians are often geographically separated from each other and/or the patients under their care. Consequently, clinical decision making in today's healthcare environment is complicated by the need to access and process large volumes of information from multiple sources at an appropriate speed and sequence to support time-sensitive interventions.

Poor clinical decisions result in errors and sub-optimal quality of care. The prevalence of error-related quality problems is significant. In 1997, the Institute of Medicine (IOM) reported that 44,000-98,000 deaths occur annually as a result of medical

errors (1999). More recent estimates indicated that millions of Americans experience preventable medical errors and that approximately 200,000 Americans die from preventable medical errors each year (Andel, Davidow, Hollander, & Moreno, 2012). Preventable medical errors are associated with significant societal costs to include an economic impact of \$1 trillion.

Given the prevalence and impact of preventable medical errors, it is imperative that we develop systems to support clinical decision-making. The release of *To err is human: Building a safer health system* has dramatically increased the focus on patient safety and quality in hospitals and healthcare systems. The report also provided possible solutions to improve patient safety in hospitals, including technology that, in combination with human knowledge, can improve the patient experience more than knowledge or technology by itself (IOM, 1999).

In order to create the technology to improve the safety and quality of patient care, an understanding of clinical decision-making is needed. Clinical decision-making is a mental process followed by clinician groups such as physicians, nurses, and pharmacists throughout patient care processes and is fundamental to high quality, reliable, and safe care. In order to improve clinical decision-making processes, one must understand how these groups process the clinical information used to make patient care decisions.

## **INFORMATION PROCESSING**

The Information Processing Model (IPM), which was first applied to medicine by Elstein, Shulman, and Sprafka (1978), depicts how clinicians mentally process information. Nurse researchers have subsequently applied this model to nursing (Carnevali, 1984; Tanner, Padrick, Westfall, & Putzier, 1987). Elstein et al. (1978) differentiated four processes in the IPM (cue acquisition, hypothesis generation, cue interpretation, and



hypothesis evaluation) and described them within the context of medical decision-making. Short- and long-term memories are central cognitive components in the human decision-making system (Thompson, 1999). Short-term memory receives information, creates a cognitive model, and transfers the information to long-term memory for storage. The cognitive model is used to prompt long-term memory where factual (semantic) and experimental (episodic) knowledge is stored (Thompson, 1999).

The first phase within the IPM involves cue acquisition and information gathering. In a clinical environment, this is the information collected through patient history and physical assessment procedures. Cue acquisition through information gathering serves as the foundation for making future patient care decisions. The next phase is hypothesis generation from the information available in the short-term memory. Due to the cognitive limitations of the human brain, only five to seven hypotheses can be considered at a time. In contrast, computer systems are not likewise constrained. Where a human can create five to seven hypotheses, a computer could consider thousands depending on availability of relevant data. Therefore, clinical information systems and clinical decision support systems are potentially beneficial to clinicians during this phase of decision-making.

Cue interpretation is the next phase and involves interpretation of the data gathered during cue acquisition. During cue interpretation, data are categorized based on perceived relevance to each hypothesis (e.g. irrelevant or relevant to confirm or negate a hypothesis). The human capacity for information processing during this phase of decision-making also is limited and surpassed by computer systems. Computers can process and confirm or negate hypotheses quicker than the human brain and can outmatch it in speed and accuracy. The final phase, hypothesis evaluation, is where the clinician selects one hypothesis after comparing alternatives based on the analysis of data in the earlier three stages (Elstein et al., 1978, Thompson, 1999). This phase requires clinical knowledge, subjective and

objective data, and knowledge of a patient's history to determine a course of action or intervention in patient care. It is where a clinician's knowledge and human processing are needed for decision-making in healthcare.

## **NURSING INFORMATICS**

In a piece of seminal work to the foundation of nursing informatics, Graves and Corcoran (1989) proposed a conceptual framework that is built upon the underpinning that nursing informatics supports the management and processing of nursing data, information and knowledge. The framework begins with a datum, a string of characters or a value. It has little meaning by itself. Data are represented by the string of alphanumeric characters, or even symbols, and can be a single character to a long string. Examples of data include 102.5 or 'redness'. The next concept in the framework is information. Information gives organization and meaning to the data. Information provides an interpretation that a temperature of 102.5 degrees is a fever in a patient or that redness in the skin is identified as a rash. Finally, knowledge is described as applying the science of nursing to the relationship of the information. Continuing the example previously described as signs and symptoms, the registered nurse caring for this patient recognizes the combination of these signs and symptoms as a possible infection and may need to contact the healthcare provider for laboratory orders and antibiotic prescription. The nurse should continue to monitor the patient's vital signs and implement a sepsis protocol.

Applying the nursing informatics clinical framework to information technology and the electronic health record (EHR), data is stored in a database. It is the information system or the EHR that organizes the data and presents it through a user interface to give context and provide information. When science is applied to the information, a clinical decision support system (CDSS) is created (Englebardt & Nelson, 2002).

## **CLINICAL DECISION SUPPORT**

The Office of the National Coordinator for Health Information Technology (ONC) defines clinical decision support (CDS) as a system that “provides clinicians, staff, patients, or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.” (HealthIT.gov, 2013b). Because there are limits to the human short-term memory, a CDSS assist in volume and speed to human capabilities and access mental models that trigger clinical information stored in long-term memory. Additionally, they can help the clinician when there is information that has been forgotten or was not known by the clinician.

The goal of clinical informaticians is to design safe and efficient clinical information systems to support effective clinical decision-making. This requires an understanding of what data are needed to facilitate cue acquisition and how data can best be presented to facilitate cue interpretation and hypothesis evaluation. This can be accomplished through the use of computerized alert, reminder, guideline, order set, documentation template, or context-specific reference information, or infobuttons.

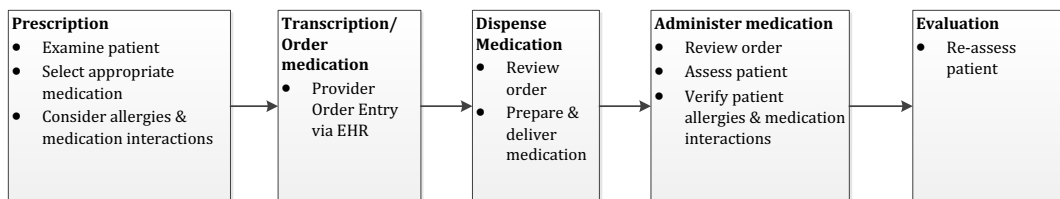
Although “information needs” have been studied for several decades, recent information technology developments have created a renewed interest in studying the information needs of clinicians. Informaticians desire to aid clinicians in having the information to make the best decisions about patient care. One possibility is to increase the understanding of clinicians’ information needs and how this information flows through communication and decision making with the goal of improving the display and usability of their information systems. One area that has received much attention is the need for more clinician information regarding appropriate medication use by patients, especially chronically ill, complex patients.

## **CLINICAL DECISION-MAKING FOR MEDICATION USE**

Although there are a multitude of decisions made by clinicians, decisions related to medication use are highly prevalent in today's healthcare environment. The IOM (2008) reported that each week four out of five adults take at least one medication (prescribed or over the counter) or dietary supplement. Additionally, they calculated that three out of five adults take over five medications. In order to provide effective and safe care, it is important for clinicians to understand all the medications a patient is taking. Important information a clinician needs to make appropriate and safe decisions include medication name, medication category, medication interactions, medication dose, medication dosing schedule, and the patient's allergies. Medication information for common medications is stored in the clinician's long-term memory, while the information about patient specific medication dosing and timing gathered during cue acquisition is stored and processed in the clinician's short-term memory. All of this information is required for decision-making.

Multiple clinical decisions are required to ensure that medications are accurately administered to achieve the desired therapeutic effects. Medication use is typically conceived as a five-phase, multidisciplinary process: (1) prescribing a medication, (2) transcribing the medication order, (3) dispensing the medication, (4) administering the medication, and (5) evaluating the patient's response to the medication (see Figure 1). Each of these actions also include sub-processes. In order to prescribe a medication a provider should assess the patient to determine if there is a therapeutic need for a medication. If a medication is to be ordered or prescribed, the provider should select the correct medication, taking into account current medication orders and patient allergies. Creating a medication order can occur through a hand-written order or through entering the medication order into a computerized provider order entry (CPOE) system. Prior to dispensing the medication, a pharmacist reviews the order and determines if there are any inappropriate components of

the order, such as an incorrect dose, route, form of administration, or timing. If appropriate, the medication is prepared and delivered to the patient or patient care area. In the inpatient setting medication administration is typically performed by nurses. The nurse should review the patient order, review medication and patient allergy interactions, perform a patient assessment, and review the “five rights” (right patient, right medication, right dose, right route, and right time). If these evaluations are appropriate, the nurse will administer the medication. Patient evaluation is the final step to ensure the medication is therapeutically appropriate for the patient.



*Figure 1.* The Medication Use Process

Poor decision-making in any of these phases can lead to errors in medication use, which can be harmful and costly. Bates et al. (1995) and Leape et al. (1995) evaluated medication errors and determined that errors occurred during most of the medication use process steps. Errors occurred in medication prescribing (39-49%), transcription (11-12%), medication dispensing (11-14%), and medication administration (26-38%). Although medication errors occur throughout the medication use process, they also occur throughout patient hospital stays. Researchers concluded that half of all medication errors occur at patient admission, discharge, or transfer (Bates et al., 1997; Marino et al., 2002; Rozich et al., 2004). In a prospective study, Cornish et al. (2005) reported that 53.6% of inpatient admissions had at least one discrepancy in medication admission orders compared to the patient’s medication regimen prior to hospital admission. Forty-one percent of these errors

were errors of omission, meaning they were medications the patients were taking prior to their admission, but the medications were not ordered once the patients were admitted. Also, in evaluating the discrepancy in patient orders, the team found that 38.6% of the errors were moderate to severe in nature (due to the category of the medications), demonstrating the potential for medication-related adverse outcomes.

Although patient safety is of primary concern, it would be remiss to not include the financial implications of medication errors in the United States due to increased monitoring and lengthened stays. In the original IOM quality report (1999), it was calculated that preventable medication errors cost the nation approximately \$2 billion annually. A follow-up study by the IOM (2006) concluded that each preventable medication error adds \$8,750 to each patient stay. Subsequent reports estimated the cost to hospitals and insurers ranged from \$7 to \$20 billion each year (IOM, 2006; National Quality Forum and National Priorities Partnership, 2006).

Reducing the incidence of medication errors is a patient safety and quality concern throughout the United States. According to the IOM, approximately 7,000 deaths each year are attributable to medication errors. Medication errors include errors in type of medication, dosage, route, and/or timing. Although some errors, such as decreased dosage or wrong time, may appear to be minimal, to the sickest, oldest, or youngest patients these errors may have significant negative outcomes (IOM, 1999).

Evidence suggests that errors occur at multiple points during and following patient transfers, both within hospitals and between healthcare facilities. Santell (2006) found that half of all medication errors occur at transition points of admission, transfer, or discharge of a patient, with 66% occurring during patient transfer between units or departments. Gleason et al. (2010) evaluated medication reconciliation and ordering at admission and discovered 36% of patient admissions resulted in errors in 5% of medication orders. These

researchers also found that in errors that reached the patient, 52.4% of the instances required additional patient monitoring or intervention and 11.7% of the errors were considered potentially harmful to the patient.

## **MEDICATION RECONCILIATION**

Given the frequency of medication errors at the point of patient transfer, special procedures that include obtaining a current medication list and reconciling discrepancies in prescribed medications at the points of patient admission, discharge, and transfer are now required by The Joint Commission (TJC) as part of the National Patient Safety Goals (NPSG) (2013). The process of medication reconciliation assists the clinician in obtaining the appropriate patient-specific medication information that can be used to ensure the appropriate medications, dosages, and timing occur when a patient is admitted or transferred throughout a hospital. Pronovost and colleagues (2003) examined the discharge reconciliation process and compared prescriptions given to the patient at discharge to the medications the patient was receiving in the hospital. The process almost eliminated medication errors among the prescribed discharge medications (Pronovost et al., 2003). Subsequently, TJC required hospitals to implement a medication reconciliation process as a NPSG in 2005. There were some components that were required, but hospitals were given flexibility in creating their own processes.

Researchers also found that medication reconciliation processes decreased medication-ordering errors (Andreoli et al., 2014; Greenwald et al., 2010; Lehnborn, Stewart, Manias, & Westbrook, 2014; Pronovost et al., 2003; Steeb & Webster, 2012) and these processes were endorsed or recommended to improve patient safety by TJC (2013), the Institute for Healthcare Improvement (n.d.), and the World Health Organization (2007). Despite these results and recommendations, there have been significant barriers to properly

implementing the medication reconciliation process. One of the most common barriers is that organizations do not agree about who is responsible for the different components of medication reconciliation. Research findings showed that nurses, physicians, and pharmacists collect the patient's current medication list and perform medication reconciliation (Cadwallader et al., 2013; Greenwald et al., 2010; Kwan, Lo, Sampson, & Shojanian, 2013; Lehnborn et al., 2014; Steeb & Webster, 2012). Additionally, there are differences in the data elements collected in the medication list, although medication name, dose, and administration schedule are common items that are collected. Other reported items included time of last dose and patient reported medication adherence (Cadwallader et al., 2013; Greenwald et al., 2010; Steeb & Webster, 2012). Another barrier is the time reported to perform the components of collecting a current medication list and performing medication reconciliation. (Andreoli et al., 2014; Cadwallader et al., 2013). Overall, there was a lack of established best practices that were agreed upon and researched in the articles reviewed.

Despite implementing processes, such as medication reconciliation and CPOE systems, more recent reports suggested that medication errors continue to occur and patients continue to be harmed by these errors (James, 2013). Because of these adverse events, additional areas of practice need to be studied. Consequently, information technology is being applied with increasing frequency to support decision-making related to medication use. Effective CDSS may help reduce these errors. In order to build effective CDSS for medication reconciliation, clinical informaticians must first understand information needs.



## **SIGNIFICANCE**

In order to create EHR that are more efficient and fully realize the benefits for clinicians and patients, understanding the use of data by the clinician was imperative. The proposed study was significant because: (1) medication errors occur frequently throughout the healthcare system, especially at points of transfer between and within levels of care; (2) clinicians have information needs with regard to medication management; (3) there are human and healthcare system cost-benefits associated with preventing medication errors.

## **PURPOSE**

The purpose of this study was to gain an understanding of registered nurses' information needs during medication processes throughout the patient intrahospital transfer process. For the purposes of this study intrahospital transfers included hospital admissions and transfers between two hospital departments or inpatient units. This study consisted of a qualitative design using semi-structured interviews with registered nurses working in an adult inpatient setting. The interviews focused on the information desired during the following medication management processes: (1) obtaining a patient's current medication list, (2) reconciling medications during intrahospital transfer, and (3) administering the first dose of a medication following a patient intrahospital transfer. For the purpose of this study, intrahospital transfer included a hospital inpatient admission and transfer of a patient between units within a hospital. Content analysis was used to create themes from the interview data. This research created a foundation to understand the information needs that result from medication processes throughout the patient intrahospital transfer process with the ultimate goal of creating solutions that assist clinicians in communication and decision-making.

## **RESEARCH QUESTIONS**

The aims of this study were (1) to gain insight into the information needs of clinicians during medication processes at the time of intrahospital transfer, (2) determine the perceived facilitators and barriers to resolving clinician information needs while performing medication management throughout the patient intrahospital transfer process and (3) determine if these information needs affect the resulting interdisciplinary communication and decision-making within the context of patient safety at the time of intrahospital transfer. The research questions were: (1) What are registered nurses' perceptions of information needs while performing medication management throughout the patient intrahospital transfer process? (2) What are the perceived facilitators and barriers to resolving registered nurses' information needs while performing medication management throughout the patient intrahospital transfer process? (3) Do perceived clinician information needs affect the resulting interdisciplinary communication and decision-making while performing medication management throughout the patient intrahospital transfer process?

## **THEORETICAL AND OPERATIONAL DEFINITION OF TERMS**

The variables of interest in this study included: clinical information needs, intrahospital transfer, adverse drug event, medication use processes, medication errors, patient handoffs, EHR, clinical decision making, clinical decision support, and medication reconciliation. During the interview process the participants were provided with the empirical definitions used by the researcher. The theoretical and empirical definitions for these variables applied in this study were:

### **Clinical Information Need**

The theoretical definition of a clinical information need is a conscious expression, which can be verbal or nonverbal, of a desire for answers to clinical questions in the course of patient care (Forsythe, Buchanan, Osheroff, & Miller, 1992; Gorman, Yao, & Seshadri, 2004). This concept was defined for the clinicians as an event where information is needed to answer a clinical question regarding medication management during the intrahospital transfer process.

### **Intrahospital Transfer**

An intrahospital transfer is a time of transition when a patient is moved from one location of the hospital to another. This may also include a change in service, provider, caregiver, or level of care (Ong & Coiera, 2011). This concept was defined for the clinician as the time immediately before, during, and immediately after the patient is moved from one patient care area within the hospital to another patient care area within the same hospital, including hospital admissions and transfers.

### **Adverse Drug Event**

The Agency for Healthcare Research and Quality (AHRQ) defines an adverse drug event as a patient injury that occurs as a result of medication use during medical care (AHRQ, n.d.). This concept was defined for the clinician as an event that results in harm or injury to a patient as a result of medication use.

### **Medication Use Processes**

Medication use processes were defined for the clinician as a set of actions followed by clinicians to prescribe medications, process orders, dispense medications, administer medications, and evaluate patients' responses to medications. This includes the processes

of collecting a current medication list, performing medication reconciliation, and administering the first dose of a medication after a patient's intrahospital transfer.

### **Medication Error**

The National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) defines a medication error as

"any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labeling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use" (NCCMERP, 2014, paragraph 1).

This concept was defined for the clinician as an event of inappropriate medication use or omission that results in harm or potential harm to a patient.

### **Patient Handoff**

A patient handoff is a process where a clinical caregiver for a patient transfers responsibility to another clinical caregiver (Patterson & Wears, 2010). The process should include information about patient care, upcoming interventions and therapies, as well as the patient's current condition and any recent or anticipated changes (TJC, 2013). This concept was defined for the clinician as the process of transferring responsibility of clinical care for a patient from one clinician to another.

## **Electronic Health Record**

The EHR is an electronic version of the patient chart. It is comprehensive, patient-centered, and should be accessible by different clinicians in different patient settings, such as inpatient hospitals, outpatient clinics, rehabilitation therapy, home health care, etc. (HealthIT.gov, 2013). This concept was defined for the clinician as the electronic version of the patient chart.

## **Clinical Decision-Making**

Clinical decision-making "is a continuous and evolving process in which data are gathered, interpreted, and evaluated in order to apply evidence to formulate a decision." (Tiffen, Corbridge, & Slimmer, 2014, p. 400). This concept was defined for the clinician as an event where there is a choice in action regarding medication management during the intrahospital transfer process.

## **Clinical Decision Support System**

The ONC defines a CDSS as a system that "provides clinicians, staff, patients, or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care." (HealthIT.gov, 2013b). This was defined for clinicians as a tool, system, or process that guides or reminds the clinician with information to aid in the decision-making process. This support is most commonly available in the form of a computerized alert, reminder, guideline, order set, documentation template, or context-specific reference information, or infobutton.

## **Medication Reconciliation**

According to TJC, medication reconciliation is the process of evaluating a patient's medication orders while in the hospital and comparing them to the medication(s) the patient

takes at home or while in another care facility. This process is comprised of the following steps: (1) create a list of the current medications a patient is taking or is prescribed; (2) create a list of medications to be prescribed during the patient’s inpatient stay; (3) compare the medications on the two lists for completion; (4) make clinical decisions based on the comparison to determine if there are any additions or deletions; and (5) communicate the new list to clinicians and the patient. (TJC, 2013). (See Figure 2.) Clinical decisions in point four could include additions or deletions of medications, reviewing lists for drug interactions, appropriate dosing, and reviewing medication orders against patient allergies. This concept was defined for the clinician as the process of evaluating a patient’s medication orders while in the hospital and comparing them to the medication(s) the patient takes at home or while in another care facility.

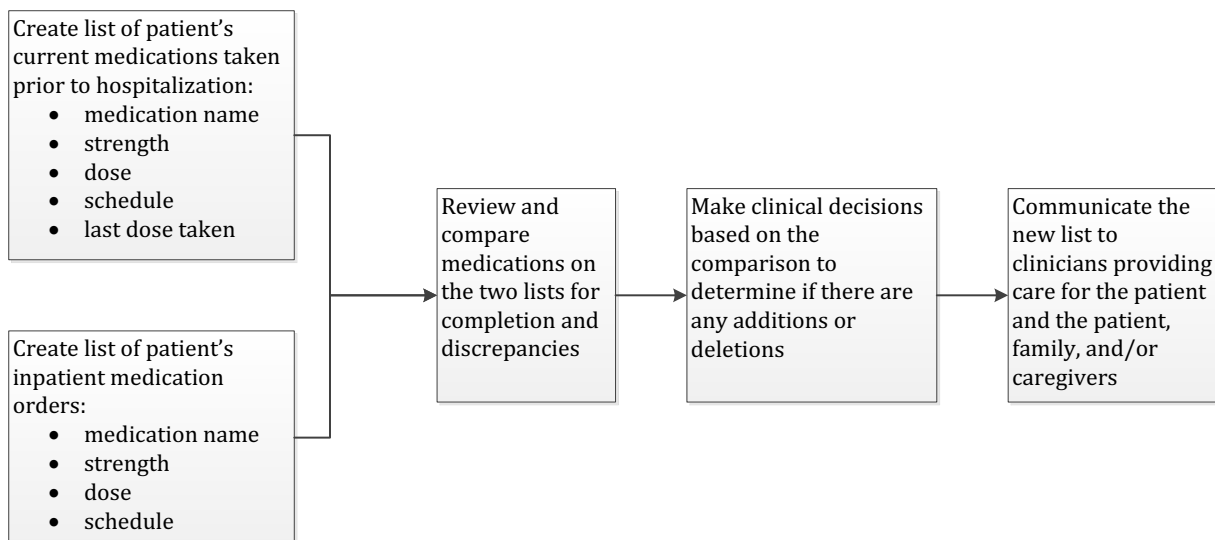


Figure 2. The Medication Reconciliation Process

## **ASSUMPTIONS**

The following assumptions were made as part of this study: (1) Clinicians have information needs during a patient's intrahospital transfer process, (2) Clinicians will be open and honest about their clinical practice experiences regarding information needs during the interviews, and (3) Clinicians will explain their perceived information needs fully within the interviews.

## **SUMMARY**

The background and significance surrounding clinician medication-related information needs throughout the patient intrahospital transfer process were provided in this chapter. Definitions of concepts that were examined during the study also were discussed. The purpose of this study was to gain an understanding of registered nurses' information needs during medication processes throughout the patient intrahospital transfer process. The study consisted of a qualitative design using semi-structured interviews with registered nurses. The interviews focused on the following components of medication management processes: (1) obtaining a patient's current medication list, (2) performing medication reconciliation, and (3) administering the first dose of a medication order following patient intrahospital transfer. This study served as the foundation for a program of research that investigates clinician information needs with the ultimate goal of implementing clinical information system changes that could lead to better resolution of information needs and ultimately, decreases in medication-related errors.

## **Chapter 2: Literature Review**

### **INTRODUCTION**

The focus of this study was to determine common themes in clinician interviews about medication-related information needs throughout the hospital transfer process, including patient admission and transfer between units. In this chapter a review of relevant literature is provided about information processing and how it relates to clinical decision-making, clinical information needs among registered nurses, medication management processes when collecting a patient's current medication list and during medication reconciliation, as well as medication-related information needs during the transfer process. It also includes how technology is used with these concepts.

After reviewing common keywords found in initial literature, the following databases were searched for articles to use in this review: (1) Pubmed, (2) CINAHL, (3) Medline, and (4) Academic Search Complete. After a cursory search, inclusion and exclusion criteria for each group of search terms were determined. All articles had to be available in the English language as well as meet additional inclusion and exclusion criteria. For the search about information processing and clinical decision-making, articles had to pertain to registered nurses or registered nurses within a clinician group of participants in an inpatient healthcare setting. Additional non-healthcare specific background literature from other disciplines (i.e., economic decision theory) was also included to create a foundation about these information processing and clinical decision-making. When reviewing the literature about clinician information needs, the research had to include the information needs of registered nurses or registered nurses within a clinician group of participants in an inpatient healthcare setting and include a measurement or study of information needs. Furthermore, the registered nurses or clinician groups needed to



focus on patient care. Therefore, groups such as administrators were excluded. Search terms around information behavior and information seeking were included because these two concepts may be studied as the result of having an information need. Research that focused on patient or family information needs was excluded. The setting of the research needed to be in an inpatient hospital setting to be included and settings such as outpatient, primary care clinics, and public health were excluded. Medication reconciliation studies had to be in an inpatient setting and articles that only defined the process were excluded.

Once inclusion and exclusion criteria were established, keywords for searching were determined. Five categories of search were performed: (1) information processing, (2) information needs, information seeking, or information behavior, (3) clinical decision-making, (4) medication reconciliation, and (5) workarounds. The following keyword searches were performed in the four databases:

"information processing" nurse	"information seeking" nurse
"information processing" nursing	"information seeking" nursing
"information needs" nursing	"information behavior" nurse
"information needs" nurse	"information behavior" nursing
"information needs" clinician	"clinical decision making" informatics
"information need" nursing	workaround informatics
"information need" nurse	"medication reconciliation"

Inclusion and exclusion criteria were applied to the search details in each database and 654 articles were identified after title review. Next, 32 duplicate records were removed using reference management software. The remaining 622 records identified were screened via abstract review for inclusion and exclusion criteria. This resulted in 267 records being removed and the remaining 355 articles were assessed for eligibility via full text review. Two hundred and twenty-seven articles were removed for the following reasons:

- (a) outpatient setting or assessed the information needs of primary care nurses,
- (b) the research did not examine or measure information needs,
- (c) the study focused on other clinician groups such as healthcare providers, administrators or nurse managers, or did not focus on those providing patient care,
- or (d) the article did not contain research findings, such as a news article, editorial, or description of a software solution. (See Figure 3).

The remaining 128 articles were reviewed for a pertinent summary of literature related to medication-related clinician information needs in an inpatient hospital setting.

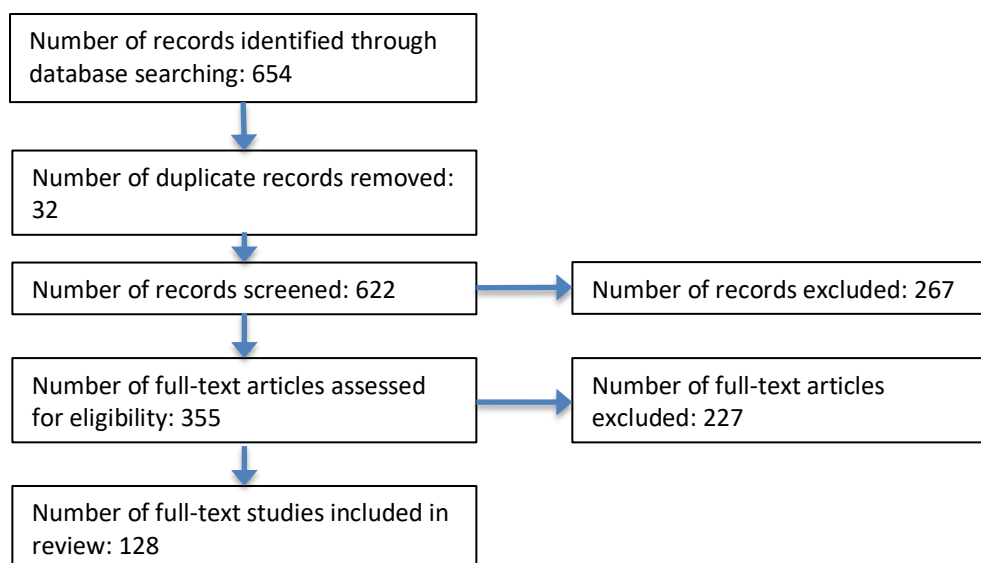


Figure 3. Review of literature article selection process

## **INFORMATION PROCESSING AND CLINICAL DECISION-MAKING**

It is imperative to understand information processing and clinical decision-making in order to build a foundation for decision support for clinicians in healthcare settings and the literature discovered for this review was often intertwined and multiple articles included both concepts. Cognitive psychology emerged in the 1950s and out of this field the Information Processing Model (IPM) was developed. In its most basic state, the IPM accounts for the human brain taking in information, storing that information, and retrieving it later for use in processing other information (Newell & Simon, 1972). This is the foundation for a clinician's decision-making process and is the interaction between the clinician and the "task environment" (Newell & Simon, 1972; Taylor, 2000). The task environment includes the environment that is coupled with a goal, problem, or task (Newell & Simon, 1972). In the IPM, human information processing consists of two parts: short-term memory and long-term memory, but all information processes occur in and out through the short-term memory (Newell & Simon, 1972). Short- and long-term memories are central cognitive components in the human decision-making system (Thompson, 1999). Short-term memory consists of receiving information, creating a cognitive model, and transferring the information to long-term memory for storage. The cognitive model is used to prompt long-term memory, where factual and episodic knowledge is stored (Thompson, 1999).

Short-term memory occurs when small amounts of information are taken in and stored it for a short period of time. The human brain is capable of storing between five to nine pieces of information at a time in short-term memory (Elstein et al., 1978; Newell & Simon, 1972). Long-term memory storage is thought to be endless (Newell & Simon, 1972). A basic premise proposed by Galbraith (1974) is that the greater the uncertainty involved in a decision, the more information that must be processed by the decision maker.

Although there is an enormous capacity for long-term storage (Wilkinson, 1997), bounded rationality emphasizes that there are limits to human processing capacity of short- and long-term memory (Newell & Simon, 1972).

There are several assumptions within the IPM. First, it assumes the clinician makes decisions based solely on a rational, linear pattern that does not involve emotional or cultural inputs. Another assumption is that a person's long-term memory is restricted by bounded rationality (Simon, 1955). This means that there is no specific amount of knowledge an individual can retain and that people have different abilities in knowledge retention and retrieval. A third assumption in this approach is that all situations can be dismantled into individual pieces of data to be collected by a clinician. This model also assumes that in every situation a clinician should be able to explain his or her decision-making process. Finally, cognitive biases can occur in information processing. Kahneman and Tversky (1973) supplied foundational research about cognitive bias, several of which apply to healthcare settings. One of the biases addressed is the availability heuristic, where individuals have a belief based on what is immediately recalled. In healthcare, many tasks are repetitive, especially within a specialty unit. Nurses may have patients with the same diagnoses, surgical procedures, and similar medication lists that lend to a bias based on what was recently experienced with another patient. Another instance of cognitive bias is that of a representativeness heuristic (Tversky & Kahneman, 1983). This bias addresses the use of stereotypes in making decisions during the care of patients. In the representativeness heuristic, individuals believe objects that belong to a category must be similar, thus applying a stereotype or judgment to an individual. These stereotypes could pertain to patients that belong to a cultural group or those with a particular diagnosis. A third phenomenon is called 'anchoring,' and refers to an individual holding a bias for an

original hypothesis or hypotheses rather than opening up to other possibilities (Harbison, 2001).

From the IPM, hypothetico-deductive decision-making emerged. Hypothetico-deductive decision-making embraces two types of reasoning: induction and deduction. Induction is where data collection occurs and leads the clinician to the generation of a hypothesis or hypotheses. Deduction is the act of using a hypothesis or hypotheses to predict the presence or absence of data, which are then used to confirm a hypothesis or make one null (Buckingham & Adams, 2000).

The IPM is frequently used by researchers (Corcoran, 1986; Hurst, Dean, & Trickey, 1991; Kalisch & Begeny, 2006; Narayan & Corcoran-Perry, 1997; Offredy, 2002; Offredy & Meerabeau, 2005; O'Neill, Dluhy, & Chin, 2005; Westfall, Tanner, Putzier, & Padrick, 1986) as a conceptual model in clinical decision-making research because clinical decision-making is a cognitive task and the researchers are studying decision-making behavior in relation to the clinical cognitive task at hand (Narayan & Corcoran-Perry, 1997). This is important to understand as a foundation for decision support research and the creation of clinical decision support systems (CDSS).

## **Decision-making in Clinical Domains**

### ***Decision-making in Nursing***

Foundational decision-making work in nursing by Carnevali (1984) integrated the IPM and the work of Elstein et al. (1978) into a decision-making model for nursing by extending the steps into the following process: pre-encounter data, entry to the data search field and shaping direction of data gathering, and coalescing cues into clusters or chunks, activating possible diagnostic explanations (diagnostic hypotheses), hypothesis and data-directed search of the data field, testing diagnostic hypotheses for a good fit, and selecting

a diagnosis. The combined processes of pre-encounter data, entry to the data search field and shaping direction of data gathering, and coalescing cues into clusters or chunks are similar processes to cue acquisition as described by Elstein et al. (1978). During these phases, the nurse is gathering information, taking it into short-term memory, and creating chunks for easier hypothesis generation. Then the nurse creates possible hypotheses by activating possible diagnostic explanations (diagnostic hypotheses), also similar to Elstein et al. (1978). The nurse performs cue interpretation during a hypothesis and data-directed search of the data field and hypothesis evaluation while checking for goodness of fit. Carnevali (1984) also added a component for diagnosis. Although this was not stated as a step by Elstein et al. (1978), it is the goal of the process they reported.

Of the 29 articles that specifically identified decision-making processes of nurses, 12 authors referenced the IPM with regard to the decision-making processes of nurses (Clack, 2009; Ferrario, 2004; Jones, 1988; Lauri & Salanter, 1998; Lewis, 1997; O'Neill et al., 2005; Ruland, 1996; Schommer, Worley, & Kjos, 2014; Taylor, 2000; Thompson, 1999; Thompson, Spilsbury, Dowding, Pattenden, & Brownlow, 2008). Other decision-making models such as intuition and Benner's Model of Clinical Expertise were used to frame studies about decision-making in nursing. Sixteen articles were either reviews of the literature, analyses of decision-making models, or contained discussions of one or multiple decision-making models. Additionally, there were two articles where the authors analyzed differences in the decision-making processes of physicians, nurses, and pharmacists (Salanter, Eriksson, Junnola, Salminen, & Lauri, 2003; Schommer et al., 2014).

### **Information Processing and Clinical Decision-making in Research**

In the review of the literature similarities were found between the way physicians, nurse practitioners, and registered nurses organized and processed patient-related

information (Di Giulio & Crow, 1997; Offredy, 2002; Offredy & Meerabeau, 2005). In a 2005 study, Offredy and Meerabeau, used think-aloud techniques to determine similarities in how general practitioners and nurse practitioners organized and used patient data. Both groups used highly complex data within a patient situation; difficulties identified in decision-making for nurse practitioners was related to new experiences and a lack of exposure to the real-time patient situations that were studied. These results confirmed an earlier study by Offredy in 2002, who used a think-aloud approach and reported similarities in decisions related to diagnoses and treatments. Although decision-making processes and results were similar between both groups in these studies, the 2002 study findings showed that nurse practitioners took more time than physicians to get to the same decision. Additionally, studies have examined factors that influence the decision-making process in healthcare providers and nurses. All groups are influenced by the complexity of the task, the experience of the decision-maker, the knowledge of the decision-maker, intuition, and the clinical discipline involved (Di Giulio & Crow, 1997; Jones, 1988; McLaughlin, Rikers, & Schmidt, 2008; O'Neill et al., 2005; Offredy, 2002; Offredy & Meerabeau, 2005).

### **Clinical Decision-making Specific to Medication Use Processes**

Although most of the clinical decision-making process literature focused on the process of diagnosing a patient, medication processes lend themselves to decision support, especially when coupled with electronic health record (EHR) technology. There were three research articles retrieved specific to the clinical decision-making process with regard to medication use processes that support the use of hypothetico-deductive decision-making, but that there may be differences in information needs based on clinician type (Di Giulio & Crow, 1997; Manias, Aitken, & Dunning, 2004; Schommer et al., 2014). In an

observational study, Manias et al. (2004) examined graduate nurses during medication processes to classify decision-making processes that were followed. Hypothetico-deductive reasoning was observed over twice as frequently (25 instances) as other decision-making models of pattern recognition (10 instances) and intuition (two instances).

Through a simulation exercise using think-aloud techniques, Di Giulio & Crow (1997) analyzed decision-making behaviors of physicians and nurses when administering PRN medications. Findings from the study showed that physicians and nurses both generate a series of hypotheses early within the simulation exercise. Differences between the groups were that physicians were more likely to rely on theory and/or experience than nurses. Additionally, nurses collected more information from the patient directly, as well as vital signs and pain assessment data, compared to physicians. The researchers also reported that physicians' main concern was to make the correct diagnosis, where nurses reported their concerns were patient reactions to PRN medications and collaboration with the patient regarding a plan of care.

### **Information Processing and Informatics**

As computers have become commonplace within industries, systems are being developed for healthcare environments and specifically for healthcare clinicians because computer systems are not constrained by limitations of the human brain. Where a human can evaluate five to seven hypotheses at a time, a computer could consider thousands depending on availability of relevant data. Therefore, clinical information systems and clinical decision support systems are potentially beneficial to clinicians during this phase of decision-making. The human capacity for information processing during this phase of decision-making also is limited and surpassed by computer systems. Computers can process and confirm or negate hypotheses quicker than the human brain and can outmatch



it in speed and accuracy. Because of the amount of data a computer can review, significant resources are being directed to implement systems and clinical decision support systems to aid clinicians with these decision-making processes. Although clinical information is one of the components needed by a clinical decision support system, it is also necessary to understand the information needs of the clinician to make sure the appropriate support is provided by the clinical decision support system.

### **INFORMATION NEEDS DEFINITION**

Only eight articles provided a specific definition of an information need (Allen et al., 2003; Baro, 2013; Davies, 2011; Forsythe et al., 1992; Osheroff et al., 1991; Ricks & ten Ham, 2015; Shim et al., 2006; Xu et al., 2005). Osheroff et al. provided an operational definition of an information need as a “desire for further information that was expressed by a study subject during routine activity in the study setting” (1991, p. 576). Forsythe et al. included the most comprehensive definition as “conscious expressions (verbal or nonverbal) of a desire for more information by one or more people” (1992, p. 185). Additionally, the authors distinguished information needs from information deficits, which may or may not be conscious needs. Allen et al. recognized an information need when a clinician “expressed (implicitly or explicitly) the need for additional information to formulate a clinical decision” (2003, p. 26). Xu et al. referred to a definition by Nicholas where an information need is when “ a person recognizes a gap in his/her state of knowledge and wishes to resolve that anomaly” (2005, p. 839). Shim et al. defined an information need as “a categorization of various ‘information pieces’ required by a nurse to perform his/her task” (2006, p. 492). Ricks and ten Ham (2015) provided definitions of key concepts, including that of an information need as “a state or process started when one perceives that there is a gap between the information and knowledge available to solve a

problem and the actual solution of the problem” (p. 2). They also provided an operational definition for the purpose of their study where an information need was referred to as “the identified knowledge gap as indicated by the participant” (p. 2). Davies (2011) provided a vague operational definition from Barrie and Ward (1997) that an information need occurred when there was the “presence of questioning behavior.” The final definition found was by Baro, who cited a 1990 definition from Ehikhamenor, “The extent to which information is required to solve problems, as well as the degree of expressed satisfaction or dissatisfaction with the information” (2013, p.183). Although a definition was not provided, there were articles where researchers measured the number of questions a clinician asked during a patient care encounter and the number of information deficits (Bass, DeVoge, Waggoner-Fountain, & Borowitz, 2013; Koch et al., 2012), contextual queries (Fafchamps, Young, & Tang, 1991), or clinical queries (Chase, Kaufman, Johnson, & Mendonca, 2009) that occurred while providing care for a patient. Other researchers provided no definition of what they were measuring regarding information needs (Ayatollahi, Bath, & Goodacre, 2013; Blyth & Royle, 1993; Borycki & Lemieux-Charles, 2009; Chen & Cimino, 2003; Collins, Currie, Bakken, & Cimino, 2009; Collins, Bakken, Cimino, & Currie, 2007; Currie et al., 2003; Daouphars et al., 2012; Devi & George, 2008; Forsman, Anani, Egham, Falkenhav, & Koch, 2013; Lappa, 2005; Lundgren-Laine, Kalafati, Kontio, Kauko, & Salanterä, 2013; Lundgren-Laine et al., 2013; Martinez-Silveira et al., 2008; McKnight, Stetson, Bakken, Curran, & Cimino, 2001; Michel-Verkerke, 2012; Patterson, Blehm, Foster, Fuglee, & Moore, 1995; Remen & Grimsmo, 2011; Sarcevic & Burd, 2008; Wen, Guan, Zhang, & Lei, 2018; Wong et al., 2011).

In summary, few studies about information needs contained definitions of the concept that was being measured. Although there is no gold standard definition that is referenced, there is agreement among researchers that provided a definition of an

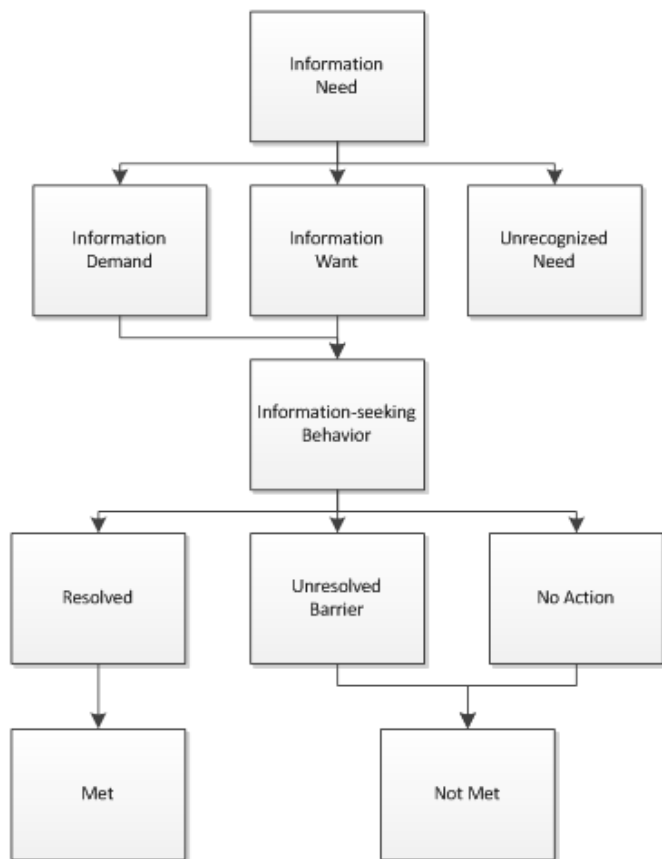
information need. Those that provided a detailed definition, defined an information need as more than just a question or questioning behavior, but also included that it was involved in providing patient care or used in clinical decision-making. The majority of researchers implied they were evaluating the questions clinicians had, often while providing direct patient care.

### **CLINICIAN INFORMATION NEEDS**

Information needs are important for the clinical informatician to understand. One of the goals of an EHR is to help provide information cues that the clinician can tie to knowledge and experiences in long-term memory, as well as the creation of clinician decision support systems to reduce cognitive load on clinicians. Also important is the understanding of the challenges that occur in meeting those information needs. Nicholas (2000) categorized information needs as information demands, information wants, and unrecognized information needs. When an individual becomes cognizant of an information need, there are information wants and information demands. Information wants include elements of information an individual thinks they might need to make or inform a decision. Information demands are required pieces of information needed by an individual to make a decision (Nicholas, 2000). Another type of information need is the unrecognized information need where the need for information can be unrecognized by the individual. Unrecognized information needs occur when an individual is unaware of the information that is available or may not even realize there is an information gap in their knowledge.

When an information need is identified and an individual decides to pursue fulfilling the need, information-seeking behavior ensues. Information-seeking behavior is a visible behavior. Because information-seeking is a behavior, it is more visible and is often used as a cue that there is an information need during research about information needs. In

resolving information needs, they are either met (resolved) or unmet. When information needs are not met for the clinician, there are two reasons. The other reason for not meeting an information need is that the individual is unable to get resolution to fulfill an information need either from barriers in finding the information or because the individual decides not to seek out the information. (See Figure 4.)



*Figure 4.* Visualization of Information Needs

### **Information Needs Methods**

A variety of methods were used to research clinician information needs. One method used to capture clinicians' information needs is the think aloud method. The think

aloud method to understand clinicians' decision-making process was used in 44 of the articles reviewed in the literature describing information needs and decision-making processes. The think aloud method has been used both in decision-making (Aitken, 2003; Cato & Bakken, 2012; Collins et al., 2009; Durning et al., 2013; Fafchamps et al., 1992; Johnson & Turley, 2006; Li et al., 2015; Narayan & Corcoran-Perry, 1997; Offredy, 2002; Offredy & Meerabeau, 2005) and as a technique in education (Ericsson & Smith, 1991). The think aloud method was developed from Newell and Simon's IPM (1972) and was first discussed by Ericsson and Simon (1993) regarding the validity of recall and the description of participants who were asked to think aloud while problem solving and making decisions. There are two types of think aloud protocols found in the literature: (1) concurrent, and (2) retrospective (Fonteyn & Fisher, 1995; Lundgren-Laine & Salantera, 2010). Concurrent think aloud protocols require the participant to think aloud while performing a task, problem-solving, or making a decision, and participants are prompted to speak aloud during pauses (Fonteyn & Fisher, 1995; Lundgren-Laine & Salantera, 2010). Retrospective think aloud protocols require participants to recall what they were thinking or to describe their thought processes during a decision-making process in the past.

In support of using the think-aloud protocol to learn about a clinician's decision-making process, Durning et al. (2013) used functional magnetic resonance imaging (fMRI) to compare differences in brain activity of physicians while comparing answering a multiple choice question to thinking aloud while answering a question. The researchers found statistically significant differences in brain activity between the two methods of answering a question. The differences found during the study are supported by current cognitive theory and add support to the idea that a think aloud protocol can be used to study decision-making processes.

The use of the think aloud protocol method is frequently used in information needs and decision-making research (Aitken, 2003; Cato & Bakken, 2012; Collins et al., 2009; Durning et al., 2013; Fafchamps et al., 1992; Johnson & Turley, 2006; Li et al., 2015; Narayan & Corcoran-Perry, 1997; Offredy, 2002; Offredy & Meerabeau, 2005). However, concerns about this methodology were identified. These concerns included that research participants may make up details or describe processes they may not normally use, but instead described desired processes (Fonteyn & Fisher, 1995; Lundgren-Laine & Salanterä, 2010).

Fifty-five of the information need studies included in this review used surveys or questionnaires as a method of capturing information about clinician information needs. Only authors of three articles described the tools used and included information about validity and reliability. Lundgren-Laine et al. (2013) and Lundgren-Laine, Kontio et al. (2013) published two research articles that described a survey that was developed based on observations in the intensive care unit (ICU). While describing the results, the researchers also reported the reliability and validity of their online survey. The tool was developed based on a prior qualitative study that examined the decision making of ICU shift leaders. The survey was reviewed by experienced clinicians and piloted in a 12-bed ICU. The survey contained two sections: demographic information about the participants and the work unit. The 122 elements that captured work unit data were divided into six categories (patient admission, organization and management of work, allocation of staff, material resources, special treatments, and patient discharge). Each element was scored on a 0-10 scale and the respondent was to score each element based on the importance of the information. Ricks & ten Ham (2015) also used a questionnaire to understand the information needs of professional nurses employed in an inpatient hospital setting. The questionnaire was described to include 250 of open- and close-ended questions to

understand the nurses' access to information, information sources, how information was being used by the nurses, and the information needs of nurses at the point of care. The researchers reliability and validity in support of the questionnaire. A pre-test trial of the questions was performed to reduce ambiguity in the questions. Content validity was supported through the review of the literature and expert review of the questionnaire. Other surveys, questionnaires, and instruments were reported by researchers, but validity and reliability were not reported. The instruments included items that described information needs (Barro, 2013; Davies, 2011; Martinez-Silveira & Oddone, 2008; McKnight et al., 2001; Patterson et al., 1995; Ricks & ten Ham, 2015; Wen et al., 2018), information-seeking behaviors (Barro, 2013; Davies, 2011; Martinez-Silveira & Oddone, 2008; McKnight et al., 2001; Ricks & ten Ham, 2015), success in resolving information needs (McKnight et al., 2001), barriers to resolving information needs (Patterson et al., 1995; Ricks & ten Ham, 2015) and clinician attitudes toward technology (Patterson et al., 1995). Other research methods found in the literature included the evaluation of data files to analyze how clinicians were using computer applications like the EHR or other information tools, such as Infobutton links (Collins et al., 2007), and direct observation or recording EHR use while performing patient care or working through a clinical scenario (Collins et al., 2009).

Despite the different instruments and questionnaires that were developed in prior studies, none of them were used in multiple studies. Also, none of the instruments were used to evaluate medication-related information needs. These findings support the need for conduct of a qualitative study that does not use a previously developed instrument.

## **Clinician Information Needs Research Results**

### ***Clinician Information Needs***

All articles reviewed related to the study of clinician information needs suggest that clinicians have information needs while providing care for patients. In reviewing the literature for all groups of clinicians, the evidence showed that information needs vary by clinician type or discipline (Collins et al., 2009; Currie et al., 2003; Xu et al., 2005). Evidence supports that information needs can be categorized as foreground or background questions. Foreground questions are patient-specific questions usually asked when determining care or obtaining needed information for clinical decision-making (Currie et al., 2003). Background questions are generic knowledge-based questions related to a discipline rather than a specific patient, such as ‘How is MRSA transmitted?’ or ‘What laboratory tests comprise a complete blood count?’ (Currie et al., 2003; Lappa, 2005). Nurses, students, and residents are more likely to have background questions compared to physicians that have completed their residency phases, who are more likely to have foreground questions (Chase et al., 2009; Currie et al., 2003; Lappa, 2005; Woolf & Benson, 1989). Common information needs for all groups of clinicians fell into categories of treatment decisions and disease information and were related to either general clinical practice or specific patient care (Blythe & Royle, 1993; Jerome et al., 2001; Lappa, 2005). Clinicians were reported to be successful in resolving an information need 50-91% of the time (Cato & Bakken, 2012; Collins et al., 2009; Currie et al., 2003; Sarcevic & Burd, 2008).

### ***Nursing Information Needs***

Common information needs among nurses identified in the literature are patient-specific information needs (such as current medication taken at home or allergies) and



information needs related to medication and medication management while performing patient care (Cato & Bakken, 2012; Daophars et al., 2012; Koch et al., 2012; Michel-Verkerke, 2012). Furthermore, not all nurses' information needs were resolved (Cato & Bakken, 2012; Ricks & ten Ham, 2015; Xu et al., 2005). In 54 information-seeking sessions, Xu et al. (2005) found users indicated the needed information was found in 31 (57.4%) instances and information needs were left unresolved in 23 (42.6%) instances. From questionnaire results, Ricks & ten Ham (2015) reported that 43% of respondents were unsatisfied with information within the information resources available to them, thus not fully resolving their information needs related to patient care. French (2005) also studied the information needs of nurses through the analysis of uncertainty expressed by nurses during workgroup sessions discussing clinical practice issues. Although the nursing groups expressed information needs, there were also elements of uncertainty that were not pursued as an information need by the nurses. Nichols (2000) defined these types of unanswered questions as an unrecognized or unresolved information need.

Specific to medication-related information needs, Cato and Bakken (2012) used a think-aloud protocol while recording EHR use to work through common medication order scenarios. They reported that nurses had information needs related to medication use processes. The majority of reported information needs were patient-specific followed by domain-related information needs (related to route, dose, and frequency of administration). Daophars et al. (2012) assessed the medication knowledge and information needs of inpatient oncology nurses; the nurses were knowledgeable about the medications and their class, storage, and administration. However, a majority of nurses were not able to identify contraindications, intravenous preparation, and administration durations, and drug-drug interactions related to medications that were common within their area of practice.

## **MEDICATION RECONCILIATION**

Medication reconciliation is an important exemplar that can be used to understand a clinical task requiring decision-making where clinicians may experience information needs. Medication reconciliation first came to clinicians' attention when The Joint Commission (TJC) introduced it as a National Patient Safety Goal in 2004 with inclusion in the survey process beginning in 2006. Medication reconciliation is meant to extend the process of collecting a current medication list to compare it to medications that are ordered when a patient is under the care of healthcare practitioners. It is intended to ensure the appropriate medications, doses, and schedules are ordered and that medications are not inappropriately ordered or omitted. The medication reconciliation process is defined as a process of comparing a patient's current medication(s) to the medications that the medical provider plans on ordering while the patient is in hospital care (The Joint Commission, 2007). Medication reconciliation is performed to prevent omissions, duplications, and dosing errors.

Medication reconciliation studies have reported decreases in discrepancies in medication orders at points of transition throughout a patient's medical visit (Agrawal & Wu, 2009; Agrawal, Wu, & Khachewatsky, 2007; Andreoli et al., 2014; Bjelbak-Olesen, Danielsen, Tomsen, & Jakobsen, 2013; Boockvar, Santos, Kushniruk, Johnson, & Nebeker, 2011; Buck, Gronkjaer, Duckert, Rosholm, & Aagaard, 2013; Buckley et al., 2013; Chan et al., 2010; Climente-Marti, Garcia-Manon, Artero-Mora, & Jimenez-Torres, 2010; Curatolo, Gutermann, Devaquet, Roy, & Rieutord, 2015; Gimenez-Manzorro et al., 2015; Keeys et al., 2014; Kramer et al., 2014; Kwan, Lo, Sampson, & Shojania, 2013; Lee et al., 2010; Lee et al., 2013; Lopez-Montenegro Soria, Climente Marti, & Jimenez Torres, 2011; Magalhaes, Santos, Rosa, & Noblat Lde, 2014; Pronovost et al., 2003; Schwartz & Wyskiel, 2006; Smith & Mango, 2013; Strunk, Matson, & Steinke, 2008). One article in

the literature was specific to the intrahospital transfer process, rather than at patient admission or discharge (Lee et al., 2010). The researchers reported that 62% of patients included in the study (n=129) had at least one unintentional medication discrepancy at transfer. Discrepancies occurred whether medication reconciliation occurred on paper or from within the EHR.

A review of the literature showed that clinicians believe the process of medication reconciliation is important (Boockvar et al., 2011; Lesselroth et al., 2011; Sanchez, Sethi, Santos, & Boockvar, 2014; Turchin et al., 2008; Vogelsmeier, Pepper, Oderda, & Weir, 2013). Despite this belief, the process of implementing medication reconciliation has not been an easy one for healthcare organizations. Moreover, there are many barriers to its successful implementation. Although, medication reconciliation was required by TJC beginning in 2006, healthcare organizations had trouble operationalizing these processes. Therefore, TJC suspended the requirement in 2009 with the understanding hospitals would continue to work toward implementing this best practice. It again became a requirement for TJC certification in 2011, with hospitals being required to collect a current medication list with a good faith effort. Barriers continue to complicate successful integration of medication reconciliation into clinical practice.

## **Barriers**

### ***Lack of Definitions***

Authors cited process variations and lack of standards as main issues when attempting to obtain a current medication list and conduct medication reconciliation (Vogelsmeier et al., 2013). These process variations start with the definition of medication reconciliation. TJC defines a medication as “any prescription medication, sample medications, herbal remedies, vitamins, nutraceuticals, vaccines, or over-the-counter

drugs” (TJC, 2010, p. GL19), but it is left to each healthcare organization to define a medication in their policy (Greenwald et al., 2010). Within the reviewed literature, medications could refer to only the patient’s prescription medications, high-risk medications, or all medications to include over the counter and herbal medications. TJC requires each healthcare organization to define within their policy the required medication collection elements needed when obtaining a current medication list. Variation between facilities was discovered, especially when determining if the collection of schedule, last dose taken, and regimen adherence were collected as part of the patient’s current medication regimen (Vogelsmeier et al., 2013). In a qualitative study to determine clinician perceptions of medication reconciliation, Vogelsmeier et al. (2013) reported clinician concerns about obtaining an accurate list of current medications when patients have multiple providers, varied adherence, and low health literacy.

### ***Role Responsibilities***

One of the most noticed variations in the medication reconciliation process is among responsibilities of the multidisciplinary team members with regard to the individual steps needed when collecting a medication list and performing medication reconciliation (Coffey, Cornish, Koonthanam, Etchells, & Matlow, 2009; Greenwald et al., 2010; Kwan et al., 2013; Lehnborn et al., 2014; Meguerditchian, Krotneva, Reidel, Huang, & Tamblyn, 2013; Salanitro et al., 2013; Vogelsmeier et al., 2013). In one study (Salanitro et al., 2013), variation in practice was reported within six Veterans’ Affairs (VA) facilities. Medication histories were collected in six categories: physicians and nurses jointly, nurses primarily with physicians completing any missing information, pharmacy and nursing, nursing alone, physicians alone, and residents and physicians’ assistants. Medication reconciliation processes also varied among the six facilities. Medication reconciliation was mainly

performed by physicians, although it was also delegated to pharmacists and nurses (Boockvar et al., 2006; De Winter et al., 2010; Keeys et al., 2014; Kern et al., 2014; Kramer et al., 2007; Kramer et al., 2014; Kwan et al., 2013; Rangachari et al., 2019; Salanitro et al., 2013) because individuals in both disciplines can receive verbal or telephone orders from physicians when discrepancies are discovered. When asked in focus groups, physicians thought nurses and pharmacists were best suited to perform medication reconciliation. However, pharmacists and nurses thought physicians were best suited to perform the task because they are ultimately responsible for patient care (Vogelsmeier et al., 2013). Kramer et al. (2014) reported pharmacists had fewer discrepancies when completing a medication history and reconciliation compared to registered nurses and pharmacy technicians. Registered nurses had significantly higher discrepancy rates during admission medication reconciliation processes per medication (0.59) when compared with pharmacy technicians (0.36) and pharmacists (0.16) ( $p < .001$ ).

### ***Difficulty in obtaining current medication list***

Clinicians have reported difficulty with obtaining an accurate current medication list from patients (Boockvar et al., 2011; Pronovost et al., 2003; Rabi & Dahdal, 2007; Vogelsmeier et al., 2013; Wang & Biederman, 2012). Rabi & Dahdal (2007) reported 80% of patients that were interviewed to create a list of current medications were unable to provide a medication list and did not know the names of all their medications. Difficulties included patients not knowing names and doses of medications, only knowing the purpose of a medication (“I take a pill for my blood pressure.”), and the inability to get a medication history from some patients. In a qualitative study to determine clinician perceptions of medication reconciliation, Vogelsmeier et al. (2013) reported clinicians’ concerns about obtaining an accurate list of current medications. Clinicians reported the following

concerns: (1) patients obtain medications from multiple providers, (2) patients have adherence issues and may not report their true regimen for taking medications, and (3) many patients have low health literacy regarding the medications they are prescribed.

### ***Outcomes Measurement***

The most common measure of patient outcomes when studying medication reconciliation was the decrease of discrepancy in medication orders at times of intrahospital transfer (Andreoli et al., 2014; Buckley et al., 2013; Gimenez-Manzorro et al., 2015; Gleason et al., 2004; Magalhaes et al., 2014; Salanitro et al., 2013; Villanyi, Fok, & Wong, 2011; Vira, Colquhoun, & Etchells, 2006). Additionally, researchers attempted to understand the severity of discrepancies, which were measured several ways in the literature. Researchers categorized severity of discrepancies by body system (Aag, Garcia, & Viktil, 2014; Andreoli et al., 2014), drug classification (Andreoli et al., 2014; De Winter et al., 2010; Gleason et al., 2004; Keeys et al., 2014; Villanyi et al., 2011), and potential severity of harm (Aag et al., 2014; Andreoli et al., 2014; Basey, Krska, Kennedy, & Mackridge, 2014; Bjelbak-Olesen et al., 2013; Buckley et al., 2013; Chan et al., 2010; Gleason et al., 2004; Magalhaes et al., 2014; Nickerson, MacKinnon, Roberts, & Saulnier, 2005; Owen, Chang, Chong, & Vawdrey, 2011; Pippens et al., 2008; Villanyi et al., 2011). In a review of the literature reporting outcome measurements related to medication reconciliation, Christensen & Lundh (2013) reported they were unable to determine if medication reconciliation processes decreased patient mortality or readmission, but reported findings that showed there was a decrease in patient calls for medication questions by patients who were discharged from the emergency department. In another review of the literature, Lehnborn et al. (2014) reported evidence that medication reconciliation identifies discrepancies in medication orders that reduce the incidence of adverse drug

events (ADEs), but there were not enough findings to report a reduction in outcomes such as length of stay, hospital readmissions, or patient mortality. From a patient perspective, Kramer et al. (2007) reported that patients who had medication reconciliation performed through an EHR reported greater understanding of discharge medication prescriptions, including medication instructions and potential side effects. In reviewing the literature, there were no studies that included specific clinician groups information needs related to medication use processes, collection of current medication use, or medication reconciliation.

### ***Additional Barriers***

There were several other barriers noted throughout the medication history and reconciliation literature. There were discussions of resource challenges for these time consuming processes (Greenwald et al., 2010) and clinician resistance to adding or changing responsibilities (Pronovost et al., 2003; Sanchez et al., 2014). Additionally, the need for interdisciplinary collaboration in the process was discussed (Hummel, Evens, & Lee, 2010; Johnson, Guirguis, & Grace, 2015; Meguerditchian et al., 2013).

### **Integration in the EHR**

There have been successful implementations of medication list and medication reconciliation integration into the EHR (Cadwallader et al., 2013; Gimenez-Manzorro et al., 2015; Kramer et al., 2007; Lesselroth et al., 2013; Wang & Biederman, 2012). Wang and Biederman (2012) compared the list of current medications collected on paper to a newly implemented EHR with medication list functionality. There were significantly fewer errors in the EHR list compared to the paper-based list. In a qualitative study that determined clinician issues with the integration of clinical information systems, Lesselroth

et al. (2011) surveyed medical providers about medication reconciliation technology and 55% of providers agreed that technology provides an advantage when performing medication reconciliation, but 35% agreed that using technology for medication reconciliation requires a lot of mental effort. They also reported that providers discussed that electronic medication reconciliation tools were difficult to cognitively process and discrepancies in medication orders were difficult to identify within EHR tools. Additional concerns with EHR tools reported by Vogelsmeier et al. (2013) included inaccurate patient medication lists, including incorrect doses, and medication lists that did not reflect patient adherence to medication orders. Technology requests from clinicians included integration between the current medication list and the medication reconciliation process, medication safety alerts, and reminders to complete the process (Agrawal & Wu, 2009; Duran-Garcia, Fernandez-Llamazares, & Calleja-Hernandez, 2012; Turchin et al., 2008).

Given the challenges of collecting a medication history and performing medication reconciliation, Falconer, Nand, Liow, Jackson, & Seddon (2014) created a software tool that prioritized inpatients relative to the patients' risks for adverse drug events (ADE). There were 38 weighted triggers that were identified by the Institute for Healthcare Improvement and patients were identified by a low, medium, or high ADE risk. During an 8-month period, 765 patients were prioritized as high risk and thus received discharge services. The medication reconciliation process prevented 526 medication errors (MEs), including 174 errors categorized as potentially producing moderate-to-major patient harm. Another technology found in the literature was the implementation of an interface engine that allows an organization to incorporate medication insurance claims from one computer system into a patient's current medication list in the EHR. Phansalkar et al. (2015) reported a 17.1% increase in the accuracy of a patient's pre-admission medication list when an interface to medication claims was added to the EHR. Additional technologies involving



natural language processing and machine learning also were shown as a proof of concept, but have not been fully implemented and evaluated (Cimino, Bright, & Li, 2007; Li et al., 2015).

## **WORKAROUNDS**

As technology is implemented in healthcare settings, clinicians have found ways to avoid using it or they create different workflows to complete tasks. This concept is called a workaround. Workarounds are well defined in the healthcare literature. Koppel, Wetterneck, Telles, and Karsh provided a definition of a workaround as “staff actions that do not follow explicit or implicit rules, assumptions, workflow regulation, or intentions of system designers” (2008, p. 409). Flanagan, Saleem, Millitello, Russ, & Doebbeling (2013) added on to the definition provided by Koppel et al. that the workaround is a result of a real or perceived limitation of a technical system. Lalley (2014) provided a description that a “workaround is a term used to describe nurses’ actions that do not follow linear plans” (p. 69). Seaman & Erlen (2015) defined a workaround as “an action that is performed by an individual in order to circumvent a block in workflow and thereby achieve a desired goal; yet, the action deviates from the protocol established by the organization” (p. 235). And finally, Patterson (2018) provided a definition of a workaround as “a deviation from an intended work process, which is used to overcome an obstacle, by a practitioner responsible for meeting a work demand; the deviation is likely an active adaptation to the process that is documented in policies and procedures” (p. 281).

Most of the literature about workarounds while using the EHR was associated with the tasks of performing computerized physician order entry or barcoded medication administration. Although there were no studies found in the literature related to intrahospital patient transfer, collecting a patient’s medication list, or medication

reconciliation, researchers reported observed workarounds related to general patient care. Clinicians and nurses created paper forms and notes as a means of reminders and communication. In a study of the documentation of vital signs, Stevenson, Israelsson, Nilsson, Petersson, and Bath (2018) observed the creation of eight paper forms that were used in three hospital units to communicate and review a patient's vital signs, especially when a patient had an order for frequent vital signs. Additionally, the researchers reported the use of "notes written on scraps of paper, 'post-it' notes, and pocket notebooks," (Stevenson et al., 2018, p. 208) to document vital signs in the patient room and then transcribe them to the EHR immediately after leaving the room. Other researchers also reported clinicians routinely created a paper-based summary to remind them of the daily work that was required (Blijleven, Koelemeijer, Wetzels, & Jaspers, 2017; Flanagan et al., 2013; Varpio, Schryer, Lehoux, & Lingard, 2006).

Also related to general patient care, the reasons for workarounds are well documented. Findings reported in the literature included hardware that was not available or would not fit in the patient room (Blijleven et al., 2017; Gimenes et al., 2017; Koppel et al., 2008; Stevenson et al., 2018), broken technology or poor usability within the EHR (Blijleven et al., 2017; Flanagan et al., 2013; Koppel et al., 2008; Lalley, 2014), and confusing processes or not knowing the process (Blijleven et al., 2017; Flanagan et al., 2013; Koppel et al., 2008; Lalley, 2014). Another reason for workarounds was reported as the need for self-organization to create a plan for the work that needed to occur during the work shift, referred to as a memory aid (Blijleven et al., 2017; Flanagan et al., 2013; Lalley, 2014). Blijleven et al. (2017) also discussed workarounds that occur as a result of a social norm. For example, a clinician began using a workaround because he or she witnessed a colleague use the same process.

## **SUMMARY OF REVIEW OF THE LITERATURE**

This literature review has shown clinicians of all types frequently have information needs while caring for patients in an inpatient setting. Although there were studies about specific information needs, there were no articles found in this review concerning literature that determined if clinicians have information needs related to medication use or medication reconciliation processes. Other gaps in the literature were the lack of a standard definition of an information need and no standard approach to studying information needs. With regard to the literature related to medication reconciliation there was a lack of research about the clinical decision-making processes of clinicians when performing medication reconciliation or other parts of the medication use process. Although studies exist around the information-seeking behaviors of clinicians when performing medication reconciliation, there was no research evaluating the clinical information needs of clinicians when performing processes related to medication reconciliation. An additional gap was a lack of findings specific to workarounds during the medication use processes of collecting a patient's current medication list or performing medication reconciliation.

## **Chapter 3: Methods**

This chapter provides a description of the methods and procedures that were used to conduct this study. The researcher had the goal of gaining an understanding of registered nurses' information needs during medication processes throughout the patient intrahospital transfer process. The research design, setting, sample, recruitment, data collection procedures, and methods of data analysis for the study are provided in this chapter. In addition, participant risks and measures taken to protect the rights of the participants are discussed.

### **RESEARCH DESIGN**

This study consisted of a qualitative design using semi-structured interviews with registered nurses working in inpatient settings. The interviews focused on the participants' information needs during the following medication management processes: (1) obtaining a patient's current medication list, (2) medication reconciliation, and (3) administering the first dose of a medication following patient transfer. Qualitative content analysis was the method of data analysis used for this study. Content analysis provides a systematic and objective method to make conclusions from verbal, visual, or written communication (Krippendorff, 2013). Content analysis was an appropriate method for studying this phenomenon, because no prior research of information needs related to medication management processes was located in the review of literature and there are no available instruments that measure information needs of nurses.

## **SETTING AND SAMPLE**

### **Setting**

This study was performed with registered nurses employed by hospital systems located in seven states across the United States. These hospitals provided a wide range of services and several primarily care for underserved populations, including minority and underinsured populations. All the nurses in this study used an electronic health record (EHR) for ordering, documentation, and medication use processes.

### **Sample**

Purposive sampling was used in this study to gather data from informants who understood the phenomenon of interest. Purposive sampling allowed the researcher to select registered nurses who could discuss the medication use process and best answer the research questions (Krippendorff, 2013; Miles, Huberman, & Saldaña, 2014; Morse, 1991; Sandelowski, 1995, 2000). The registered nurses were employees of healthcare facilities, versus contract employees. Individuals were selected due to their role in and experience with the medication use processes within their healthcare facility. Inclusion criteria included registered nurses that had responsibility for obtaining the patient's medication history/current medication list, and reconciling or administering medications during a patient transfer or change in level of care. Having these experiences made the participant a good informant, which is an individual that has experienced the phenomenon in question and is able to provide detailed information during the interview (Morse, 1991). All clinicians were required to have at least one year of experience so they had an understanding of and experience with medication management processes in the facility.

## **RECRUITING AND ENROLLMENT**

Institutional Review Board (IRB) approval was obtained from The University of Texas at Austin IRB and approval for the use of an external IRB was obtained from two local healthcare organizations. Once approved, recruitment started. Participants were recruited from within the two participating health systems in addition to recruitment of registered nurses that attended the national conference of the Academy of Medical-Surgical Nurses (AMSN). Permission to access AMSN members was obtained from the national office of the organization. Additionally, a grant in the amount of \$6775 was obtained from AMSN to conduct this study.

Because purposive sampling was used, names of potential participants who are interested in medication processes also were obtained from clinical leaders. These individuals were familiar with the clinicians who practiced within each facility and the clinicians' knowledge and practice with medication use processes. A letter of explanation and invitation for this study was sent via email to each potential participant (see Appendix A). Interested individuals were screened for inclusion and exclusion criteria in person or via a phone call or email. Those that meet the criteria were asked to schedule an interview at an agreed upon private location, and they received a study fact sheet regarding the research study. Individuals contacted via email who did not meet inclusion criteria were sent a thank you letter via email to inform them that they did not meet the research criteria to participate (see Appendix B). Potential interview locations included a private location within the hospital or office within the hospital system administrative offices, an office within the School of Nursing, or a private room at the conference. A reminder was sent to participants one to three days before the scheduled interview. At the end of the interview, each participant received a \$10 gift card to a local coffee shop or online store for participating in the study.

## **DATA COLLECTION PROCEDURES**

### **Demographic Data Collection**

Prior to beginning an interview, the participant was asked to complete a demographic information sheet. The purpose of the demographic information sheet was to collect information regarding the personal and professional background of the informant: (a) age, (b) gender, (c) years of clinical experience, (d) years of electronic health record experience, (e) years of experience with the facility electronic health record, (f) highest degree earned, (g) profession, and (h) area of clinical or specialty experience (see Appendix C).

### **Semi-structured Interviews**

The researcher asked each participant semi-structured, open-ended interview questions (see Appendix D). These types of questions allowed thoughtful, detailed responses about the medication use process by the participants (Miles et al., 2014; Sandelowski et al., 1989). Clarifying questions, or probes, were used to gather additional information from the participants. Examples of clarifying questions and statements were: (a) Tell me more about that, (b) Will you please give an example and (c) Will you please explain further. Additional clarifying questions were asked if the participants referred to specific EHR functionality in order to appropriately capture the details in the interview transcript. Each interview lasted no more than 90 minutes.

### **Field Notes**

Field notes are used to enhance the details of a qualitative study and may be obtained before, during, and/or after an observation or interview (Emerson, Fretz, & Shaw, 2011). For this study, the researcher wrote field notes throughout the interview in the form

of jotted notes, phrases or short notes that added to the richness to the interview data (Emerson et al., 2011; Miles et al., 2014). Jotted notes captured the tone and non-verbal communication that occurred during the interviews (Emerson et al., 2011; Miles et al., 2014). After the observations, field notes were typed from the jotted notes (Emerson et al., 2011; Miles et al., 2014).

## **DATA ANALYSIS**

Interviews were digitally recorded on two digital recorders, allowing one to be a backup in case of technical problems. Immediately after each interview session, the interview was downloaded to a personal, password-protected laptop and a copy was submitted to a transcription service. Transcribed documents were printed and stored in a locked file cabinet in the researcher's home when not in use. After completion of the research study, the recorded interviews were deleted. The transcripts were read by the researcher first while listening to the digital voice recording to confirm the transcription. Transcripts were then read several times to immerse the researcher in the data and to begin to understand the spirit of the participant's words (Krippendorff, 2013; Sandelowski, 1995a).

Content analysis was the method by which the interviews were analyzed and a two-cycle, line-by-line coding technique was used. Thematic or phrase meaning units were the unit of analysis for this study. A thematic meaning unit is a grouping of text that is conceptually representative of the participants' answers to the questions asked. (Krippendorff, 2013; Sandelowski, 1995a).

While reading the entire text, meaning units were identified within each line of text. Identified meaning units were coded and grouped into categories, which were mutually exclusive and exhaustive (Krippendorff, 2013). A code is a word or short phrase that was



used to describe the meaning unit of an interview or field note (Saldaña, 2016). A codebook including coding definitions and decisions, as well as later decisions about creation of categories and themes, was maintained to assist with reliability and trustworthiness of the data (Saldaña, 2016). Because coding was a cyclical process, the interview transcripts were reviewed at least twice, as a two-cycle process. During the second reading and review of the transcript the researcher determined if similar codes could be grouped into categories (Miles et al., 2014; Saldaña, 2016).

Once categories were created, they were evaluated for a theme or multiple themes. Themes could cover multiple categories and are the interpreted meaning throughout the coded transcripts (Graneheim & Lundman, 2004; Miles et al., 2014; Saldaña, 2016). Once this process was complete for each interview, peer debriefing with the dissertation chairperson occurred to review findings, discuss questions, and confirm decision-making processes. Because the constant comparison method was used, the process occurred after each interview to assist in refining interview questions and to confirm any discovered themes. Interviews continued until saturation was reached. Saturation was determined when new categories, themes, or explanations stopped emerging from the data that were being analyzed (Sandelowski, 1995a).

## **RIGOR**

In order to maintain trustworthiness, there were several procedures that were followed. First, the details of the analysis process was described in a study codebook. The purpose of the codebook was to create an audit trail that described decisions made throughout the study (Saldaña, 2016). Another detail that supported the trustworthiness of the research was including examples from participants' interviews to support the connection between codes, categories, and themes. Peer debriefing with the dissertation

chairperson was another method for maintaining study rigor because these discussions addressed concerns, questions, and feedback about code, category, and theme decisions. Finally, member checking with registered nurses was employed to validate themes. Member checking consisted of reviewing findings with individuals like those interviewed in the study and knowledgeable about the concept of medication use processes within inpatient settings (Graneheim & Lundman, 2004; Saldaña, 2016).

## **PROTECTION OF HUMAN SUBJECTS**

### **Measures of Human Subjects Protections**

The study was reviewed by The University of Texas at Austin IRB and the use of an external IRB was approved by two local healthcare organizations. Following IRB approval, participant recruitment began and the following information was provided to each participant when meeting inclusion criteria to participate in the study: 1) a description of the study and voluntary nature of participation, 2) the confidential treatment of study tools, audio recordings of the interviews, and interview transcripts, and 3) the lack of repercussions for not participating or terminating participation in the study.

### **Risks to Participants**

Due to minimal risk for participants, a waiver of signed consent was requested and approved. A fact sheet was distributed to each study participant. The receipt of a fact sheet (see Appendix E), verbal consent, and completion of the demographic questionnaire prior to beginning the interview constituted consent. Risks due to participation in this study were minimal and there were no negative events that occurred during the interviews.

## **SUMMARY**

The main purpose of this chapter was to describe the methodology for this study. A description of the methodology and methodological information about this study were included. The study design, settings and samples, interview format, data collection procedures, management of data, human subjects protection, and procedures for data analysis were discussed. The study methods to protect rigor and trustworthiness within this study were described.

## **Chapter 4: Results**

The results of this descriptive qualitative study are presented in this chapter. The purpose of this study was to gain an understanding of nurses' information needs during medication processes throughout the patient intrahospital transfer process. A multi-state sample was obtained and a description of the characteristics of the sample is provided followed by a discussion of the themes and sub-themes from the interviews, with supporting participant statements.

### **SAMPLE CHARACTERISTICS**

Ten participants were interviewed as part of this study. Table 1 contains a summary of the participants' demographic characteristics. The 10 participants lived in seven states across the United States: California, Florida, Nevada, New York, Oregon, Texas, and Wisconsin. The age range of the participants was from 27 to 56, with a mean of 37.7 years. There were eight female (80%) and two male participants (20%). This ratio is consistent with the U.S. Census Bureau estimates where 12.6% of nurses are men (U.S. Census Bureau, 2017). Participants reported a range of three to 19 years of work experience and electronic health record (EHR) experience, with a mean of 9.9 years of work experience and 7.6 years of EHR experience. Nine of the 10 participants reported a BSN as the highest nursing degree received. Two nurses reported obtaining Masters degrees: one nurse reported obtaining a Master of Science in Nursing and one a Master of Divinity. Participants reported working in a variety of settings: medical-surgical units, oncology, float pool, orthopedics, and a neurosurgical unit. Four nurses (40%) worked in an academic medical center, five (50%) worked in an urban medical center (non-academic), and one (10%) worked in a community-based hospital.

Table 1

*Description of Participant Demographics (N=10)*

	<i>N</i>	%	Mean (Range)
Gender			n/a
Female	8	80	
Male	2	20	
Age			37.7 (27-56)
21-30	3	30	
31-40	3	30	
41-50	3	30	
51-56	1	10	
Yrs. Nursing Experience			9.9 (3-19)
1-5	4	40	
6-10	2	20	
11-15	1	10	
16-19	3	30	
Yrs. EHR Experience			7.6 (3-19)
1-5	7	70	
6-10	3	30	
11-15	1	10	
16-19			
Highest Nursing Degree			n/a
BSN	9	90	
MSN	1	10	
Hospital Size			n/a
Community Hospital	1	10	
Urban (non-teaching)	5	50	
Academic	4	40	

A purposive sample was used for this study. Participants who had extensive experience with medication management processes were recruited through advertising, at the AMSN conference, and in meetings with clinical leaders. Prior to scheduling meeting times with participants, the principal investigator (PI) also distributed a research fact sheet and verified with every participant that each had at least one year of experience with the phenomenon of interest. Purposive sampling ensured that participants could effectively

communicate their experiences with medication management processes, including obtaining a current medication list, the impact on medication reconciliation, and administering a medication following an intrahospital transfer (Miles, Huberman, & Saldaña, 2014; Morse, 1991).

## **FINDINGS**

### **Rigor**

Prior to beginning interviews, a pilot interview was conducted with a registered nurse to review interview questions and possible responses. The interview was reviewed by the PI and dissertation chairperson for feedback regarding the interview questions and interview technique. That interview was not analyzed as a part of the study because the individual that was interviewed did not meet inclusion criteria. Interview questions and use of follow up questions were refined as a result of this pilot interview. Additionally, an audit trail was maintained where records of first-round coding and decisions on combining codes into sub-themes and themes were logged. Development of the identification of codes and themes was discussed with the dissertation chairperson and a dissertation committee member following the first four interviews and then toward the end of the analyses. Finally, member checking occurred with two registered nurses, who were not a part of the study. Both registered nurses agreed with the findings.

### **Interpretive Process**

Data analysis began after the first interview was transcribed. Notes were jotted for each phrase or sentence that was coded from the interview. These notes became the initial first-round codes. The codes were then updated to improve descriptions as the first four interviews were completed. As interviews were transcribed and coded, 14 codes emerged

in first-round coding that were able to be used in the remaining analyses of transcripts. Data saturation was obtained after the eighth interview and confirmed with the final two interviews. During an iterative review, the 14 codes were combined into seven codes, used as sub-themes, that fell under four overarching themes that also were used to guide answers to the study research questions (see Table 2). The identified themes are that during medication use processes: (1) registered nurses have information needs, (2) there are facilitators and barriers to resolving information needs, (3) information needs impact decision-making processes, and (4) communication serves as a workaround to resolving information needs. Sub-themes were found for the first two themes. The following sections provide the research questions and detail each of the themes using quotes from the participant interviews to answer each question.

**Research question #1: What are clinicians' perceptions of information needs while performing medication management throughout the patient intrahospital transfer process?**

**Theme: Registered nurses have information needs**

The first theme, registered nurses have information needs, includes details of the perceptions of the information needs related to medication use processes during intrahospital transfer. There are three sub-themes included in the description of this theme: (1) Clinical knowledge and patient information are necessary to make decisions; (2) Trust as a strength of information; and (3) Colleague experience as information reliability.

***Sub-theme: Clinical knowledge and patient information are necessary to make decisions***

One of the first sub-themes that emerged from the interviews is that nurses reported needing patient information related to medication use during the intrahospital transfer

Table 2

*Final Themes, Subthemes, and Categories/Codes*

Theme	Sub-Theme	Code
Registered nurses have information needs	Clinical knowledge and patient information are necessary to make decisions	Clinical knowledge and patient information
	Trust as a strength of information	Trust Preference
	Colleague experience as information reliability	Experience
There are facilitators and barriers to resolving information needs	Information seeking is used to resolve information needs through access to tools and sources of information	Access to sources of information
	The EHR as a facilitator and barrier	EHR Usability Barriers - EHR Facilitators - EHR
	The patient as a facilitator and barrier	Barriers – Patient Facilitators - Patient
	Importance of assigning responsibility	Defining responsibility
Information needs impact decision-making processes		Impact on decisions EHR usability
Communication serves as a workaround		Communication as a workaround Communication to pass along information

processes. Text segments that were included in this sub-theme emerged as being information needs that are collected and resolved, or resolution is attempted. All participants reported needing to know the name and dose of medications, as well as the administration schedule and time of the last dose taken, as described by RN02:

[We ask for the] medication, dose, I guess route—which usually is a pill—and then how many times a day they take it. And then, if they say daily—just one time a day—I ask—I don't think this is something everybody does—but I ask, "Do you



want to take it at night time or in the morning?" Or, um... or if they're coming in at 5 pm, and they take [it in the evening]... I would like, ask, "Have you taken this previously?" like "Do you need me to give this to you?"

RN04 confirmed these information needs:

The name of the medication, dose of the medication, the time, you know, um, the range, when they're supposed to take it, how long, if they're PRNs, if they're scheduled medications... we put down the times that they last took them, the date that they last took them, and then, again, the rough timeframe of AM, PM.

Additionally, participants discussed the need to obtain the patient's medical history, allergies, and current symptoms. Although this information is not required as part of the patient's current medication list, it is frequently compared to the current medication list to determine completeness of information. For example, if a patient says they have diabetes the nurse will verify there is an anti-diabetic medication, such as Metformin, in the patient's current medication list. As a result of this practice, additional information needs may arise to discuss with the healthcare provider or pharmacist during the medication reconciliation process. RN03 described her use of the patient's symptoms or diagnoses in review of the current medication list:

Um, because if you notice for example you know they list their medical history. Um, and they'll say – and it kind of goes back to what I had said before. If they list, you know well I have high blood pressure, but then they're not on a blood pressure medication. Then you have to question it. Or they give you a blood pressure medication, but they've never had high blood pressure. Or they give you a diabetic medication, and their hemoglobin A1C is five.

During the first administration of medications following intra-hospital transfer, registered nurses reported that they review the medication with the patient as an opportunity to provide or reinforce education for the patient or use it as a secondary confirmation that the patient is taking the medication. For example, one registered nurse, RN01, communicated her process for medication administration to confirm the medication orders, "When I'm giving a first dose I will say, "Have you had this before? Do you know

what you're taking?" I'll give some education regarding the medication. Most of the time they know the medications they've been on [before their hospitalization]." RN03 shared the practice of reviewing medications and providing education for the patient:

I always think it's good practice to go over every single medication with your patient. And then if they say oh, I don't take Depakote; you can then go in the system and say well it's a new medication that the doctor just prescribed for you because of this.

I'll say this. I have, you know, a baby aspirin for you – 80-milligrams. And often say what I'm giving it to you for. And I said, you know I have Depakote for you. It's – and they'll be like well what's Depakote for? That doesn't sound familiar. And so, I like to make sure that I include them in the medication administration. That way, you know, because some nurses will just pull all the pills in a cup and say here. Here you go.

Finally, the other information need that was discussed during medication administration was the need for administration parameters. This information determines when the medication can be given versus holding a dose to prevent a side effect or negative consequence related to the medication. Frequent examples given were the need for the patient's current blood pressure and parameters to give or hold a patient's blood pressure medication, and the patient's most recent potassium result from the laboratory before giving a potassium bolus. RN03 shared her experience:

normally I-I'll always look at their vital signs before I give-administer any kind of medication. I-I'll try and review the labs that we do have available. Um, and based off of that, then I'll look at the parameters of the medications to make sure that it's falling, uh, within it. For example, like blood pressure comes to mind. I have a blood pressure medication I have to give. I want to make sure I check their heart rate and their blood pressure before I give it. If their blood pressure, by chance, is below 100 – their systolic – I have to pause and say okay. You know that – do I want to bottom them out by giving them this medication? I check to make sure of their clinical parameters.

Another task following a patient's intrahospital transfer with a change in level of care was reported. Nurses reported they verify the patient was ordered the appropriate route

of the medication, as discussed by one registered nurse, RN03. “Patients come in who are initially NPO but we [begin] feeding them, and they get Pepcid. It’s IV. So, I’ll just call the pharmacy. Hey, they’re eating. Can you just switch it to a pill now?” Additionally, nurses discussed the process to discontinue orders that were not appropriate for the lower level of care. This was frequently discussed as titrated intravenous medications that required frequent monitoring and/or assessment that were provided on acute care units.

***Sub-theme: Trust as a strength of information***

Following discussion of the information needs registered nurses commonly experienced during medication use processes, participants discussed where they obtain their information and a clear sub-theme emerged; there must be a trust of information sources. Nurses comments coded into this sub-theme contained the perception of the quality of the source of information, not just the information itself. All participants spoke about information sources they used. Although all the registered nurses discussed information sources they used frequently, the order of the sources they used to obtain the needed information, or the level of trust in an information source, varied between each nurse and there was no consensus that could be determined from the data. Participants even contradicted each other, especially about the use of the patient as a reliable source of information. Prior experiences and work situations seemed to determine the information sources that were used, such as working in an orthopedic unit where patients frequently are admitted to the unit post-operatively and are not able to communicate a medication list.

Other words used by participants during interviews were “preference,” and “best practice.” When describing sources of information, a few participants ranked several sources in order of “trust.” RN01 mentioned that, “You just have to go on what they say and they can say anything.” RN02 preferred the use of the medication bottles, “if they

happen to bring in their medications, they'll use the bottles, and I'll ask the patient if they take this medication.” Although she also would use the patient as an information source, “I guess if I had a very confident patient, or a patient that would say, like, ‘This is my medication, and this is all I take,’ and, like, was able to recite everything. Or if they handed me a piece of paper that I could easily, like... there's exactly the dose and when they take it, and everything.” RN03 also used medication bottles as a first source of information gathering:

If I'm lucky, they will have brought them with them from home if they thought about it before they came in. Um, best practice is to use the bottles that they have. The second option, and if you're lucky, they have a list that they keep with them in their wallet or purse of their medications.

RN10 also discussed a rank of sources:

I consider the pill bottles as higher quality, because I can see when it was filled and then who prescribed the medication, and all the directions are already there. And then, I go – if I know that the patient is alert and oriented, then I'll go to what they say. Some of them would bring us just a list of their medication so that I consider a little bit less than the first two. But usually, it's the pills and then whatever they say if they're alert and oriented, and then a list.

RN05 discussed his experiences with patients as a reliable source of information and the order of information sources:

that would depend on the patient. They usually come up through the ER and if they've been in the hospital before, the electronic record will already have some of their patient data in there. But you don't know if it's 10 years old, five years old, what's the deal. And I work on a neurosurgical unit so the patients aren't always competent or mentally able to give us their list of what they do. So, we try to get from the patient first, ask them what their medical history and their medications are. A lot of them don't know. Your good days, they'll bring a list or they'll know what they're on and be able to tell you all of the information, but that rarely happens. And we try to get it from the family if the family is with them. If not, ask them to bring the bottles in or give us a list from home within the next couple of hours if they're able to, which doesn't usually happen very quickly either. If they say they're going to bring it, it's usually the next day before we have access to it. So, in that regard it would be okay, well who is your pharmacist

and who is your doctor, because maybe we can call the pharmacy and get at least the latest list from the pharmacy of when they dispensed it and if it's a current dispensary or not.

RN06 and RN07 additionally contacted the pharmacy if information could not be collected from the patient or family:

And to me, if I can't get it from the bottles themselves from the family, then I'll call the pharmacy. And to me that's the most reliable if they're using only one pharmacy (RN06)

Preferred if it's written, they have a written list, we'll get that. Um if we need to, we can um draw information from their pharmacy or ah facility if they come in from one. (RN07)

Another area of trust that was discussed included how to determine when the patient's current medication list was complete. Determining completeness was a topic discussed by most participants. However, how each nurse determined if a current medication list was considered complete during the admission process varied. For some nurses, completeness seemed to be when the nurses exhausted resources available to them, such as getting a list of medications, a bag of bottles, or calling the patient's pharmacy, family, or primary physician rather than having an accurate list of current medications. Terms, such as RN04 said, "completed it to the best of my ability," or "a good faith effort" by RN06, were given in the interviews. However, RN09 shared, "I mean, honestly, there's nothing I can really think of that tells me okay, everything's correct. I mean, when I'm putting the meds in the computer."

***Sub-theme: Colleague experience as information reliability***

Another perception of information needs involved the experience of a clinician resource. Participants all detailed using healthcare providers, other nurses, and pharmacists as resources to resolve an information need. RN08 stated, "I'll call the pharmacy if I have

a question, sometimes even a provider, you know nurse practitioner, doctor or even sometimes another [nursing] colleague.”

In addition to just using resources, a few participants presented details about how the amount of experience a nurse or physician has may determine the reliability of the information they provide. A new registered nurse may not know information that is needed or does not have the experience to answer a question to fill an information need. This was detailed by two nurses. RN03, discussed that a partial or complete medication list may arrive from the emergency department (ED). At this facility, the current medication list is collected at triage, where new nurses start at that facility. The nurse expressed that she did not always find the list to be complete and would re-verify the current medication list for patients that were admitted from the ED:

When you work-start working the ER, you're often assigned to triage. And that's the first place you're assigned. And that's where you will enter the home medications that you take. And, um, some – because they're new they don't understand the system. And they could be putting in medications wrong. Hoping that the information has, or it's been done properly, yeah.

RN08 said that she discussed information needs with colleagues, but it depended on the individual clinicians she was working with for that shift. She said that most clinicians were open to helping with questions, but sometimes other clinicians may have a tone that is not welcoming:

Yeah, and usually um we bounce ideas off of each other quite a bit. And [it] depends on the people that you work with too. You kind of know who you can ask things to and who you can't. You know because they're like yeah, go ahead, go ahead, it's fine. Um but for the most part we collaborate with each other first.

While some nurses struggled with getting information from certain colleagues, RN04 provided a summary of the interdisciplinary nature of information needs and knowledge deficits, where each member of the healthcare team is important in providing

discipline-specific information to allow a member of the team to have a holistic understanding of the patient and his or her care:

I think that, uh, there's different knowledge deficits in each aspect of the, the team, you know, so the nurses can give the doctor's information to take better care, maybe better medications. And then the doctors can give the nurses information that they need, um, you know, to give a medication. And then pharmacy, they're just a wealth of knowledge regardless, you know.

**Research question #2: What are the perceived facilitators and barriers to resolving clinicians' information needs while performing medication management throughout the patient intrahospital transfer process?**

**Theme: There are facilitators and barriers to resolving information needs**

The next theme, there are facilitators and barriers to resolving information needs, includes details of the perceived enablers and obstructions to resolving information needs related to medication use processes during intrahospital transfer. There are four sub-themes within the description of this theme: (1) information seeking is used to resolve information needs through access to tools and sources of information; (2) the EHR as a facilitator and barrier; (3) the patient as a facilitator and barrier; and (4) the importance of assigning responsibility.

***Sub-theme: Information seeking is used to resolve information needs through access to tools and sources of information***

All participants spoke of sources they use to resolve information needs. First, the EHR is used to locate patient-specific information, and applications (apps) such as medication databases are used to resolve medication-specific information needs. Other sources for resolving information needs included the discussion of contacting the patient's family, long-term care facility, and healthcare colleagues such as other nurses, or a favorite of most participants, the pharmacist. RN04 discussed pharmacists, "Because it's almost

easier to pick up a phone and ask him than to find your way, you know, through the different resources that we have.” Additionally, he discussed online resources:

And then utilize the online resources as well. So mainly just for compatibilities, um, IV compatibilities and things like that. Um, but then again, if we have, you know, administration questions pertaining to why the patient is on this medication, you know, if we're kind of questioning do they need to be on it? Do they need this? Can they have something else?

Although other facilities are frequently used as a resource, nurses participating in the study detailed struggles with getting information regarding a patient's current medication list from them because they are not interfaced. RN03 illustrated a struggle from getting information from Veteran's Affairs (VA):

The VA is one of those really troubling places where, um, if the patients don't know their home meds, they say I get everything through the VA. They just send it to my house. I can't call the VA to get their medication information, because you have to enter their VA number. There's all this information you have to enter just to get to someone to answer your questions. So, often a VA patient is a complicated patient when it comes to getting the home medications if they don't have a physical list or physical bottles with them.

***Sub-theme: The EHR as a facilitator and barrier***

Many of the basic features of storing and retrieving patient historical information, patient assessment information (such as most recent blood pressure), and diagnostic laboratory test results were reported as a benefit of the EHR. From the start of the collection of the patient's current medication list, the EHR was reported to aid in the collection of medication information. Most participants spoke of using the EHR as the first resource to see if a patient's discharge medication list was available as a start to collecting the patient's current medication list. Nurse RN03 spoke of the organization's EHR as, “one of the nice things about our Meditech system – and within the medication reconciliation tab, there are the current hospital medications [as well as the] patient-reported medications.” Likewise,



RN02 agreed about the use of the EHR to verify historical medications and the current medication list as a resource:

And if they have been in our hospital before, it would say, "History" basically something that people have input into the record before, it'll pop up also. So, what we're supposed to do is look through everything and make sure it's correct—if they have been here before. The usual doses pop up, and it's very easy, but it's just when they take a ton, and it just takes a lot of time when you're busy and you're focusing on other things. So, I think it's just trying to focus on your patient that just comes to your floor, and like trying to make enough time to... to put in their medications.

Unfortunately, many features resulted in unmet information needs or usability issues that created additional information seeking. RN01 discussed how the medication list from a prior admission may be inaccurate:

we try to get a report from the patient and then whatever is in the system currently, and it's currently not current. When they end up being discharged from being admitted, they say, "Why is that showing up on my discharge paperwork? I don't take that antibiotic," or, "I don't take that medicine." It's an antibiotic that they had taken years ago, or "I don't take that pain medicine." That was probably from a surgery that they had.

A couple of participants discussed documenting incomplete information from the patient or another source in the EHR. RN02 discussed that patients frequently are not aware of all of the components of a medication order and how it is documented in the EHR. "If they just say, "I take some Synthroid, but don't know the dose," then we can put that in, but the doctor can't really do anything about it." And then an information need continues on as medication reconciliation is performed by the healthcare provider. RN03 shared a similar experience from a different healthcare organization:

If you have been a patient before, let's say it was three months ago. When you're discharged, your meds are finalized, and that list stays active in your account. So, when you get readmitted three months later, that list stays in the computer system thinking that you haven't made any changes... So, once MedRec is complete, we check a box; say we don't have the doses, we just never check the box, and the doctor, I guess he or she would do what they want with that information...

Showing that, like, "It's not 100 percent sure, but did our best." And if we check it, it means we're 100 percent sure.

It's supposed to be. It's supposed to make it easier for the nurses that your medication list is active. It should be. But nurses – you know a patient may not have been admitted for two years. The last time they were here was two years ago, and medications can change within two years. Conditions can change within two years. And so, some nurses will think, oh there's a list on there. It should be all fine. And they don't actually review. They just click the review button without actually reviewing with the patient.

Certain circumstances can make documenting the patient's current medication list challenging in the EHR, where there can be a set workflow and specific fields may be required by the EHR. RN03 provided an excellent example:

I'll give you a great example. I had a patient who took – I think she was on 105-micrograms of Synthroid. But she had to take a 90-microgram pill and then half of a 30-microgram pill in order to get her 105 because they don't make a 105. So, I had to be sure when I entered it, and I had to notify the physician. I said this is a correct entry. She does take both pills.

And while doses can be can be a challenge, RN03 also discussed that medication schedules may be complex and challenging to enter as current medications:

When you enter Coumadin, you have to enter each dose separately. You can't enter Coumadin, and then in a comment section put, you know, 7-milligrams or 5-milligrams Monday, Tuesday, Wednesday. Then Thursday, Friday, Saturday is 2.5. Because when the doctors then go through to review, there isn't a simple way for you to click or restart and then that to carry over to the pharmacy. We actually have to put each one in individually.

However, RN04 discussed information needed to administer medications was easy to locate, "They are, yep, in our electronic health record and within our medication administration record, each has got the name of the medication, dose of medication and then within the whole drop-down box there'll be, you know, administer if or else hold if. So, it's all right there."

Both facilitators and barriers of the EHR were discussed during and following patient transfer. Struggles were reported by some nurses related to inappropriate

medication orders following transfer of a patient to a lower level of care, such as titrated medications that are only administered in critical care settings. RN04 discussed how her healthcare organization's EHR prevented this issue. The EHR allows for the accepting healthcare provider to create new orders and discontinue inappropriate orders prior to the patient transfer. However, the system does not activate them until the patient transfer occurs:

Within our Epic systems there will be orders signed and held, so despite them still being in critical care, critical care has all the orders still accessible. But there will be signed and held orders upon transfer, so when the patient gets put into our med surg unit group, I guess you could call it, the unit, um, then we can release those signed and held orders so then all the critical care orders or whatever orders the doctors want to keep around, will either drop off their chart or else stay on their chart.

Although the EHR functionality worked at one healthcare organization, RN03 discussed that the functionality of the system had to be used with a certain process to ensure medications are continued in a certain format, "Meditech is not very user-friendly. And if we-we do have some newer physicians who don't know the system, and so they don't understand that you do have to go in and then restart the medication a certain way."

***Sub-theme: The patient as a facilitator and barrier***

Similarly to the EHR, the patient was discussed as both a facilitator and a barrier to resolving information needs. The participants all spoke about their perceptions of the patients, and the information they could provide to resolve an information need varied greatly from being the best sources of information to a barrier to resolving information needs. RN05 discussed that the process includes using the medication list presented in the EHR, "We just go over it to make sure that it has been discontinued. We ask them when

their last dose of the medication was. And we check when the last dose was and um, a lotta times patients will have a list of their medications and we verify it with that.”

Although the patient was reported to be a valuable source for resolving information needs, RN03 discussed a situation where the patient was a barrier, and even created additional information needs to resolve:

We have patients who come in who just say that I don't know what I take. And you know that they have all these chronic conditions that they've listed...they say you know I have-I have heart problems. I have blood pressure problems. I have cholesterol problems. And then they say, well I only take two pills. I take an aspirin and I take a Pepcid for my stomach. And then you just feel like with all the conditions you've listed, I just don't feel like it's correct.

RN02 also discussed how the “bag of medications” the patient or family may bring in during admission to the hospital can create a barrier to resolving information needs related to medications that the patient is currently taking. “If they bring a bag of meds, that's great. But I would have to, like, "You take this?" and make sure that they've not mixed pills, because lots of times, people just put lots of pills in one thing.” RN04 presented an additional scenario where the patient presented information that created gaps when compiling the current medication list:

“I have a patient who was on Warfarin and I was asking him before [contacting] the pharmacy what dose were you taking? And he goes, "I don't know, but I take two purples and then I take, uh, uh, you know, a pink." And I'm like, "So you don't know the dosages?" He's like, "No, I just know the colors.”

Another discussion point was how patients bring in a list of medications that are outdated or bottles of medications that had the incorrect medication or mixed medications. Additionally, one registered nurse discussed that patients may be a barrier, just because they do not understand the importance of the information that is being collected in providing patient care and making decisions. “People are taking a lot more over-the-

counter meds, they're not reporting that and because they don't think it's important to report um so it's just constant probing, asking of questions. Just what else do you take?"

***Sub-theme: Importance of assigning responsibility***

A final sub-theme that emerged from analyses of the interviews is that having certain responsibilities delineated facilitates the medication use processes. Although the registered nurses discussed who was responsible for certain parts of the workflow, they also discussed concern about steps that should be included. All nurses reported that the patient's current medication list was either collected by a nurse, pharmacist or pharmacy technician, or a combination of the nurse, healthcare provider, and/or pharmacist. For example, RN01 detailed the process "starts in the emergency room. We're assuming that the emergency room is their first point of contact, and then we get them from the emergency room. Maybe they'll clarify it for me because we're kind of going off what they've done although we're doing it again." RN03 stated, "A lot of times physicians will put them in." Whereas, RN08 stated, "If it's during the day, most likely it's a pharmacist. If it's overnight, it's a pharmacy tech."

Participants reported that responsibilities were agreed upon within their facility, but struggles were reported when processes weren't followed by the responsible party or the individual did not complete the assigned task at the right time. RN06 provided a thorough description of when the physician initiates medication reconciliation prior to the nurse completing or verifying the patient's current medication list:

There's difficulty if the doctor's already initiated the process [of medication reconciliation before the current medication list is complete.] Again, if the doctor's already started or done his reconciliation...and then you update the list [with] new home meds. Those don't get translated back into the inpatient [orders] until you contact the doctor again and say hey, I know you already did the home list, but you need to go back and do the home list again, because there's – it

wasn't accurate or it was missing some components. So, I need you to review it again. The way the Epic is built up, they can go back to the home list and just click to [reorder] the ones they had left off earlier.

She also reported that it would be helpful if there was a process to contact the clinical provider after the current medication list is complete so processes do not have to be repeated:

Some doctor's activate [the inpatient medication orders] before the nurse has the chance to be able to enter [the patient's current medications.] And since we do have the ability to text with the doctors back and forth...it should be easy for the doctor to say hey, I'm going to be up there in 15 minutes, can you make sure the list is updated by then, or the nurse to say if they do get the information, okay doc, the patient's here, I've already reconciled the list so you're good to go. That kind of thing to be able to help the communication.

**Research question #3: Do perceived clinician information needs affect the resulting interdisciplinary communication and decision-making while performing medication management throughout the patient intrahospital transfer process?**

**Theme: Information needs impact decision-making processes**

The most common information needs that the registered nurses reported related to decision-making processes were during administration of medications. There are many medications that are only administered if the patient meets certain parameters. For example, only administer potassium if the patient's potassium level is under a certain value. Another example provided by participants is to only give the patient a blood pressure medication if the patient's systolic and/or diastolic blood pressure is above a certain value. These parameters should be part of the patient's medication order, but are often free-text statements that the clinical provider has to type in as part of a comment within the order. It was reported that often these parameters were missing and required additional communication to resolve to allow for a decision to administer a medication. As RN06 reported, "It won't tell you hold for this, unless the doctor manually put it in. So at that

point as a prudent nurse, I'm going to say you didn't write a parameter on it, but I'm sure not giving it until the doctor...decides." RN09 corroborated the discussion:

Half the time the doctors will have to put in the parameters. There are times where they won't, and then you check a patient's blood pressure and it's like 96/50 something and they're – you're going to give them Metoprolol and we'll have to call the doctor and just say, "Hey, I mean, I don't want to give this, but I need parameters from you,"

In addition to missing information to be able to decide about giving an initial dose of a medication, nurses reported that sometimes the information was difficult to find or required extra clicks to determine if the patient met the parameter for giving the medication. Nurses reported that the EHR allowed for free-text entry of parameters for administration, but the free-text entry is for the nurse to read before administration and does not alert the nurse if the parameter is met or not, or even if the parameter has been assessed. For example, RN07 shared the EHR will alert to an abnormal parameter, such as a low blood pressure, but does not provide decision support when a medication is being administered that the patient's blood pressure does not meet the parameter, "Epic...when we put the vital signs in...if the diastolic is low...the number will be red. But it doesn't alert me that you should not give this medication, no. Uh-uh." An additional information need was detailed by RN10, who said that the EHR for the health system will display the last lab value for a patient prior to administering the medication. However, there is a caveat that the nurse must verify the date of the result because the system will display the last value, but it could have been from several days prior or even a prior admission:

If we're giving potassium, the system flags you and it shows you the latest potassium report. If we're giving quinidine, it gives you the latest INR report. So, the latest lab result is there... I just tell my orientees," Just make sure that the latest lab result is for today." Because sometimes... It could be the last week or something. You have to make sure that it's correct. It doesn't give you – well, it gives you the latest one.

A final discussion point that challenges decision-making is that patients may have multiple orders for a condition, such as blood pressure medicines to try one medicine, then a second or third if the patient does not respond. RN06 discussed the challenge that the system does not suggest the additional orders if the patient's blood pressure remains elevated:

But when you have medications that are say for treating cardiac issues, blood pressure above 160 or so, you'll have multiple medications that can be used, this one first, this one second, this one third, but they won't be linked to each other to say okay well you tried that one but you didn't try this one yet. [And the EHR] can show them that it was given, but it won't prevent them from doing the next one.

#### **Theme: Communication as a workaround**

The last theme, communication as a workaround, includes details of the use of workarounds to resolve the information needs related to medication use processes during intrahospital transfer. When asked about workarounds that are the result of an information need, most of the registered nurses could not think of any that they were aware of, were sure there were some but could not think of an example, and two provided a workaround that was unrelated to an information need. Those examples were from individuals who were skipping processes for time savings. Although nurses did not identify workarounds related to information needs when specifically asked about them, they did share processes and examples of workarounds while answering other questions during the interviews that were coded as workarounds resulting in communication due to an information need. RN04 discussed two scenarios where the nurses documented differences in the patient's current medication list that subsequently required communication to the healthcare provider:

So, within our system, you know, we'll have to kind of flag that for the provider. We chart, you know, patient taking differently, and then we flag our new patient taking 1,000 milligrams every six hours. So not a lot of the time is that caught by



newer nurses just because they don't have that practice and they don't have that education. So that can sometimes get missed.

Previously in this chapter, it was discussed how the EHR presents the medications the patient was ordered for a previous hospital discharge. For RN04's healthcare organization, the information need resulted in a workaround to communicate inaccuracy in the patient's current medication list:

When you're doing it, they'll have older, um, antibiotics that they're taking either for a previous surgery or just preoperatively. So, again, you put in the electronic medical record, you know, patient not taking. And then, you know, then you have to call the provider.

RN02 detailed a significant workaround that occurred within the facility:

I guess the only problem I would run into if I'm... like say they take their Lipitor at night, the patient arrives at 5 pm, I move it to 8 pm, so to the next shift—because that's when they want to take it. Um, it would pop up—Lipitor would pop up the next day in the morning. So, the nurse, the next—I don't know, it's just this rude thing where it just pops up, and all they give it like 9 am, the nurse would have to know—to obviously ask the patient, like, "This is Lipitor, do you take it now?", and hopefully, the patient will say, "No, I take it at night." And then we'll have to move it again. So, this would happen continually, you just move it yourself. The only way to get it moved to night completely, like on a different schedule, is to ask the doctor to, like, go in the computer and do it. Or call the pharmacy, and they'll do it also. But, like, nurses can't change it. So, it's like we can move it by hand pretty easily, like right-click and move the time, but it would always show up the next day too... And usually in the report, I do try to pass on like, "I moved this medication," But also, then it's like a whole nother—because night shift isn't even the more—like you have to rely on the night shift to tell the day shift that, like, you moved it.

RN02 also described workarounds related to information needs regarding antibiotic scheduling:

And then also, antibiotics. If it's—if something happens, and your antibiotics is like two hours late, you have to move that every six-hourly antibiotic. But then, sometimes, it's not getting moved every six hours, and then like if you give it too early. So, like, the nurses at our hospital have to really look at when the last dose was given, and like, "Do the six-hour math, and kind of move it." [to the correct time in the EHR every shift]

## **SUMMARY**

The purpose of this chapter was to describe the findings regarding the medication-related information needs during and following intrahospital transfer after analyses of 10 registered nurse interviews. An overview of the characteristics of the participants, as well as maintenance of methodological rigor, was provided. Four themes were discussed with eight sub-themes. Quotes from registered nurses provided an enriched description of the findings. The themes that were discovered address the study research questions, including that registered nurses have information needs, there are facilitators and barriers to resolving information needs, and the influence of information needs on workarounds and decision-making processes for registered nurses.

## Chapter 5: Discussion

There is a lack of literature about nurses' information needs regarding medication management during intrahospital transfers. The purpose of this chapter is to discuss the qualitative findings presented in Chapter 4. The discussion is focused on interpreting the research findings and relating those findings back to the existing literature about this topic. The study was guided by the following research questions: (1) What are registered nurses' perceptions of information needs while performing medication management throughout the patient intrahospital transfer process (2) What are the perceived facilitators and barriers to resolving registered nurses' information needs while performing medication management throughout the patient intrahospital transfer process, and (3) Do perceived registered nurses' information needs affect the resulting interdisciplinary communication and decision-making while performing medication management throughout the patient intrahospital transfer process? In addition to discussing findings, the implications for nursing practice, education, policy, and research are provided.

### DISCUSSION

The purpose of this study was to gain an understanding of nurses' information needs during medication processes throughout the patient intrahospital transfer process. The discussion will coincide with the themes emanating from the research questions.

#### **Research question #1: What are registered nurses' perceptions of information needs while performing medication management throughout the patient intrahospital transfer process?**

One theme with three subthemes emerged to describe registered nurses' perceptions of information needs while performing medication management throughout the patient intrahospital transfer process. First, registered nurses in this study supported that patient

information, as well as clinical knowledge, are needed to make decisions regarding patient care during medication use processes. The nurses in the study discussed that they had information needs related to medication management processes. These information needs included medication-specific information as well as patient-specific information. Participants talked about requiring information to include: (1) name and dose of medications, (2) administration schedule, (3) time of the last dose taken, (4) patient's medical history, (5) allergies, and (6) current symptoms. These results align with domain-related information needs (related to route, dose, and frequency of administration) reported by Cato and Bakken (2012). Findings from this study also support findings from a previous study by Vogelsmeier et al. (2013) who reported a lack of standards in the information collected in a patient's current medication list.

Although standard information was collected, including name of the medication, dose, and administration schedule, inconsistencies were found. Some nurses discussed the importance of collecting the time of administration of the last dose to determine if the medication should be given in the current day or if the medication needed to be scheduled differently from hospital standard administration times. Other nurses framed the importance of inquiring about the medical history and current symptoms as information that is useful to determine the completeness of the current medication list. One nurse discussed her belief of the importance of asking patients specifically about supplements and herbal medicines as a part of her process of collecting current medications. Although programs such as Meaningful Use have placed a spotlight on collecting a current medication list and performing medication reconciliation, the program also left a great deal of freedom for healthcare organizations to determine different processes and procedures, thus a lack of standardization. Additionally, The Joint Commission 2019 National Patient Safety Goal for medication reconciliation does not provide requirements for clinicians

collecting a current medication list. The Element of Performance states, “Obtain information on the medications the patient is currently taking when he or she is admitted to the hospital or is seen in an outpatient setting. This information is documented in a list or other format that is useful to those who manage medications” (The Joint Commission, 2019, p.5). This requirement leaves room for organizations to create their own policies and procedures around creating a current medication list, which can lead to the lack of standards and the different processes reported by nurses in this study.

While all nurses reported review the patient’s current medication list at admission, only a few reported that they check the patient’s current medication list for completion at transfer. Most of the nurses reported they do not review it or check to see if it is complete if the patient transfers from another level of care. This report was concerning as many patients that transfer from a higher level of care may not be able to communicate when they are admitted to the hospital in a critical state.

Previous literature supported that registered nurses were more likely to have information needs related to more generic background questions, such as information about a diagnosis or treatment for a condition (Chase et al., 2009; Currie et al., 2003; Lappa, 2005; Woolf & Benson, 1989). However, discussions from registered nurses in this study revealed that information needs related to medication use processes resulted in patient-related foreground information, such as the patient’s current medication list, most recent laboratory results, and hold order parameters for a certain medication. One example of a background question detailed by multiple participants of this study included the information need to determine intravenous medication compatibility. This contrary result regarding nurses requiring foreground information in this study compared to prior studies reporting registered nurses using more background information was most likely a result of the topic of medication use processes versus more general patient care. Medication use

processes are patient-specific processes and require more information that comes from foreground questions.

Regarding the resolution of information needs, the registered nurses in this study reported finding answers for most of their information needs. This is consistent with results from previous studies where the resolution of information needs were reported between 50-93% of the time (Cato & Bakken, 2012; Currie et al., 2003). However, one unresolved need and element of uncertainty was discussed by participants in this study regarding the accuracy of the current medication list. Nurses discussed completing a patient's current medication list but were unable to verbalize that they were confident the list was accurate and complete. Most of the nurses deemed they were finished by exhausting resources such as reviewing the patient's medication list from a prior admission, reviewing the bottles of medications brought in by patients, or calling the patient's pharmacy. The nurses finished the task versus feeling totally confident about completing the list of the patient's current medications.

Multiple participants reported an information need regarding when to hold a medication; this information was frequently reported to be missing or difficult to find as part of a patient's medication orders. When the give or hold parameters are missing, there are reported delays in patient care. The registered nurses reported having to look in multiple text fields in the EHR to find the parameters or having to call the clinical provider for order clarification. Each of these actions takes time away from other nursing responsibilities. Furthermore, participants provided anecdotal accounts regarding the potential for giving a medication that may result in an error and possible patient harm as a result of a missing parameter. Additionally, no participants in this study reported that when parameters are provided they are integrated into a decision support system to alert the nurse that the patient

should not receive the medication that is being administered. The potential errors related to this missing functionality also were not found in the literature.

Registered nurses in this study had conflicting reports about the resources they use to resolve information needs related to collecting a patient's current medication list. Although some nurses reported using a current medication list provided by the patient, most reported they did not trust current medication lists verbally provided by patients because their prior experiences showed patients reported inaccurate medications or had gaps in their memory. Issues with a patient's health literacy, such as not knowing the names and doses of prescribed medications or identifying a medication by its purpose or color, were additional reasons for not trusting the patient provided medication list by the participants. On the other hand, physical medication lists provided on paper and by bringing medication bottles were an acceptable information resource reported by some participants in this study. Others reported that bottles would contain multiple, incorrect, or expired medications. Low health literacy also was reported as a barrier to completing medication reconciliation processes.

The lack of trust in the patient's ability to supply a current medication list supports the results of Boockvar et al. (2011), where physicians and pharmacists also expressed that the patient was an unreliable source for medication information. Additionally, the nurses' lack of trust in patient-reported medications provides support for the findings of Rabi and Dahdal (2007), who reported a lack of the use of patient-reported medications. They found only seven percent of patients had a physical medication list at admission and 80% did not know the names of the medications they were taking. The finding of the lack of trust in a patient list provides an endorsement of the participants in the Vogelsmeier et al. (2013) study, who also voiced concerns about the accuracy of the patient provided medication list due to poor health literacy and concerns of non-adherence.

Another perspective regarding trust relates back to the literature where one of the assumptions in the Information Processing Model, bias, can occur. One type of cognitive bias is called ‘anchoring’ (Harbison, 2001). Some of the reports about trust could actually be bias related to a first experience with a patient, or a group to which the patient belongs, such as family members. A couple of registered nurses shared that they often did not believe patient-reported allergies to pain medications or narcotics because they treat a significant number of patients with addiction. These findings support that an individual may hold a bias for an original hypothesis rather than being open to other possibilities, such as a patient truly having an allergy. Similarly, the representativeness heuristic addresses the use of stereotypes to address bias (Tversky & Kahneman, 1983). In the representativeness heuristic, individuals believe objects that belong to a category must be similar. Registered nurses’ reports of trusting patients who confidently report their medication lists could be the result of bias for a particular group of people.

All registered nurse participants interviewed in this study reported that a pharmacist is the preferred, and frequently used, point of contact for questions related to medications, medication orders, and a patient’s current medication list. Specifically, pharmacists were most discussed as a resource for information needs. Findings from this study support the results from Johnson, Guirguis, & Grace (2015), who reported the importance of including pharmacists throughout the medication reconciliation process. Pharmacists were reported to be able to determine the appropriateness of medications related to a patient’s conditions and could ensure the appropriate medication order-related information is updated in the EHR.

Another finding reported by the registered nurses in this study was that calling on a colleague as a resource was dependent on their experience or history with that individual. For example, one nurse reported that new nurses were more likely to work in triage in the



emergency department, and therefore she did not trust a current medication list collected by nurses from the emergency department. The other example provided was when a colleague was shown not to be open to help in the past. The literature reviewed during the course of this study reported similar resources that were used, such as the pharmacist or clinical provider, to resolve information needs, but researchers have not examined why resources are or are not used by a clinician with a question. This is important because clinicians are a finite resource that have other tasks and responsibilities in patient care. When an individual is taken away from their clinical responsibilities to aid in the resolution of an information need, potential delays in patient care could occur.

**Research question #2: What are the perceived facilitators and barriers to resolving registered nurses' information needs while performing medication management throughout the patient intrahospital transfer process?**

Registered nurses in this study perceived the EHR as being both a facilitator and barrier to resolving information needs during medication use processes. All of the registered nurses used an EHR for documenting patients' current medication lists, they also reported benefits and struggles with functionality and workflow while using the EHR. Facilitators discussed included interfaces with outpatient pharmacies to link a patient's current prescriptions, as well as informational tools, such as electronic medication references. These facilitators are similar to other reported functionality in previous studies, such as alerts (Agrawal & Wu, 2009), email reminders to clinicians to complete medication reconciliation processes and interfaces to outpatient pharmacy systems (Duran-Garcia, Fernandez-Llamazares, & Calleja-Hernandez, 2012), access to pharmacy claims to access prescriptions obtained by the patient (Phansalkar et al., 2015), and access to medication resources and pre-admission documentation (Turchin et al., 2008).

There were also several barriers to obtaining medication information that emerged from the interviews in this study. The first is that inaccurate medication lists are documented and stored in the EHR. Registered nurses reported that medications may have changed between patient admissions due to changes by a primary care provider or consulting provider. Also, the collected medication list may contain completed or expired prescriptions or inaccurate or missing information. This finding is consistent with information in the study by Vogelsmeier et al. (2013), who reported that inaccurate and incomplete patient medication lists were related to patient non-compliance with medication orders.

Another barrier found in this study was the challenge of documenting uncommon doses of medications. Potential errors can occur because a medication may have to be documented as two separate doses, but nurses also discussed how multiple doses may be documented in error. When faced with two different doses of the same medication, errors of omission or commission may occur. Additionally, documenting a dosing schedule that varies by day of the week was reported to be awkward and time-consuming.

The patient also was discussed as a barrier to collecting a current medication list. Several of the nurses reported struggling when the patients brought in their medications from home as a means of sharing their current medications. It was reported that old medications the patient was no longer taking would be brought in as part of a “big bag” of medications. Another patient action that created a barrier, included the patients combining two or more medications in a single bottle. This action made it difficult for the nurse to identify the medication and required the intervention of a pharmacist to assist with identification. This additional consultation also increases the time that it takes to perform the process of collecting a patient’s current medication list. Ultimately, much of the discussion from the nurses who did not trust the patient as a source of medication was

related to low health literacy of the patient. This finding supports the research by Vogelsmeier et al. (2013), where physicians, pharmacists and nurses also reported patients' low health literacy as a barrier to completing accurate and complete medication reconciliation processes. However, in this study several of the nurses reported that if they perceived the patient was confident about reporting their current medications and had a good understanding of the medications, or competent health literacy, the patient was a trusted resource and facilitated the collection of a current medication list. However, clinicians in the Vogelsmeier et al. (2013) study conversely reported concerns about not receiving a complete patient medication list due to patient non-adherence to medication orders. Therefore, it is possible that even if a patient acts confident in reporting their medications, they may not accurately or completely report the medications they are taking prior to admission to the hospital, or they may give a false report of compliance.

Findings from this study confirm that there is variation in the responsibility of collecting a current medication list. Although the main information collected remained relatively consistent among the study participants, there were inconsistencies in assigning responsibility. It was reported in some facilities that nurses in the initial place of intake, such as the emergency department, intensive care unit, or surgical services, would begin the process of collecting a current medication list or performing medication reconciliation. Most participants reported that the nurses in the initial intake department, such as the emergency department, intensive care unit, or surgical services, attempted to collect a current medication list, but that it was frequently not initiated or was incomplete when the patient arrived at the inpatient medical-surgical unit. Other participants reported they started a new review of collecting a patient's current medication list either due to policy or the fact that the list from the initial department was not complete.

Another point of inconsistency was the type of individual who collected the current medication list. Individuals who were reported to participate in the process of creating a complete current medication list for a patient included the registered nurse, pharmacist, clinical provider, and medication reconciliation technician, who was reported to be a pharmacy technician. These findings support the results of inconsistent responsibility reported in previous studies. For example, researchers have reported medication reconciliation performed by nurses and pharmacists (Coffey et al., 2009), although other investigators reported findings that medication reconciliation was performed by physicians and pharmacists (Meguerditchian, Krotneva, Reidel, Huang, & Tamblyn, 2013). Clinicians interviewed by Rangachari et al. (2019) reported not only that nurses, pharmacists, and physicians performed the medication reconciliation process, but the participants struggled over the fact that no group would take ownership of the process. Furthermore, Vogelsmeier et al. (2013) examined the medication reconciliation process as a whole and interviewed physicians, nurses, and pharmacists to determine clinician perception of responsibility for the medication reconciliation process. The physicians discussed that medication reconciliation was a “simple clerical task” (p. 424) that could be performed by nurses or pharmacists, but the nurses and pharmacists believed it should be a physician task because medication reconciliation could result in changes to medication orders and determine the course of clinical care.

**Research question #3: Do perceived clinician information needs affect the resulting interdisciplinary communication and decision-making while performing medication management throughout the patient intrahospital transfer process?**

The impact of information needs on communication while collecting a patient’s current medication list, as well as while administering the first doses of medication after a patient’s intrahospital transfer, were discussed by the participants in this study. Although

information-seeking occurred within the EHR to find information about the medication order and patient-related information, such as vital signs or lab results, registered nurses also used collegial communication to aid in resolving information needs. Registered nurses in this study commonly reported discussing information needs with other registered nurses, healthcare providers, and pharmacists in attempts to find resolution to their questions. Clinicians from outside locations such as nursing homes, rehabilitation facilities, and outpatient pharmacies, were also frequently used. Additionally, non-clinicians, such as the patient's family, were often identified by participants as an information resource. The use of these resources is consistent with study findings from Cato & Bakken (2012) who reported that registered nurses communicated with a physician or pharmacist on 19% of the reported medication administration-related information need events. Also, Currie et al. (2003) found healthcare providers were a common non-EHR resource to resolve information needs.

In addition to communication to resolve information needs, communication was also used to facilitate a workaround to resolve information needs. When asked directly about experiences with or witnessing behaviors involving workarounds, nurses denied any practices of workarounds or said they could not think of any issues with workarounds with their practice or the practice of their colleagues. However, within their interviews, there were two clear practices of similar workarounds that were described. The most notable was a nurse that spoke of a scenario where the nurses were unable to permanently change the schedule of a medication administration from the way it was ordered. Instead of contacting the physician or pharmacist, the nurses created a system to change the administration time each day and they passed along the new scheduled time verbally during the patient handoff. The nurse was able to reschedule a single dose to administer it and then would communicate the new administration time to a nurse in the next shift, who would change

the next dose to the corrected time. A second example was similar in that the incorrect time of administration was displayed in the medication administration record. Nurses learned to check the prior antibiotic administration because the standard dosing times were often incorrect. In this example, there was no handoff of times, but the nurses learned to check prior administration times for antibiotics before administering a dose.

In addition to medication administration schedules, another workaround that included communication was reported when the registered nurse had to use an EHR where standard doses were unavailable to document as part of the patient's current medication list. The nurse would document two standard doses and then communicate to the clinical provider that the patient took both doses combined, it was not an error in data entry, and a combined dose or both doses should be ordered as part of medication reconciliation. Another similar example reported was when the clinical provider ordered multiple medications of different doses where only one was to be administered based on the patient's severity of symptoms. For example, ordering five milligrams of a pain medication for mild pain and 10 milligrams if the patient reports severe pain. Several nurses reported that there was no EHR-generated alert to keep the nurse from administering both doses of the medication. These instances of workarounds support findings from Lalley (2014), who found that workarounds were created by the nurses to improve care delivery and facilitate patient preference. Additionally, the findings of this study support that workarounds were learned through an informal curriculum that is passed along through preceptors and onboarding processes (Varpio, Schryer, Lehoux, & Lingard, 2006).

Other researchers who studied workarounds reported broad findings related to workarounds in nursing tasks or those specific to the EHR processes of computerized provider order entry (CPOE) or barcoded medication administration (BCMA). Results of this study are consistent with their findings although this study did not specifically address

issues within BCMA workflow. Researchers have previously categorized workarounds, including when the functionality did not fit the workflow or usability of the EHR as too complicated to resolve the information need of the nurse (Blijleven, Koelemeijer, Wetzels, & Jaspers, 2017; Flanagan, Saleem, Millitello, Russ, Doebbeling, 2013). In both cases, the nurse either found a workaround to the EHR functionality to help fill the information need or relied on communication as a workaround to fill the information need. These examples also were reported by registered nurses in this study.

Errors can occur when the same functionality is used to fit different workflows. Furthermore, when the system does not fit the clinician workflow additional workarounds can be created. (Rangachari et al., 2019). Given the reliance on communication for both workarounds and adjustments to workflow to fit the EHR functionality, the potential patient care errors related to this finding are great. The Joint Commission (2007) reported that communication is a root cause of 60% of sentinel events as a result of miscommunication and forgetting information. When the nurses in this study are using communication that requires one nurse to remember to continue to communicate medication dosing or timing changes to the next nurse providing care, over the course of a 12-hour shift with multiple distractions, it could be easy to forget to pass the information to the next shift. Creating workarounds that require communication between clinicians is an unsafe practice that puts patients at risk of an adverse event.

Regarding decision-making processes, reports from the nurse participants supported the use of hypothetico-deductive decision-making and both inductive and deductive reasoning (Buckingham & Adams, 2000). Using inductive reasoning, the registered nurses collected data from the patient in the form of the patient's current medication list. The data collected in the list was reported to be used by the participant as a comparison during other clinical processes as an inductive process, such as medication reconciliation and creation

of the patient's problem list. An example of deductive reasoning discussed by a few nurses was the use of the patient's current health history in comparison to the medications the patient reported to determine if there are possible gaps. For example, if a patient's problem list included type II diabetes, the nurse reported looking for an anti-diabetic drug to help confirm the accuracy of the medication list.

Additional reports in the literature were that clinicians experience cue interpretation to signals if the information presented meets a hypothesis the nurse is making about the patient or patient care. (Carnevali, 1984; Elstein et al.; 1978). Support of the findings in the literature were demonstrated by nurses that felt confident about completion of a medication list based on the reports of common medications and medications that would be prescribed based on the patient's diagnoses. When there is not enough information to process a cue to fit a hypothesis, there was a reported information need by the registered nurse. Some of these cues were easily identified when participants in this study discussed gaps in the basic information they needed to collect, such as the patient only reporting the name of a medication, providing a pill color, or reporting the indication for a medication, such as, "that is my medicine for my blood pressure." When there were reported gaps in the information needed to complete the medication information in the electronic health record (EHR), the nurses all reported trying to resolve these information needs.

Another example of cue acquisition by the participants included those created by the EHR or missing information. During the process of administering a medication that should include a parameter of when to hold a dose of the medication, the nurses reported having the clinical knowledge to know that there should be a parameter, but often it would not be provided by the ordering healthcare provider. An example of this gap in cue acquisition would be that the patient has an order for an antihypertensive; the nurse has the knowledge that the medication should be held if the patient's blood pressure is too low, but



if the healthcare provider did not include the parameter, cue acquisition does not occur and instead an information need was recognized by the nurse.

The most common information need related to medication administration reported by the registered nurses in this study was an indication to give or hold a medication. Examples of information needs at the time of administration were most commonly a patient's current vital sign(s) or a laboratory result. These are a few examples of information needs around the indication to give or hold a medication. First, nurses reported that frequently the EHR had an icon for the nurse to click to review a free-text indication to hold or give a medication. The first information need that nurses discussed was the lack of the indication being documented by the healthcare provider. When this information is missing, there is a potential delay in care because the nurse had to contact the healthcare provider to obtain this information. Additionally, the nurse always has to know this information because it is required as part of the order. The nurses discussed that indications are needed for all PRN/as needed orders, but important indications are also needed for scheduled medications. The need for indications is information that is frequently reinforced during onboarding or by a preceptor during informal education, especially for commonly prescribed medications. Several nurses expressed concern about when the indications are missing. For example, new nurses may not know there should be indications for a medication or a distracted nurse may not notice they are missing. In both cases, nurses expressed a fear that a patient may receive a dose of medication when it is not indicated. Another concern discussed by nurses in this study was a lack of decision support by the EHR around medication indications. Although a few nurses discussed that the EHR may display pertinent information, such as a potassium level prior to administering potassium, all nurses in this study reported there were no alerts from the EHR to indicate whether a patient should, or more importantly, should not receive a dose of medication.

Nurses' work tasks are complex and they carry a heavy cognitive load (Thomas, Donohue-Porter, & Fishbein, 2017). Human factors, such as interruptions and disruptions, create additional problems. Thomas et al. (2017) reported nurses experience 3.4 to 5.9 interruptions an hour. When you add these human factors to the perceptions reported by nurses in this study, such as the development of workarounds and the EHR as a barrier to resolving information needs, there is a risk for potential medication errors that could cause adverse events and negatively affect patient outcomes.

## **IMPLICATIONS FOR NURSING**

### **Practice**

Findings within this study support the need for standardization of medication use processes in addition to standardizing responsibilities for process steps within medication use processes. In urban and large community areas, regional development of policies and procedures may facilitate patient transfer as well as decrease risk of errors for staff that have privileges in multiple facilities or are employed by multiple healthcare organizations. For example, policies may include determining what criteria are met for satisfying a minimal search, such as checking with caretakers, outpatient pharmacies, or the patient's primary care facility. Additionally, informatics staff within a healthcare organization need to visit the nursing units within the organization to ask about and be able to recognize workarounds that have developed and are being shared throughout an organization. Clinical informaticians should review system optimization processes to determine if workarounds are being used, as well as develop workflow processes to reduce and eliminate workarounds from developing.

In 2010, the Institute of Medicine (IOM), released the report *The future of nursing: Leading change, advancing health*. As a result of this report, the IOM and the Robert Wood

Johnson Foundation (RWJF) released subsequent recommendations that included the use of registered nurses as leaders and participants during the design and improvement of health systems, including support systems such as EHR design. Nurse informaticians should be part of an interdisciplinary team when implementing any system changes related to medication reconciliation. Registered nurses that provide care at the bedside should be included as well for their input about information needs.

An additional recommendation with a practice implication, includes the initiation of a nurse informatician led group to study the frequency of workarounds related to medication orders and scheduling. A nurse informatician should observe practices that occur in patient care units related to medication administration schedules to determine if nurses are following administration times without the use of a workaround. If an issue exists, a quality improvement project should be initiated to correct workflow and improve system functionality related to medication administration scheduling.

Also greatly influencing the practice of registered nurses is the lack of alerts and reminders in the EHR related to medication use practices of collecting a patient's medication list and administration of the first dose of a medication following intrahospital transfer. Alerts are common in current systems to prevent administration errors and verifying the Five Rights: right patient, right medication, right dose, right time, and right route. However, alerts were not reported by participants in this study during collection of a patient's current medication list and administration of the first dose of a medication following intrahospital transfer, with exception of nurses reporting only having reminders to complete the entry of the patient's current medication list as a task in the EHR. Clinical decision support was not reported by participants to provide alerts to possible categories of medications that may be missing from the patient's current medication list based on the patient's problem list or commonly missed medications for elderly or chronically ill

patients. Additionally, another alert that could be created in the EHR to support these medication use processes would be one that actually provides the needed information to verify if a medication should be held, not just a place to document the medication or requiring the nurse to search for the information using multiple clicks through the system.

A final practice issue resulting from this study is the concern of legal implications related to unresolved information needs or workarounds used to resolve information needs. Participants in this study reported incomplete documentation of patients' medication lists as well as incorrect documentation of medication administration times. For example, nurses reported that following transfer of a patient, they did not review the patient's medication list or collect one if it was not started earlier in the patient's admission. A patient's symptom, such as hyperglycemia, may be addressed in intensive care with an insulin drip. However, if the patient's prior medications taken at home are not reviewed when transferred to the medical-surgical unit the patient risks negative outcomes if a required medication, such as an oral antihyperglycemic, is not ordered when the patient is transferred to the lower level of care. Additionally, the instance reported by one nurse of incorrect documentation by communicating changes to medication administration that are inconsistent with the medication administration record, could result in an error if the communication is not clear or forgotten. In both of these examples, if legal recourse is sought, the nurse could be held responsible financially and is at risk for loss of his or her nursing license.

## **Education**

Although nursing informatics is integrated into baccalaureate and masters level nursing programs, most bedside clinicians are not experts at evaluating workflow and informatics, or understanding how they are integrated into the use of the EHR. For

undergraduate nurses, an understanding of an overview of workflow development with the integration of clinician information needs into workflow mapping will aid nurse informaticians in the development of clinical information systems, including an overview of usability, displays, and reporting. For nursing students in masters level informatics programs, the ability to collect a workflow process through interviews and observation is a competency. Inclusion of an understanding of recognizing information needs and gaining skills in identifying when clinicians have information needs throughout workflow processes would improve the implementation of information systems that aid the clinician in decision-making processes.

Patient education needs to be addressed as well. Education for patients should recommend not only medications and administration schedules, but the importance of having the patient maintain a current medication list that is reinforced and reviewed with every clinician visit. Clinicians should provide an updated current medication list to the patient with every healthcare visit. For example, to demonstrate the importance of the medication list, a digital or paper version could be displayed on the white board in a patient's room. Although a digital version would be easier to maintain the accuracy, either version could be referred to while administering patient medications. Education could be provided about which medications were taken at home versus those that will be administered in the hospital. Providing reinforcement of this information as well as demonstrating medication use during the inpatient stay strengthens the importance of this information to patients. When patient's see how admission information is used by clinicians during an inpatient stay, this may also decrease negative feelings during the collection or confirmation of inpatient data collection, which is expressed by patients with phrases such as "Why are you asking this again?" or "How do you use all of this information that is asked during inpatient admission processes?"

## Research

Findings from this study support the need for additional research to fully understand the information needs related to medication use processes during intrahospital transfer. Further studies that include additional clinician participants such as clinical providers, pharmacists (both inpatient, outpatient, and retail), medication reconciliation technicians, as well as patients and their caretakers would increase the understanding of the impact of information needs on medication use processes because in this study the information needs of registered nurses was the focus. Additionally, expanding the scope to include a focus on additional points of admission through surgical services and the emergency department is necessary.

Another subsequent area of research would be an observational study to determine the influence of information needs while using the EHR during medication use processes. Understanding the impact to the clinician end user during EHR use is essential to suggesting improvements to usability and workflow. An observational study would also allow for confirmation of the results of this study.

Finally, the findings regarding workarounds during medication use processes also call for additional studies to determine the types and frequencies of workarounds and whether the workarounds pose a risk to patient safety. The effect of information needs related to medication use processes needs to be measured. One potential problem to be addressed is to quantify the number of potential errors and actual errors that may be occurring due to not having *hold and give parameters* in the system or not building rules in the system. Understanding the current influence on patient safety and patient outcomes, would determine the importance of the need for major system changes to not only display the needed parameter information required for review but also create alerts if the nurse is

about to administer a medication outside of the ordered parameters. Additionally, further studies about the occurrence of workarounds related to other information needs are needed.

## **Policy**

There are implications to policy on both a local and national level. On a local level, healthcare organizations should review medication use processes to standardize how a patient's current medication list is collected, required data elements, and the resources that should be used and exhausted in a good faith effort to collect all the necessary information. If processes are standardized, they will facilitate the transfer of patients throughout healthcare organizations within the community. Participants should include hospitals, urgent and emergent care centers, local pharmacies and pharmacy chains, primary care centers, and physician offices.

At a federal level, the Centers for Medicare and Medicaid Services (CMS) and the Office of the National Coordinator for Health Information Technology (ONC) are responsible for certifying EHRs and determining regulatory requirements that must be met. If it is determined that there is a significant risk of medication errors related to lack of hold parameters, the CMS and ONC should include regulations for coded indications that could also be included in alerts for the healthcare providers ordering medications and the nurses administering the medications. Additional federal requirements could include the maintenance of the patient's current medication list as part of the Health Information Exchange. This would allow for a single list to be created that could be updated by primary care providers and specialists, resulting in improvements in continuity of care between healthcare organizations.

## **NEW KNOWLEDGE AND REMAINING GAPS**

There are two points of new knowledge as a result of this study. First, this study evaluated the information needs of registered nurses regarding the individual steps in the medication use processes during a patient's intrahospital transfer. Previous studies investigated barriers and facilitators of medication reconciliation as a larger process that includes the tasks of collecting a patient's current medication list, performing medication reconciliation, and placing medication orders, but have not studied the implications of information needs on these individual steps. Similarly, there were no studies found in the literature that evaluated the information needs of registered nurses while compiling a list of the patient's current medications at admission as well as the implications of medication reconciliation and medication orders on medication administration.

Remaining knowledge gaps to be addressed include the replication of this study to understand clinician information needs at the time of discharge and transfer to outside facilities, such as rehabilitation centers and long-term care. The complete cycle of medication reconciliation and medication use processes need to be evaluated to determine the information needs of different clinician groups, patients, and caretakers. Additionally, a gap remains in understanding potential delays in patient care and registered nurses' information needs related to the ability to locate information about when to hold the administration of a medication. Finally, the examination of the effect of information needs on productivity and potential errors due to complex medication orders remains a gap in the current literature.

## **LIMITATIONS**

This study was conducted with registered nurses located in Central Texas and nurses that attended a national conference of medical-surgical nurses. The informants may



have different beliefs than clinicians in other practices or clinical facilities about information needs regarding medication procedures during intrahospital transfers. Therefore, the study findings cannot be generalized to other clinician groups, patients, or to other hospital facilities located in other geographic areas of the nation.

## **CONCLUSION**

Although researchers have reported that registered nurses have information needs related to medication processes, no previous study investigated information needs related to medication use processes during critical times of patient intrahospital transfer. This study consisted of a description and exploration of the perceptions of registered nurses related to medication use processes during patient intrahospital transfer. Findings for the four themes that emerged from the research were discussed along with recommendations for nursing practice, education, policy and research.

## Appendices

### Appendix A: Letter of Introduction

Dear [Clinician Name],

I received your name from your facilities' informatics leader or expert. I am a doctoral student at The University of Texas at Austin currently working on my dissertation titled, "Registered Nurse medication-related information needs at the time of patient transfer." I am looking for clinicians to interview regarding the following medication use processes: (1) collecting a current medication list from a patient, (2) performing medication reconciliation, (3) dispensing prescribed medications after admission or transfer, and (4) administering the first dose of medication after patient admission or transfer. You have been identified as a registered nurse that has experience with one or more of these processes and are willing to discuss them during an interview process. The interview process will take between 45 to 60 minutes and can be accomplished at a hospital or clinic site, or at a mutually agreed upon private location.

If you would like to participate, please contact me via email at [cara.schlegel@utexas.edu](mailto:cara.schlegel@utexas.edu) or via phone at XXX-XXX-XXXX. I appreciate your consideration of this request.

Sincerely,

Cara S. Schlegel, MS, RN

Doctoral Candidate

The University of Texas at Austin

## **Appendix B: Thank You Letter**

Dear [Clinician Name],

Thank you for responding to my request to participate in an interview related to my dissertation. Unfortunately, you do not meet the criteria to participate. [Insert reason here, if appropriate.] Your willingness to support my research is greatly appreciated. If you have any questions or would like to discuss this decision, please contact me via email at [cara.schlegel@utexas.edu](mailto:cara.schlegel@utexas.edu) or via phone at XXX-XXX-XXXX.

Sincerely,

Cara S. Schlegel, MS, RN

Doctoral Candidate

The University of Texas at Austin

## Appendix C: Demographic Characteristics

Please complete the following demographic information:

- 1) Age \_\_\_\_\_
- 2) Gender (circle one)  
Male                  Female
- 3) Years of clinical experience \_\_\_\_\_ (round to the nearest year)
- 4) Years of electronic health record experience \_\_\_\_\_
- 5) Years of experience with this facility's electronic health record \_\_\_\_\_
- 6) Highest degree earned (circle one)  
Associate Degree                  Bachelor of Science  
Master of Science                  Doctor of Nursing Practice
- 7) Profession (circle one)  
Registered Nurse  
Advanced Practice Nurse
- 8) Area of clinical or specialty experience \_\_\_\_\_
- 9) City and state of work location \_\_\_\_\_
- 10) Hospital size  
Rural/Critical Access                  Community Hospital  
Urban (Non-teaching)                  Academic Hospital

## **Appendix D: Semi-structured Interview Questions**

### **Registered Nurse Semi-structured Interview Questions**

1. When you are assigned to care for a newly admitted a patient, tell me about...
  - a. the processes you follow for ensuring you have a complete current medication list.
  - b. processes you follow when reviewing a current medication list for a patient.
  - c. the information you look for when reviewing a current medication list for a patient.
  - d. a time when you were unsure if a current medication list was complete.  
How did you go about collecting and verifying the information you need to make a decision?
  - e. situations where the collection of the information needed for the patient's current medication list was difficult?
  - f. sources of information you use to collect the patient's current medication list?
  - g. processes you follow to ensure you have the necessary information for the patient to have the correct medication orders.
  - h. the barriers you have in completing collecting the necessary information for a current medication list and/or medication reconciliation processes.
2. When you admit a patient to the hospital, is there different information needed based on the acuity of the patient? If yes, why? What makes the decision-making

process different? If no, please explain why the information needed is the same for all patients.

3. When you are assigned a newly admitted patient, tell me about processes you follow and the information needed when administering the first dose of a medication for a patient.
4. Does the process and the information needed for administering the first dose of medication vary from subsequent administrations of the same medication? If yes, how does it vary? What are reasons for this variance? Do you have information needs that are not met?
5. Do you have concerns about unmet information needs that affect patient safety during medication processes (obtaining a current medication list, medication reconciliation, administering the first dose of a medication order) at patient admission? If so, please tell me about your concerns.
6. When you receive a patient transfer within the hospital including a change in the level of care tell me about...
  - a. the processes you follow when reviewing a current medication list for a patient.
  - b. the information you look for when reviewing a current medication list for a patient.
  - c. a time when you were unsure if you had the necessary information for a current medication list. How did you go about collecting and verifying information?

- d. processes you follow to ensure the patient has the correct medication orders appropriate for the new unit or change in level of care.
  - e. the processes that help with the collection of information to improve the speed, accuracy, and/or the completeness of medication processes at patient transfer.
  - f. the barriers you have in getting the information you need to complete transfer medication reconciliation processes.
7. When you are assigned a patient as a result of a transfer between units within the hospital, tell me about process you follow when administering the first dose of a medication order for a patient. Does this process vary based on whether the medication administration is occurring before or after medication reconciliation has occurred?
  8. Does the process and the information needed for administering the first dose of a medication following patient admission differ from the administration of the first dose of a medication following a patient transfer?
  9. When preparing a patient for transfer within the hospital including a change in the level of care tell me about the communication that occurs between healthcare providers (transferring and receiving) regarding a patient's medication order information.
  10. When preparing a patient for transfer within the hospital including a change in the level of care tell me about the communication that occurs and the information that

is shared between nurses (transferring and receiving) regarding a patient's medication orders. Do you have information needs that are not met?

11. Do you have concerns about unmet information needs that affect patient safety during medication processes (obtaining a current medication list, medication reconciliation, administering the first dose of a medication order) at patient transfer? If so, tell me about your concerns.
12. How frequently do you communicate with other disciplines (i.e., nurses or pharmacists) about medication management processes (obtaining a patient's current medication list, performing medication reconciliation, or administering the first dose of a medication order)? What are your most frequent communications about?
13. Do you have access to adequate information from medication management processes (obtaining a patient's current medication list, performing medication reconciliation, or administering the first dose of a medication order)? If not, tell me how the lack of access to adequate information from medication management processes (obtaining a patient's current medication list, performing medication reconciliation, or administering the first dose of a medication order) affects your decision-making ability?
14. How does not having access to adequate information for medication management processes (obtaining a patient's current medication list, performing medication reconciliation, or administering the first dose of a medication order) affect your decision-making ability?



15. Do you ever find yourself using a workaround when you have an unmet information need related to medication management processes (obtaining a patient's current medication list, performing medication reconciliation, or administering the first dose of a medication order)? Have you witnessed others using workarounds when they are unable to resolve an information need related to medication management processes (obtaining a patient's current medication list, performing medication reconciliation, or administering the first dose of a medication order)?
16. Is there anything else you would like me to know **about your information needs regarding** medication processes, obtaining a current medication list, performing medication reconciliation, or administering the first dose of a medication after patient admission or transfer?

## **Appendix E: Research Study Fact Sheet**

### **Research Study Fact Sheet for Clinician Medication-Related Information Needs at The Time of Patient Transfer**

**Title:** Clinician medication-related information needs at the time of patient transfer.

**Principal Investigator:** Cara S. Schlegel, MS, RN

**General Information:** You are being asked to participate in the above titled research study. You have the option not to participate in this study.

#### **What is the purpose of the study?**

The purpose of this study is to gain an understanding of clinicians' information needs during medication use processes throughout patient intrahospital transfer processes.

#### **What you will be asked to do?**

By agreeing to participate in this study, you will be requested to complete a demographic form and participate in a single, audio-recorded interview with me. Completion of the demographic form and the interview should take approximately 60 to 90 minutes.

#### **What are the benefits to society as a result of this study?**

Potential benefits to society may include eventual improvements to systems and/or processes concerning medication orders and administration that are used during transfer of patients. Such benefits that are aimed at improving patient safety and quality.

#### **What are the risks involved in participating in this study?**

Given the nature of this study, potential physical, psychological, and legal risks for study participants are highly unlikely. However, one such risk is a potential risk to professional reputation. Because the topic of the research involves areas of medication errors and patient safety, the clinician may have difficulty discussing events involving a lack of information because of a perceived risk to his or her professional reputation. This risk will be minimized by confidentiality procedures that will be put in place, such as the de-identification of participant information in transcripts, meeting in private locations, and securing all files and documents. In addition, there is minimal risk that during the interview the participant may recall a traumatic clinical event that causes the participant distress. Although, the focus of the research interview will revolve around information needs of clinicians, the questions ask clinicians to recall clinical situations about medication use processes. The principal investigator acknowledges that these discussions can unearth memories. If a participant becomes upset or distressed during the interview, the interview will immediately pause and the participant will be asked if they would like to end the interview.

**Confidentiality and privacy protection?**

Measures will be taken to ensure participant privacy and confidentiality. Communication about the study will be conducted only with the PI. The study data will only be used for the purpose of this study. All data will be de-identified by assigning participants a pseudonym. All study related materials will be maintained in a locked file cabinet and stored in a password protected laptop computer. Further steps to maintain privacy will include: conducting the interview in a setting that is private and free from distractions such as an office, conference, or meeting room.

**Do you have to participate?**

Participation in this study is voluntary. You may decide not to participate, choose not to answer certain questions, or stop participating at any time, and these decisions to participate or not to participate will not have any influence on your relationship with your employer or The University of Texas at Austin and the School of Nursing.

**Will there be any compensation?**

Participants will receive a \$10.00 gift card to a store such as a coffee shop, Amazon.com, or Target for participating in the study.

**Whom to contact with questions concerning your rights as a research participant:****Principal Investigator**

Cara S. Schlegel, MS, RN  
The University of Texas at Austin, School of Nursing  
XXX-XXX-XXXX  
cara.schlegel@utexas.edu

**Faculty Supervisor**

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