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Exploring Strategies for Implementing Barcode Medication Administration Systems

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This is to certify that the doctoral study by

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2015

Abstract

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by

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MBA, Cardinal Stritch University, 1996

BSN, Minnesota State University, Mankato, 1990

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The number of medication errors associated with preventable deaths in healthcare facilities remains at a high rate for healthcare leaders. Practices of medication delivery remain similar to those 10 years ago. Hospitals that have implemented barcoding medication administration systems have reported a decrease in medication errors ranging from 60% to as high as 93%. Despite this utility of barcoding, only 50% of U.S. hospitals have implemented barcode medication administration. This comparative case study explored the strategies hospital leaders used to implement barcode medication administration systems, utilizing the sociotechnical theory for a conceptual framework. Face-to-face, semistructured interviews were used to identify experiences from a purposive sample of 20 hospital leaders from Minnesota and Iowa. The research question guiding this study addressed strategies hospital leaders used to implement barcode medication systems to reduce preventable medical errors. After analyzing the interview transcripts using inductive analyses, 4 themes emerged. These themes include the strategic organizational communication, technology and end user support, hands-on training, and application of audit reports. Hospital leaders might benefit from the study findings when developing strategies to implement barcode medication systems. The implication for positive social change includes the potential of decreasing patient medication errors and reducing loss of life caused by medication errors with hospital leaders accelerating the adoption of barcode medication systems in hospitals. Other health care providers may explore how the findings might help reduce medication errors in their facilities.

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Dedication

I dedicate this study to my wonderful husband Tom, for all the love, support, and encouragement he provided throughout this process. In addition, the dedication expands to my children, Kayla, Marissa, and Nick, smiling from heaven. It is through the eyes of children we remember; life is short, live each day to the fullest.

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Section 1: Foundation of the Study

Medication errors have shocked the U.S. population (Hunter, 2011). The relaxed progress toward the reduction of medication error rates has continued with practices remaining similar to those performed 10 years ago (Consumer Union, 2009). In harmony with the electronic medical record, barcode technology design enables the safety of patients by identifying the right patient, right medication, right dose, right time, and right route with each medication delivery (Seibert, Maddox, Flynn, & Williams, 2014). Barcode medication administration delivery systems emphasize an innovative process in reducing medication errors. However, the rate of implementation is slow, with only 50% of U.S. hospitals having implemented barcode medication administration (Pedersen, Schneider, & Scheckelhoff, 2012).

Background of the Problem

The American Recovery and Reinvestment Act of 2009 made interoperable health information systems a priority (Jha et al., 2009). However, the rate of electronic health adoption has remained low. Jha et al. (2009) found that only 1.5% of U.S. hospitals had a comprehensive electronic record system and 7.6% had a basic system. Implementation of computerized order entry for medication was 17% in U.S. hospitals (Jha et al., 2009). This low adoption rate of electronic health records (EHR) would suggest that policies put in place by the federal government did not achieve the health care performance goals that depend on health information technology.

In April 2004, the Department of Health and Human Services implemented the barcode rule U.S. Food and Drug Administration (FDA) strategy that uses state-of-the-art

technology to improve patient safety. When used with bar code scanners and computerized patient information systems, bar code technology can prevent many medication errors, including administering the wrong drug or dose, or administering a drug to a patient with a known allergy (FDA, 2011). While the bar code rule was effective in supporting bar code identification on each medication, it was only a recommendation to use barcode scanner in the delivery of medication to the patient. The ethical question becomes why the government has not supported a law to mandate barcode medication systems. The U.S. Veteran Affairs Medical Centers have implemented barcode medication systems in all 172 hospitals (Tzeng, Yin, & Schneider, 2013). Rivish and Moneda (2010) explored the benefits of barcode identification since the Veterans Affairs Medical Center implementation in 2006. The authors reported a 61.97% to 93.48% improvement when comparing postbarcode medication administration to prebarcode administration at the Veterans Affairs Centers (Rivish & Moneda, 2010). Utilizing the barcode data from Veterans Affairs Centers throughout the United States, Huttner et al. (2012) were able to collect data on the antibiotic usage in treating drug-resistant pathogens. The outcomes of barcode in the Veterans Affairs expanded beyond medication delivery into drug research and best practice outcomes. Barcode medication administration is a revolutionary way of using technology to administer medication and, at the same time, preventing medication errors (Cleary-Holdforth & Leufer, 2013). Barcoding is one of many advances in technology that hospitals have been implementing to minimize medication errors.

Problem Statement

People die needlessly each year because of preventable medical harm (Tzeng et al., 2013). The FDA Adverse Event Reporting System (FAERS) in 2011 noted 573,111 serious preventable incidents of harm occurred in patients with 98,518 resulting in death. Of the 573,111 patient deaths reported to FAERS in 2011, 38% of the deaths were a result of medication errors (Classen et al., 2011). Weston and Roberts (2013) stated that the majority of barcoding implementations have responded with a reduction of medication errors ranging from 60% to 93%. Conversely, only 50% of U.S. hospitals have implemented barcode medication administration (Pedersen et al., 2012). The general business problem is some hospital leaders have not implemented barcode medication administration systems in U.S. hospitals despite the known benefits of the systems. The specific business problem is that some hospital leaders lack strategies to implement barcode medication systems.

Purpose Statement

The purpose of this qualitative case study was to explore the strategies hospital leaders used to implement barcode medication administration systems. A case study provided the in-depth focus required to understand the experiences of hospital leaders (Yin, 2011). Twenty hospital leaders from two hospitals in Minnesota and Iowa participated in interviews to discuss their strategies. Method triangulation is a powerful technique that facilitates validation of data (Flick, 2011). I used method triangulation by supporting the participants' responses from the interviews with policy and procedures on barcode administration process obtained from each hospital. The implication for positive

social change included the potential for some hospital leaders to accelerate the adoption of barcode medication systems in U.S. hospitals, resulting in a decrease in medication errors, reduced risk, and harm to patients resulting from those errors.

Nature of the Study

This qualitative, comparative case study was to explore the strategies hospital leaders used to implement barcode medication administration systems. The value of a case study design lies in exploring and describing the relevant variables of interest (Van de Glind, Heinen, Evers, Wensing, & Van Achterberg, 2012). The use of case studies allowed for comparisons in diverse settings (Houghton, Casey, Shaw, & Murphy, 2013). A qualitative design is appropriate for the analysis of concepts and themes derived from the case study experience. Qualitative research can accommodate different paradigms and different styles of research and research reporting (Bansal & Corley, 2011). A qualitative case study design was appropriate to explore the strategies for successfully implementing to barcode medication administration systems by gathering information via semistructured interviews from a diversified group of participants in two hospital settings.

One of the key philosophical differences between most qualitative research and quantitative research is acknowledging the role the researcher played in the research outcomes (Bansal & Corley, 2011). Quantitative studies are objective and seek to find hard, overall data, using numbers (Pratt, 2009). Difficult to access from a quantitative design, the development of new information and interpretation permissible to obtain a realistic perception is qualitative research (Farquhar, Ewing, & Booth, 2011). A

quantitative study does not support participants' opinions from an interview setting utilizing open-ended questions; therefore, I eliminated it from selection. A mixed method approach was not suitable for this study because of time constraints and the intense data collection process. This study involved an attempt to explore the strategies hospital leaders' used to implement barcode medication administration systems.

Utilization of a comparative case study allowed for an in-depth exploration of real-life events. A single case study would provide information from only one source while the comparative case study provided data from a number of facilities experiencing a similar event (Yin, 2009). Generating data from real-life events through multiple organizations provided a greater depth of information, contributing to the overall credibility of the assumptions documented. The data from multiple experiences provided a stronger and more compelling story; thus, I selected the design of a comparative case study for this study.

Research Question

The intent of this research was to explore the strategies hospital leaders used to implement barcode medication administration systems. I collected data using semistructured interview questions in addition to obtaining policy and procedures on barcode administration process from each hospital. The following research question guided this study: What strategies do hospital leaders use to implement barcode medication administration systems? Based on this question, I asked participants to answer the following semistructured open-ended interview questions:

Interview Questions

1. What are your views and perceptions of barcode medication administration systems?
2. What are the benefits of implementing barcode medication administration systems?
3. What are the challenges you experience when implementing barcode medication administration systems?
4. What did you do to contribute to the implementation or designing of barcode medication administration systems?
5. What strategies did you use when implementing or designing the implementation of barcode medication administration systems?
6. What other additional information would you like to add about implementing or designing the implementation of barcode medication systems?

Conceptual Framework

Emery's sociotechnical theory provided a framework for this study. Originating in the work supported by the Tavistock Institute in London, sociotechnical system evolved in the 1950s (Emery & Trist, 1960). In sociotechnical theory, consideration of both technical and social factors occur when seeking to promote change in an organization (Cherns, 1976). The selection of sociotechnical theory in understanding the interdependencies that influence technology adoption provided the framework for the study (Lesselroth, Yang, McConnachie, Brenk, & Winterbottom, 2011). The basic principle of sociotechnical theory is the collaboration of technology with human

performance. In sociotechnical theory, ensuring the collaboration of social solutions with technical solutions to the needs of an organization confirms the collective solution results (Ackerman et al., 2012). The sociotechnical theory for this study was to demonstrate the attributes of the combined qualities of people and technology critical to the implementation efforts of a barcode system. The design and deployment of new information technology projects in complex medical settings benefits from informed understandings of, and responses to, the dependent properties of human–technology relations (Ackerman et al., 2012).

The purpose of this study was to explore the strategies hospital leaders used to implement barcode medication administration systems. The goal was to identify the strategies that advanced barcode adoption. The complexities of human-technology interactions are reliant on social, technical, and institutional processes and procedures (Lesselroth et al., 2011). Sociotechnical theory enhanced the study by the collaboration of people and technology in one process of barcode medication delivery. A sociotechnical theory selection for research design increases the understanding of the interdependencies that influence the acceptance of technology adoption (Lesselroth et al., 2011). The results might allow for better positioning of hospitals in the future to accomplish successful barcode implementation. Currently, no evidence has guaranteed the public that physicians, nurses, and other health care providers are any more competent in patient safety practices than health care systems were 10 years ago (Consumer Union, 2009).

Definition of Terms

The following key terms appear in this study.

Barcode medication administration (BCMA): BCMA is a point-of-care technology that integrates nurse scanning of barcode medications with the patient's electronic medication record (Koppel, Wetterneck, Telles, & Karsh, 2008).

Electronic health record (EHR): An EHR is a longitudinal record of a patient's health information stored in an electronic form generated by one or more encounters in any health care delivery setting (Thompson, 2010).

Electronic medical record: An electronic medical record is an electronic version of a patient's medical record that allows for easy access to patient data and information (Thompson, 2010).

Health information technology: Health information technology is a method of information processing using both computer hardware and software for the entry, storage, retrieval, sharing, and use of health care information (Gaylin, Moiduddin, Mohamound, Lundeen, & Kelly, 2011).

Medication error: Defined by the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP, 2014), a medication error is 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.

Workaround: Workarounds are an alternate route, developed by an end user, to bypass a perceived block in the workflow. This alternative route does not follow the expected rules or workflow of the designed process (Koppel et al., 2008).

Assumptions, Limitations, and Delimitations

Assumptions

Assumptions are those beliefs assumed in a study or understood to be true without verification. I assumed participants answered the interview questions honestly and without bias. I assumed participants had sufficient knowledge in barcode medication administration systems to provide meaningful answers. I assumed those interviewed were hospital leaders representing the beliefs of the profession. I maintained participants' privacy pursuant to Institutional Review Board (IRB).

Limitations

Several limitations associated with this study occurred. Limitations are those elements that I had no control over. A limitation was the possibility that study participation may not have honestly expressed the degree of implementation progress because of concerns about confidentiality. The possibility of missing important information by not asking the right questions could have occurred (Keele, 2011). Limitations included a small sample size, two hospitals in Minnesota and Iowa. The study did not take into consideration hospitals in other regions of the United States. The timeframe of the interviews may have limited attendees because of work schedule or uncontrollable circumstances.

Delimitations

Delimitations are characteristics in the study that set the boundary for the study. The primary delimitation was limiting the interview responses to 20 participants in two hospital settings in Minnesota and Iowa. Financial stability of the participants' organization in the relationship to the cost feasibly of implementation was neither a prequalifier nor a disqualifier in this study. In addition, no consideration to the availability of specimen collection and breast milk collection with barcode systems was noted.

Significance of the Study

Contribution to Business Practice

Andel et al. (2012) estimated the annual cost of preventable medical errors at $735 billion to $980 billion. Medication errors deaths contribute to 38% of the total of preventable medical errors (Classen et al. 2011). The cost saving business practice for implementing barcode medication systems is essential in identifying the reduction of medication errors. Quality care by decreasing preventable medication errors and administering the right medication, at the right time, to the right patient, by the right route with the right dose supports the delivery of safe medication practice.

Implications for Social Change

In a study conducted at a Veterans Affairs Medical Center employing such a barcode scanning system, the administration of 5.7 million doses of medication resulted in no medication errors to patients (FDA Press Office, 2009). By exploring the strategies hospital leaders used to implement barcode systems, hospitals will have the knowledge to

proceed with implementation. Saving patients' lives is a social change. Implementing barcode medication systems in each hospital provides a greater assurance that proper identification of each patient and their medications matched to the correct order based on time, route, and dose occurs. Fostering a drive to implement policy changes in the FDA mandating barcode medication administration delivery systems is a possible outcome of this study.

A Review of the Professional and Academic Literature

This literature search on barcode technology included information on the history of electronic medical records, the development of barcode technology, benefits and challenges, workarounds, and adaptation of barcode medication implementation. Relevant literature related to the study's conceptual framework, sociotechnical theory, research themes, and the potential gaps generated from this qualitative study. The literature review included information on the current research, the significance of the results, and gaps in the current knowledge.

Appropriate to identify current research in the field, several databases provided source material for the review. Journal articles, dissertations, nursing literature, and other reference material from the Walden University online library resources and Minnesota State University–Mankato supported the literature review. The primary databases searched included Health Sciences, Nursing, Business, and Management. Specific databases included SAGE Publications, Ltd, MEDLINE; EBSCOhost; CINAHL Plus with Full Text; Health Sciences: A SAGE Full-Text Collection; and ABI/INFORM Global; Health and Medical Complete. Additional databases searched involved ProQuest

Central, ProQuest Dissertation, and Google Scholar. Various keywords used when conducting research on scholarly documents included *barcode, medication, medication error, electronic medical record, and sociotechnical theory* or a combination of these keywords.

The total number of all references used was 125, which included books, peer-reviewed journal articles, government reports, and Internet sources relevant to the research topic, questions, and design. Total numbers in each category were: (a) five books, (b) 109 peer-reviewed journals and articles, (c) seven government reports, and (d) five Internet sources. Of the 109 peer-reviewed journals and articles used to conduct this research, 100 (92%) peer-reviewed journals and articles were published within the last 5 years. The literature review section contains 88 references with 81 (92%) peer-reviewed journals and articles. The 109 peer-reviewed journals and articles represent 87% of the 125 references included in this study.

The literature review included information on seven themes: (a) sociotechnical theory, (b) EHR history, (c) health care reform, (d) research method and design, (e) barcode medication, (f) workarounds, and (g) medication safety. Following is a discussion of the historical review of health information technology.

Historical Review of Health Information Technology

In the early 1990s, the Institute of Medicine (IOM) and the National Committee for Quality Assurance (as cited in Fetter, 2009) recommended the adoption of computerized patient records as the standard for a patient's medical record. The IOM reported that computer-based patient records were essential technology for health care to

improve the quality of care and patient safety (Shapiro et al., 2011). The intent was to replace paper-based patient records (Halford, Obstfelder, & Lotherington, 2010). Computerized patient records, commonly referred to as EHR, offered health care providers a more convenient way to access data, store information, and access health information simultaneously from different locations (Savage, 2012). Among the many factors at work to encourage a change from paper to EHRs were reduced medical errors, increased quality of care, increased effectiveness of patient care, and increased savings of billions of dollars to the health care industry (Calman, Houser, Luroio, Wu, & Pichardo, 2012).

In 2004, the United States Government acknowledged that by computerizing health records providers can avoid dangerous medical mistakes, reduce costs, and improve care (Kelley, Brandon, & Docherty, 2011). The cost associated with inadequate systems and medical record mistakes could cost the United States up to $29 billion annually (IOM, 1999). The implementation of EHR enables the explicit coordination among providers in medication ordering and multidisciplinary team communications. Noted by Bar-Dayan et al. (2013), in a study conducted from 2005-2008, the EHR facilitated effective utilization of providers and demonstrated a decrease in organizational costs.

Despite the increased usage of technology in the health care industry, the adoption of the EHR was slow. In 2008, the percent of physicians using an advanced EHR system was just 17%, and only 22% were participating in 2009 (Centers for Disease Control and Prevention [CDC], 2012). However, in 2008, the Center for Medicare and Medicaid

Services (CMS) adopted rules to provide incentives for physicians to use electronic medical records starting in 2009 (Bigalke & Morris, 2010). In 2009, The American Recovery and Reinvestment Act (ARRA) introduced financial motivation for hospitals, clinics, health systems, to implement EHR systems (Jah, 2009). Health Resources and Services Administration announced $31.4 million in grants to help health centers adopt and implement EHRs and other health information technology innovations. (Bigalke & Morris, 2010). As promised by the Health Information Technology of Clinical Health (HITECH), a provision of the American Recovery Reinvestment Act, beginning in 2011 health care providers and qualifying hospitals who could demonstrate successful certified EHR technologies use were eligible for incentives payments (Bigalke & Morris, 2010). These incentives are sizable with expected ranges of such payments to physicians between $44,000 and $64,000 and to hospitals between $4 and 8 million over a multiyear period (Bigalke & Morris, 2010). The results of the incentives were impressive. According to the CDC (2012), in 2011 29.6% of primary care physicians had adopted the basic EHR, and in 2012 more than 50% of physicians had demonstrated EHR success and received incentive payments. For hospitals, just 9% had adopted EHRs in 2008, and in 2012, more than 80% demonstrated use of EHRs (CDC, 2012). King, Patel, Jamoom, and Furukawa (2014) found most physicians stated the EHR enhanced patient care overall and 65% noted the EHR alerted the physicians to potential medication errors.

As the adoption of the EHR increased, the usage of computerized physician order entry (CPOE) and clinical decision support systems developed. CPOE is a clinical software application designed for health care providers to write patient orders

electronically as a replacement for paper (Huston, 2013). Hug et al. (2013) concluded that 75% of 180 reported adverse drug events were preventable by implementing CPOE. Computerized clinical decision support systems (CCDSSs) are informational technology-based systems designed to improve clinical decision-making by matching characteristics of individual patients to computer knowledge-based algorithms (Haynes & Wilczynski, 2010). In combination, CPOE and CCDSSs give providers access to point-of-care delivery knowledge, best practices, and decision-making support to improve patient care (Huston, 2013). Although CPOE and CCDSS systems target medication ordering, CDSS support other purposes as well (Khanna & Yen, 2014). The downstream effect of improving order legibility and alerting physicians to medication allergies and drug interactions from CCDSSs is preventing dispensing and medication administration errors by intercepting patient-specific information to susceptible adverse events (Rothman, Leonard, & Vigoda, 2012). The delivery of a medication is the result of complicated processes involving 10 to 15 steps, hence the successful implementation of BCMA can aid the staff in quicker access to results, and other pertinent information supporting better decision-making (Hunter, 2011).

The Office of the Inspector General (OIG) released a report in November 2010 based on data from almost one million discharged Medicare patients from hospitals in October 2008 (Office of the Inspector General, 2010). Of that group, 780 patients had experienced 128 adverse medical events. Of the 128 events, 40 (31%) were attributed to medication errors. The most common type of medication-related death (in five patients)

involved excessive bleeding from anticoagulants (Barlas, 2012). Half of the medication-related deaths deemed preventable, based on reviews of the data by physicians.

Medical errors cost health systems well over $3.5 billion per year (Foote & Coleman, 2008). Foote and Coleman (2008) noted medication error injuries occur in approximately 1.5 million Americans. Moreover, in a report 4 years later, Andel, Davidow, Hollander, and Moreno (2012) reported medical errors cost health systems well over $735 billion to $980 billion per year. Dr. Lucian Leape of Harvard related medical errors to having three jumbo jets filled with patient's crash every two days (IOM, 1999). With medical error rates achieving higher numbers, barcode medication systems work as a safety barrier between the nurse, and patient and are an answer to reducing medication errors (Helmone, Wargel, & Daniels, 2009).

The most common error involving medications is the administration of an improper dose of medicine, accounting for 41% of fatal medication errors in addition to giving the wrong drug, and using the wrong route of administration each accounted for 16% of the errors (FDA Press Office, 2009). Researchers from the Department of Pediatrics, College of Medicine at The University of Iowa–Iowa City investigated the effect of barcode medication administration in a neonatal intensive care unit (Morriss et al., 2009). During a 50-week study on 92,398 medication doses administered by barcode, a reduction in preventable adverse drug events by 45% in a neonatal intensive care unit occurred. The research is abundant in support of barcode medication systems in the reduction of medication errors and reducing preventable adverse drug events.

Barcode Medication Administration Systems

While most medication errors are benign and low risk to patients, some medication errors are severe and even deadly (IOM, 1999). The introduction of information technology into health care is to provide patients with a safe environment for care delivery (Seibert et al., 2014). By the mid-1980's bar coding, was suggested as a strategy for reducing medication administration errors (Nold & Williams, 1985). Nevertheless, it took another 15 years for the first innovated work to start with bar code medication improvements.

The inspiration came from a nurse working at the Veterans Affairs Medical Center in Topeka, Kansas. In 1994, she noticed the bar coding at a rental car company and concluded a similar system applied to enhance the safety for her patients during medication administration would reduce medication errors (Dartt & Schneider, 2010). The Veterans Health Affairs' specific goals were to improve patient safety, improve the documentation of medication administration, decrease medication errors, and capture medication accountability data (Emmendorfer et al., 2012). While variability among BCMA systems is common, the basic premise includes an encoded bar code that allows for comparison of medications ordered and the patient (Poon, Keohane, & Yoon, 2010). This prototype became the model for the bar-code medication administration (BCMA) system used throughout the 172 VA Hospitals in the United States (Emmendorfer, et. al., 2012).

Nursing education emphasizes the safe and accurate delivery of medication by following the five rights of medication administration: right medication, right patient,

right dosage, right route and at the right time (Seibert et al., 2014). The process of BCMA originates with the medication orders originating from the order entry system, processed by the pharmacy and appears in the medication record for the nurse to administer. Subsequently, the nurse scans barcodes on the patient wristband and the barcode on the medication, which allows the system to check to ensure the five rights of medication administration are, monitored (Buerhaus, 2013). Coupled with the time on the computer, barcoding provides the data points for electronic analysis to ensure that the administration of the correct medication occurs to the correct patient, in the correct dosage, using the approved method of administration, at the correct time (Early, Riha, Martin, Lowdon, & Harvey, 2011). BCMA systems design is to ensure the five rights of medication administration and prevent medication errors through a standardized approach (Poon et al., 2010). Validated by the nurse electronically as opposed to the tradition manual process BCMA assists the nurse in confirming the five rights (Buus, Nyvang, Heiden, & Pape-Haugaard, 2012). If a mismatch between what is ordered and what scanned, a warning pops up on the computer screen to alert the nurse to a potential unsafe step in the medication administration process (Poon et al., 2010). These alerts allow the nurses to pause and take action by calling the pharmacy or the physician and stop the administration of a potentially unsafe medication. The benefits of this collaborative, multidisciplinary team process in medication resolution, results in the environment of safe medication dispensing (Cleary-Holdforth & Leufer, 2013).

Medication Errors

The IOM exposed the lack of quality, and safety of the American health care system in the highly publicized landmark document, *To Error is Human: Building a Safer Health System* (1999), reciting as many as 98,000 people die each year needlessly as of result of medical errors (IOM, 1999). In 2011, medication errors harmed 1.5 million people (Hsiao & Hing, 2012). Classen et al. (2011) reported 49% of all admissions encounter a preventable error that results in injury, known as an adverse drug event (ADE). Of the 49% ADE, 19% were medication errors (Classen et al., 2011). The risk of dying from an ADE is one in 200 or as many as 187,000 deaths in hospitals each year (Goodman, Villarreal, & Jones, 2011). While not all ADEs result in harm, those that do are costly. Van Den Bos (2011) reported the annual cost of measurable medical errors at $17.1 billion. In 2012, Brunetti and Dong-Churl (2012) noted the approximate cost of ADE's to the nation was between 76.6-136 billion annually on the morbidity and mortality cost of errors. In addition, medication errors cost an extra 3.5 billion in medical costs (Hsiao & Hing, 2012).

The IOM reported the state of health care was not acceptable. However, the report also suggested that errors highlighted where failed systems, and the problem was not bad people (IOM, 1999). Nurses are not trying to compromise safety, but sometimes the system and the nurse seem to be working at cross-purposes (Buerhaus, 2013). Jones and Treiber (2010) found 78% of nurses admitted to making medication errors. By recommending a systems approach to making health care safer by improving quality and safety in health care the individual blame declines. Once a culture of shame, and silence,

health care institutes have successfully shifted to a culture of safety (Crigger & Godfrey, 2014). Despite significant resource allocation and efforts drawing attention to patient safety on the part of government agencies, and health care regulators, the harm resulting from medical care remains very common (Landrigan et al., 2010). Medication errors are the second most frequent cause of injury for all types of medical errors (FDA, 2011). An estimation of more than 40% of adverse events that occur in a hospital setting occur from medication errors (Cortelyou-Ward, Swain, & Yeung, 2012). Medication administration is the very process of improving a patient's health by providing correct medication; however, this is the exact practice that puts patients' safety at risk (IOM, 1999). With a continuing drive to implement health care technology to improve patient safety, issues related to proper maintenance, access, and ease-of-use in their design and implementation transpire (Keer, Williams, Cooke, & Ashcroft, 2013). While EHR and computerized order entry may capture errors committed during medication prescribing, BCMA may be more effective in intercepting errors committed during medication administration (Brunetti & Dong-Churl, 2012).

Barcode Benefits

The affirmative statistics of barcode assisted medication administration on preventing medication errors is overwhelming. Hassink, Duisenberg-Van Essenberg, and Roukema (2013) reported a 50% reduction in the frequency of medication errors after completing a six-week pre and post barcode implementation study. In a nine critical access hospital study by Cochran and Haynatzki (2013), the observation of 3103 medication passes was completed. Pharmacist working hours on and off site, in

relationship with those sites using a barcode system; conclude the greatest impact on lowering the odds of a medication error reaching the patients was those hospitals that implemented a bar code system (Cochran & Haynatzki, 2013). Other researchers found the implementation of BCMA in a seven-hospital system with 800 licensed providers administering medications, a 79% reduction in overriding the medication system resulted in the prevention of errors estimated from a length of stay reduction of 1476.6 days and estimated cost savings of $2,860,752 (Early et al., 2011). Three months post implementation of a barcode system at a 386-bed teaching hospital in San Diego, California noted a 58% decrease in medication errors (Helmone, Wargel, & Daniels, 2009). A study at Brigham and Women's Hospital in Boston compared 6,723-medication administration before barcode, with 7,318 medication administrations following barcode implementation resulting in a 41% decrease in error and a 51% reduction in potential drug-related adverse events (AHRQ, 2010). Scott, Friesner, Rathke, and Doherty-Johnsen (2014) observed 34% of medication errors were in the area of administration. Errors occurring during the administration process are difficult to detect prior to reaching patients because of the systems currently in place (Brunetti & Dong-Churl, 2012). In an Emergency Department study by Seibert et al. (2014), a significant reduction in the target errors resulted in an increase of administration accuracy from 87% to 99% and a reduction of wrong dose errors from eight to zero following the implementation of a barcode system. In a study of 14,041 medication administrations, a 41.4% reduction in errors occurred, while the rate of potential adverse drug events fell 50.8% (Poon et al., 2010). Sakowsik and Ketchel (2013) identified BCMA as an effective and potentially

cost-saving tool for preventing harm. The cost associated with medication error exhibited an average savings of $2000 in preventable error harm in BCMA-enabled bed over five years (Sakowski & Ketchel, 2013). Recommendation of additional research on the effectiveness of BCMA is necessary. The description of medication errors and adverse drug events that occur with and without BCMA further support patient safety concerns (Sakowski & Ketchel, 2013). The strength of the studies on medication error reduction with barcode systems continues to enhance the discussion on requiring barcode medication administration systems in every United States hospital. The weakness in barcode systems research is the limited availability of current studies that represent the lives saved, the cost reduction in health care, and the continued enhancements toward reducing patient medication errors.

Additional benefits achieved with BCMA include a reduction of time in the medication delivery process. A study in North Taiwan discovered the implementation of BCMA reduced the time for oral medication delivery by 50% (Tsai, Sun, & Taur, 2010). In a time-motion study of paper-based medication delivery compared to BCMA, the results indicated the implementation of BCMA led to a reduction in time spent by nurses on medication administration activities and increase in the time spent on direct patient care activities (Swibedi et al., 2011).

Implementing BCMA technology decreases medication administration errors and reduced time spent by nurses in the medication administration process, as documented in research. BCMA provides safety to the patient and increases time efficiencies. However, as noted by Halbesleben (2010), even in the best systems, errors will inevitably occur.

Barcode Challenges

Rapid technological advances and process changes add to the complexity of the challenges faced by nurses today (Englebright, Aldrich, & Taylor, 2014). The demand for health care reform is so compelling there appears no choice, but to implement new technology, yet these systems appear less mature (Coiera, Aarts, & Kulikowski, 2012). The nurses' role in medication management design and workflow in medication systems is imperative (Choo, Hutchinson, & Bucknall, 2010). The implementation of the medication process requires the cooperation of a variety of health care professionals including physicians, pharmacist, and nursing (Karavasiliadou & Athanasakis, 2014). Adoption of BCMA remains a challenge in the process of multidisciplinary collaboration (Strykowski, Hadsall, Sawchyn, VanSickle, & Niznick, 2013). Hunter (2011) noted using barcode could produce a blind faith in technology and produce a sense of false security. A future era, which is almost error-free will be highly dependent on improved machinery and improved computer systems (Yamamoto, Watanabe, & Kanemori, 2013). In the end, staff is still accountable for the five rights of medication administration (Hunter, 2011).

Workarounds

Numerous health care information technology systems, to reduce medication errors have entered the health care market. Although these systems can help to improve patient safety, and reduce adverse medical events, new problems develop with their deployment. Workarounds are alternative routes in medication delivery that do not follow the expected rules or workflow of the designed process (Debono et al., 2013). Workarounds have the potential contrast when the collision of technology and workflow

occur. Strategies developed by health care workers when faced with work system obstacles include workaround, and safety violations (Alper et al., 2012). Workarounds permit, yet potentially compromise, the execution of patient care (Debono et al., 2013). Barcode medication systems are susceptible to workarounds because BCMA introduce new steps in the work process (Yang et al., 2012). According to Halbesleben (2010), health care professionals found it easier to work around the block in the process than correct the problem that caused the block. When nursing is dissatisfied with the system, the perceived gain in investing in the process diminishes. Hence, a workaround response is more likely to occur (Halbesleben, Rathert, & Williams, 2013). People must feel confident that action occurs about an issue and that it will not end up in some dead-end suggestion box (Buerhaus, 2013). Redesign of systems could potentially reduce the rates of both common but harmless errors and rare but harmful errors (Ferner, 2012). The necessity to explore the relationship of technology within nursing workflow is to understand workarounds in BCMA. Implementing new technologies can affect all elements of the work system, potentially creating new impacts on the entire system of inpatient care (Buerhaus, 2013).

Sociotechnology Theory

Health care information technology jointly facilitates and inhibits the outcomes in clinical setting (Novak, 2010). Berg (1999) found the evolution of sociotechnical theory as a more reflective system theory than the technology acceptance model (TAM) emphasizing the interrelatedness of technology within human workflow. While tailored to understand acceptance of computer technologies, TAM is not specific to health care.

The development of TAM by Davis in 1989 was to explain and predict the acceptance and usage of information technology (Davis, 1989). TAM suggests that user acceptance of technology determines the user's perceived usefulness or how useful a person perceives the technology to be and their perception of ease of use or how easy the person believes the technologic is to use (Day & Gu, 2012). In TAM, an individual's perception regarding the usefulness and ease of use of a new technology indicates whether to implement and use new technology (Wei & Peng, 2011). Sociotechnical systems viewpoint is an important component in perceptions as human factors, and technology become more pervasive in everyday life (Novak, 2010). Sociotechnical theory describes the interplay between the technical and social systems. Changes in one part of the system likely relate to other parts of the system (Montague & Asan, 2012). Novak (2010) suggested information system development and implementation is a complex sociotechnical activity in which the social and the technical negotiate and evolve together. The social change resulting from barcode technology interacting with the social component of the end user and the patient creates the sociotechnical design theory. Therefore, the deployment of health information technology is not a single event in time, but rather an interactive process that requires modifications and improvements (Poon et al., 2010).

Cresswell, Worth, & Sheikh (2012) utilized a comparative qualitative case study approach in the investigation of the sociotechnical process of change in EHR implementation process. The sociotechnical method highlighted the technology and the consequences illustrated in the social setting. The hospital case study sites conceptualized

the complex inter-relationship of the technical and social environment, resulting in a slower implementation process emphasizing a plan to deal with emerging challenges and consequences resulting from the instruction of new technology (Cresswell, Worth, & Sheikh, 2012).

The challenge lies in the opportunity for improving quality and safety while transforming everyday clinical work (Karsh, Weinger, Abbott, & Wears, 2010). Adaptations are inevitable and do not always imply the software needs to be fixed (Holden, Rivera-Rodriguez, Faye, Scanlon, & Karsh, 2013). While health information technology systems are built to support current clinician workflows, their implementation, and effective use requires unavoidable changes to existing workflows (Cortelyou-Ward, Swain, & Yeung, 2012). Novak, Holden, Anders, Hong, and Karsh, (2013) added to the literature on technology implementation by articulating adaptations that occur when described frames of clinical work collide during sociotechnical transitions. Illustration of this conceptual model involves the everyday work routine, including priorities and tradeoffs, problem-solving strategies and understanding of safe medication practice. Augmenting clinical practice with technology practice reveals a collision, a mismatch between practice and technology (Novak et al., 2013). During this time of the collision between practice and technology, organizations struggle to adapt to problem-solving skills caused by the impact.

Information technology systems are tools to facilitate and supplement the delivery of patient care. Change is never easy, and change that involves a transformation of workflow in the context of caring for hospitalized patients, presents challenges to all

those involved (Simon et al., 2013). BCMA creates new problems that nurses are either able to solve effectively or ineffectively, leading to potentially riskier workarounds (Holden et al., 2013). Clinicians may perceive changes to the workflow process as unnecessary and requiring more work. Ultimately, technology tools can close communication and continuous care gaps and promote more effective quality patient care, which reduces health care cost.

Research Themes

Research is a process that leads to the discovery of new knowledge. The purpose of research is to explore, discover, describe, and interpret information (Flick, 2011). Variables found in qualitative research, are any measurable characteristic that can vary (Keele, 2011). Qualitative research data displayed efficiently demonstrates the presences of themes and their relationships (Bansal & Corley, 2011).

The discussion of themes and perceptions to explore are more common in qualitative research, while quantitative research commonly displays data and numbers (Keele, 2011). Cypress (2011) noted integrating common themes generates a reflective perception of the views of the participants. The purpose of the study was to explore the strategies hospital leaders used to implement BCMA systems. Potential themes and perceptions emerged from the data collected from the interviews assisted in the delineation of what the study participants describe as strategies in BCMA adoption. The clustering of common themes permitted the prior preconceptions about the topic under investigation an ongoing sense of caution in personal bias when making sense of the data (Kumar, 2012). This study strived to provide insights from the perceptions of multiple

health care participants that have important implications for health care leaders in their efforts to support the BCMA adoption and implementation process.

Potential themes and perceptions explored included financial restraints, technical limitations, resistant to change, and organizational constraints. As the perceptions of the participants emerged, a more precise and focused discovery of patterns developed (Bansal & Corley, 2011). Financial restraints, similar to the historical install of EHR research is a potential theme. Research by Sakowski and Ketchel (2013) estimated the cost of barcode implementation for a 110-bed facility at $3 million. Bigalke and Morris (2010) noted EHR technologies expanded only when sizable incentive payments were available from the government. With only 50% of United State hospitals using barcode medication administration (Pedersen et al., 2012), an incentive payment plan by the U.S. government to increase the implementation efforts of barcode medication administration has not currently been explored.

The technical limitations of obtaining bar code scanners, additional computers to accommodate the workload changes, and the bandwidth of connectivity remain consistent with implementation barriers in new technology. Searching for the right equipment can be a daunting task (Hunter, 2011). Researchers at the US Department of Veterans Affairs have made one of the largest investments in information technology (Spetz, Burgess, & Phibbs, 2012). However, frustration with network problems and the perceived shortage of equipment plagued some facilities during implementation (Spetz, Burgess, & Phibbs, 2012). Dedicated time over several months provided to team members in a rural hospital

in New England ensured the team could adequately design and evaluate new products prior to implementation (Richardson, Bromirski, & Hayden, 2012).

Resistant to change for individuals, providers and organizational systems are a potential risk factor thus a perceived theme. The implementation of new technology can be a complex endeavor (Gooder, 2011). BCMA systems affect current work processes of nurses requiring individual and system changes. Changes of this magnitude require expertise in process improvement and assessment in workflow changes to be successful (Richardson, Bromirski, & Hayden, 2012). A key to an organization's successful implementation of barcode systems is to understand the level of change involved, the perceived satisfaction with the system and how effective the user views the system in preventing errors (Gooder, 2011).

Lastly, organizational constraints of leadership involvement and culture change are potential emerging themes. During a team evaluation prior to BCMA, one of the most significant points learned was the need for organization support for a culture of change and safety (Richardson, Bromirski, & Hayden, 2012). Sites with unsupportive leadership, or where staff did not respect the ability of the leadership team, faced more challenges during and after implementation of BCMA (Spetz, Burgess, & Phibbs, 2012).

Gaps in Research

The literature remains sparse in BCMA technology. Most studies in health care barcode technology are of the impact on safety. The complexity of the health care system and the significant involvement of humans with technology, there will always be errors in the system (Conrad, Fields, McNamara, Cone, & Atkins, 2010). Consequently, those

studies do not capture the lack of implementation by U.S. hospitals. The gaps in the literature for exploring strategies hospital leaders need to implement BCMA merit continued scholarly research.

Medication errors persist even though there have been technological improvements to assist in the reduction of errors in the medication process, such as BCMA technology. The literature has shown the benefits of BCMA for reducing medication administration errors (Hassink et al., 2013; Cochran & Haynatzki, 2013; Early et al., 2011; Helomne et al., 2009; Scott et al., 2014; Seibert et al., 2014; Poon et al., 2010) as well as other benefits. In addition, the reduction in time spent on medication delivery (Tsai et al., 2010; Swibedi et al., 2011), and cost reduction (Sakowsik & Ketchel, 2013). Yet, still non-adherence to the BCMA process. Technology alone cannot solve the problem of medication administration errors.

I designed this study to bridge the execution gap between BCMA technology and U.S. hospitals. I accomplished this by exploring the strategies needed for hospital leaders to implement BCMA. Perhaps by identifying the strategies from hospital leaders, the focus on patient safety will encourage the implementation of BCMA to reduce medication administration errors.

With published research substantiating the efficacy of BCMA in decreasing the frequency of medication errors, fewer than half of the nonfederal hospitals have adopted this technology (Seibert et al., 2014). The application of barcode administration technology is relatively new (Emmendorfer et al., 2012). Dartt and Schneider (2010) found the first implementation of barcode medication took place in the Veterans Affairs

hospital from 1993 to 2001. Overall, there remains limited information on barcode medication administration systems. Current research focuses on the reduction of medication errors in hospital units, potential workarounds, and workflow adaptation. This study involved the attempt to explore the strategies hospital leaders used to implement barcode systems. In recognition of the strategies, improving business practice with the facilitation of safer medication practice will potentially reduce the cost of medication errors resulting in positive patient care outcomes. Therefore, like organizations may graduate to a quicker, safer implementation process.

To date, this study was the first study designed to address the strategies for successfully implementing barcode medication administration systems. Limited and conflicting research regarding BCMA systems occur (Gooder, 2011). This study may fill a significant gap in the literature.

Summation of Barcode Research

Since late 1990's, there has been a significant effort to design and implement effective strategies to improve the quality of health care (Rozenblum et al., 2011). EHRs are an essential technology to improve delivery and quality of health care, provide significant cost savings, and make patient information available 24 hours a day, around the world, (Devoe et al., 2011). Basic EHR had advanced from 17% adoption in 2008 to 40% adoption in 2012 (Hsiao & Hing, 2012). Because of government incentives, the implementation of EHRs continues to grow in physician offices and hospitals.

Medication errors have been a national health care item since the IOM sentinel report in 1999. Recognizing the positive implications barcode technology could offer in

the reduction of medication errors the evolution of barcode systems developed. A pioneer in the use of BCMA technology, the VA has utilized BCMA to administer medications since 2000 (Rivish & Moneda, 2010). While barcode medication systems are relatively new, the study of the success of barcode in the reduction of medication errors continues. Thus far, the majority of implementations have responded with a reduction of medication errors related to barcoding ranging from 60% to 93% (Weston & Roberts, 2013).

Sociotechnical systems design theory supports this study in the investigation of the strategies hospital leaders need in the implementation of barcode medication systems in U.S. hospitals. The system design effectiveness results in the collaboration of technology with human factors. While TAM focuses on individual perceptions to whether a new technology will be useful, the sociotechnical theory evolution of social and technical relationships critically transforms the social network to outcomes. The impact of information technology on the clinical work system is not a linear process that unfolds; the journey is in which the work system changes and adapts, and the person adapts to the work system (Carayon et al., 2014).

The completion of data collection formulates the identity of emergent themes. Common themes from participants formulate the need for analysis thus increasing the understanding of why the lack of adoption of BCMA exists. Research themes explored may include financial restraints, technical limitations, resistant to change and organizational constraints. Themes emerge following the intersection of personal data collection and the merging of professional information. Recognition and identification of extraneous variables are important in assessing the potential effects these may have on

the study prior to the start of the research. Appreciation of themes and awareness of extraneous variables better positions this study for data interpretation.

Gaps in the research are evident in the discussion of strategies needed for hospital leaders to implement barcode medication systems. While the current research has provided data on the reduction of medication errors through barcode implementation, the lack of adoption of a barcode medication system throughout U.S. hospitals remains unknown. Furthermore, additional research continues in the review of workflow adaptation and workarounds; however, the gaps remain in why the adoption of barcode technology remains low. According to current research, the strategies hospital leaders need, remain unexplored in the implementation of BCMA systems.

Transition and Summary

In this qualitative study, I aimed to explore the strategies hospital leaders used to implement barcode medication administration systems. Section 1 was an overview of the study including the background, problem and purpose statements, nature of the study, and the research question. Section 1 also reviewed the conceptual framework, operational definitions, assumptions, delimitations limitations, significance of the study and implications for social change, and review of the literature. Section 2 contains the methodology and design chosen for this study. The section contains the restatement of purpose, the role of the researcher, study participants, and ethical procedures. In addition, Section 2 contains research and design, population and sampling methods, data collection instruments, data organization and analysis techniques, concluding with reliability and validity.

Section 2: The Project

Section 1 provided background and research providing clear evidence regarding the lack of implementation of barcode medication systems. Section 2 provides additional information about the project including a purpose statement and the role of the researcher. Participant selection, research method and design, population, and sampling are included. Section 2 concludes with information on ethical research, data collection, instruments, technique, and data organization techniques, along with data analysis and reliability and validity.

Purpose Statement

The purpose of this qualitative case study was to explore the strategies hospital leaders used to implement barcode medication administration systems. A case study provided the in-depth focus required to understand the experiences of hospital leaders (Yin, 2011). Twenty hospital leaders from two hospitals in Minnesota and Iowa participated in interviews to discuss their strategies. Method triangulation is a powerful technique that facilitates validation of data (Flick, 2011). I used method triangulation by supporting the responses from the participants' interviews with policy and procedures on barcode administration process obtained from each hospital. The implication for positive social change includes the potential for some hospital leaders to accelerate the adoption of barcode medication systems in U.S. hospitals resulting in a decrease in medication errors and reduced risk and harm to patients resulting from those errors.

Role of the Researcher

The role of the researcher is to select participants, collect and organize data, and analyze data. As the researcher, I recruited participants, collected data, explored new knowledge, and reported all data (Corman, 2010). I purposely selected participants to participate in the study in person, by phone, and through e-mail. Supported by the Belmont Report in research ethics, an informed consent, assessment of the risk and benefits and the selection of participants provided the moral framework for the study (Burns & Grove, 2011). I used an interview process and obtained policy and procedures on barcode administration process from each hospital to collect qualitative data regarding the strategies hospital leaders used for successful implementation of barcode medication systems. Appendix B reflects the interview protocol in the study. Twenty midlevel managers participated in face-to-face semistructured interviews to share their experiences. Yin (2009) noted interviews allow for a more fluid response rather than inflexible response. Participants' views expressed during the interview ensure the accuracy and in-depth analysis (Bluhm, Harman, Lee, & Mitchel, 2010).

One way to mitigate bias is to identify the researcher's known bias upfront. Bias can occur in any study and may misrepresent the assessment of information (Keele, 2011). Case studies are prone to bias because the researcher must understand the issue (Yin, 2009). The evidence of a successful researcher is to identify the barriers prior to the research and evaluate the probability of bias occurring. One test of this possible bias is the degree to which a researcher is open to contrary findings (Yin, 2009). Yin (2009) proposed to mitigate bias by reporting the findings to a few critical colleagues with a

request of offering alternative explanations or suggestions for data collection, and if contrary findings produced documentable rebuttals, this would prove critical and produce possible changes. I applied member checking throughout the interview process as an approach to achieving research validity and mitigating bias. In member checking, the participants check to see if authentic representation occurred during the interview and the researcher's interpretation of the participant is correct (Harper & Cole, 2012). As a nurse of 30 years and a participant in barcode design, I was aware of my personal and professional biases regarding the study. To complete the study impartially, I was mindful of my bias as a nurse. Therefore, the hospitals selected did not employ me. The data collected was my only source of reference, thus reducing the risk of tarnishing the data analysis process by eliminating the presence of personal attitudes, prejudices, or beliefs pertaining to the research topic.

Participants

Participants in this study were hospital leaders. Twenty hospital leaders from two hospitals in Minnesota and Iowa participated in interviews to discuss their strategies. A purposeful participant selection for this study consisted of 20 members, 10 in each hospital, of hospital leaders in two hospitals. According to Molenberghs et al. (2014), a small sample is perfectly acceptable in a case study.

Participants in this study partook in an interview process seeking to identify the strategies for successfully implementation of barcode medication administration systems. I had handed each participant an informed consent letter before participants participated in the case study research (Appendix A). Each participant had the opportunity to review

the informed consent letter and ask questions prior to signing. To enhance trust with the participant, I explained the purpose and benefits of the study. All participants who agreed to complete the interview signed a consent form stating their participation in the study was voluntary. Participants assigned letters and numbers to maintain their confidentiality during coding and analysis. Each participant could have chosen to withdraw from completing the interview at any time with no penalty. No names or personal information collected in the interview collection. The participants' identity remained confidential; hence, coding of the collected data warranted privacy. Signing a consent form acknowledged the participants' understanding of their role in the study that the interview was voluntary, the participants may have withdrawn at any time during the completion time with no penalty, and the responses were confidential (Qu & Dumay, 2011). During this study, there were no foreseeable risks or harm to human participants. The consent form included a statement that data from the study were in a safe place for 5 years to protect participants' rights. I will save collected data on a computer hard drive and jump drives that are password protected and located in a home office drawer for safekeeping. For disposal of the collected data, I will shred all collected data and delete all electronic data following the 5-year period. No names of the participants appear on any forms, only letters and numbers used to minimize the risks of exposure and protect professional reputations.

Research Method and Design

The method I used in this study was qualitative. The design was a case study. Sociotechnical theory supported understanding the strategies hospital leaders engaged in

for successfully implementing barcode medication administration systems. Qualitative research methods enable researchers to investigate evidence in natural environments. Qualitative research inspires the description of personal information people and events bring forth in a stimulating manner for the reader (Bansal & Corley, 2011).

Method

Qualitative research encourages creativity and can accommodate different paradigms and different styles of research and research reporting (Bansal & Corley, 2011). Selected participants are experiencing the phenomenon of interest at their point of interaction in qualitative research (Lesselroth et al., 2011). One of the key philosophical differences between most qualitative research and quantitative research is acknowledging the role the researcher played in the research outcomes (Bansal & Corley, 2011). Quantitative studies are objective and seek to find hard, overall data, using numbers (Pratt, 2009). A qualitative study synthesizes the human experiences resulting in an inductive analysis, while deductive analysis occurs during a quantitative study generating a numeral summary that allows the researcher to reject or accept the null hypothesis (Lesselroth et al., 2011). In a qualitative study, the questions asked provided a greater depth in understanding the experience (Farquhar et al., 2011). Thus, a qualitative case study approach was more appropriate than a quantitative approach to understanding the strategies hospital leaders used to implement barcode medication administration systems.

Mixed method permits the use of quantitative numerical data with the integration of the qualitative meaning and understanding of participants' experiences (Keele, 2011). Historically a mixed method combined quantitative data with the qualitative data to

validate the explanation for the quantitative data (Bansal & Corley, 2011). A mixed method approach was not suitable for this study because of time constraints and the intense data collection process. This study involved deeper insights in understanding what strategies hospital leaders used to implement barcode medication administration systems.

Research Design

While other qualitative designs—(a) ethnography, (b) grounded theory, (c) phenomenology, and (d) Delphi technique—are relevant, the focus of human perception, beliefs, and attitudes applied more accurately tell the story in a case study design. The value of a case study design lies in exploring and describing the relevant themes of interest (Van de Glind et al., 2012). Houghton et al. (2013) noted the use of case studies allows for comparisons in diverse settings. The utilization of a comparative case study in the identification of barcode systems strategies broadens the scope of the information each individual organization brings to the collection, thus enhancing the value of the data received.

Ethnography is the study of cultural groups in a natural setting over a prolonged time (Cruz & Higginbottom, 2013). Data collection within the culture occurs through observation, interviews and documents such as maps, and records that provide an understanding of the community of the culture to the researcher (Cruz & Higginbottom, 2013). As nursing is a defined culture group, the study of the strategies of barcode implementation expands beyond the nursing culture, hence forfeiting the ethnography design.

Originally proposed by Glaser and Strauss in1967, grounded theory is a strategy conducted when data collection and analysis occur concurrently (Dunne, 2011). Typically, the elimination of a literature review in the grounded theory is common to avoid contamination and keep the researcher free to discover (Thornberg, 2012). Grounded theory develops new theories based on empirical data collected in the field (Dunne, 2011). A grounded theory design approach did not meet the goals of this study based on the constructed defined question in the study. In addition, the absence of generating a theory on the challenges of barcode medication administration did not support the study.

The goal of phenomenological research is to describe a lived experience (Roberts, 2013). Only those who have experienced the phenomena can communicate it (Kumar, 2012). Pringle, Hendry, and McLafferty (2011) argue that the ambiguity of the guidelines and the lack of sufficient advice do little to recommend phenomenal studies. Even though a phenomenological research could be effective for the lived experience of the individual in barcode medication administration, the focus of a case study explores the process and event along with the human involvement.

The Delphi technique combines the testimonies of experts in developing the trends and needs of the research study (Morgan, King, Rudd, & Kaufman, 2013). Morgan et al. (2013) noted the Delphi technique chosen effect is determining consensus from a group. The case study was to explore the strategies hospital leaders used to implement barcode medication administration systems, and not gain the testimonies of expert in developing consensus from a Delphi technique.

The value of a case study design is the human interaction in obtaining the data content. Theme development emerged during data collection. Saturation is the point in data collection when no new or relevant information emerges (Flick, 2011). Achieving saturation demonstrates no new themes, or new coding and replication of the study demonstrates the same results. This study interviewed a minimum of 20 participants to obtain robust data.

Population and Sampling

The sample of participants for this study consisted of 20 hospital leaders drawn from the populations at two hospitals in Minnesota and Iowa hospitals. Each hospital had 10 participants. A purposive sampling method allowed participants who understand the central phenomenon selected for the study (Burns & Grove, 2011). The determination of the sample size in a case study is by the nature of the study (Yin, 2009). A small sample may be biased and not constant, however, is perfectly acceptable in a case study (Molenberghs et al., 2014). The case study design was feasible for the research because barcode medication administration is dependent on the number of participants of the problem, and examination of multiple cases permits literal replications of the results (Yin, 2009).

I choose a purposive sample of 20 hospital leaders. Purposive sampling is a method chosen by researchers to select participants who understand the central phenomenon (Burns & Grove, 2011). To be eligible to participate in the study, the participants were hospital leaders employed within a hospital environment, and willing to participate in a face-to-face interview process that took about15 minutes to complete.

Sampling is purposive in nature (Flick, 2011), and ensures the selection of key participants' whose knowledge and expertise are relevant to the purpose of the research (Burns & Grove, 2011). Within purposive sampling, using a maximum variation sampling method, the researcher selects a small number of cases that maximize the diversity relevant to the research (Cohen & Crabtree, 2006). I used maximum variation sampling method in this study to gain the diversity in hospital leaders within two hospital settings. According to Suri (2011), the advantages of using the purposive sampling design include less expensive, time, and travel as well as the ease of sample selection.

A feeling of humanity increased the participation of hospital leaders (Carayon et al., 2014). Medication safety is a worthy topic. Participants linked to pertinent topics of interest are important in persuading people to participate in a study (Harcombe, Derrett, Herbison, & McBride, 2011). Some people enjoy contributing based on exposure to other colleagues involved in research, and several feel a sense of duty, influenced by their occupational background (Harcombe et al., 2011).

Ethical Research

The Walden University IRB approved this study to ensure the research fulfills the university's ethical standards along with U.S. federal regulations. Walden University's approval number for this study is 11-18-14-0305501, and it expires on November 17, 2015. Grady (2010) noted that the main function of a university's IRB is to protect the participants and promote ethical research. Ethical considerations in research include the ethical treatment and respect for confidentiality for all participants involved. I conducted all interviews. The informed consent provided participants with an introduction to the

research process, interview, and the consent form (Appendix A). Participants voluntarily agreed to partake in the completion of the study by signing the consent form. (Appendix A).

There was no incentive offered for participation in the interview. Participants could exit the interview at any time during the process by ending the interview session without penalty. I took notes on my computer, recorded the interview process to ensure data collection accuracy, and repeated answers during the interview. Following each interview, I reviewed the notes with the participant to ensure that the accuracy of the information matched. I amended the notes to reflect what the participant said. I took care to ensure privacy by using letters and numbers and no names or titles. I used NVivo software to assist me in analyzing participants' responses and in the coding and identification of themes collected from the raw data. I secured the interview responses in my computer by a private passcode and kept any documentation in a locked home safe. Data related to the study will remain in a locked cabinet for a period of 5 years. I will destroy the data after the 5-year period is complete.

Data Collection

Case studies can incorporate interviews as the principal data collection for retrieving participant perceptions (Yin, 2009). For this study, I used a semistructured interview to support data collection. I conducted the interview questions at two hospitals settings in Minnesota and Iowa. I collected policy and procedures on barcode administration process from each hospital. Qu and Dumay (2011) noted selecting the right instrument for data collection is crucial to the data analysis and research outcomes.

Instruments

In a qualitative study, the researcher becomes the primary instrument for data collection (Marshall & Rossman, 2010). To understand the strategies for successfully implementing barcode medication administration systems, I conducted face-to-face open-ended interviews (Appendix C) of hospital leaders from two hospitals in Minnesota and Iowa. Collected policy and procedures on barcode administration process from each hospital occurred. The face-to-face interviewers captured the thoughts and personal perspectives of the hospital leaders in exploring the strategies used in a successful implementation of barcode medication administration systems. As the primary instrument, I became a significant part of the instrument collection process with the secondary instrument, the interview. The interviews of the participant provided the material for data analysis and comprised the primary data collection instrument in this research Interviews afford the participants' the ability to expand and elaborate on questions (Yin, 2011). By providing a disclaimer, informing participants that participation was voluntary and only I would have access to the individual responses, eases a sense of intimidation among those who volunteered. As a qualitative comparative case study, all data collected via the interviews contained no scoring in association with the data gathered. Reliability of a qualitative study depends upon the consistency of the data collection technique (Flick, 2011); therefore, I delivered the same question to all participants. Establishing validity is an outcome when utilizing a panel of experts in question review (Radhakrishna, 2007). A stable instrument indicates a high degree of reliability and the results are repeatable (Golafshani, 2003).

Triangulation of data demonstrated an additional confidence in the validity. Triangulation combines data drawn from different sources and at different times, in different places or from different people (Flick, 2011). Method triangulation is a more comprehensive description of the topic by using multi data sources in the investigation (Burns & Grove, 2011). I used method triangulation to achieve credibility by supporting the responses from the participants' interview with policy and procedures on barcode administration process obtained from each hospital.

Applying the correct interpretation of the answers during the course of the interview was critical in obtaining accurate interpretation of data. Harper and Cole (2012) defined member checking as a quality control process in qualitative studies to improve accuracy, credibility and validity by participant verification of the collected data. Member checking gives participants the opportunity to correct errors and challenge interpretations, by agreeing or disagreeing with the interpretation, allowing for changes if necessary to achieve accuracy and completeness of the data collected. Member checking provides the opportunity for the participant to volunteer additional information. Member checking allows participants to review the preliminary findings of their transcripts and overall themes, while providing participants the opportunity to assess adequacy of data and preliminary results as well as to confirm specific aspects of the data (Patton, 2015). Furthermore, member checking relies on the assumption that there is truth in the reported data. The data collected and overall themes, confirmed by the participant, allows for the final confirmation. I applied member checking throughout the interview process by providing the participant the opportunity to review the gathered data for correction

purposes and to add additional data. Any additional data was included in the collection process. I confirmed member checking by providing participants the opportunity to assess adequacy of data and preliminary theme results as well as to confirm aspects of the data. I took full responsibly for accuracy in all collected data to ensure accuracy and completeness of the data.

Prior to interviews, I conducted expert validation with five panel experts to ensure the reliability (method) and validity (results) of the questions. Expert validation used to assess the accuracy and consistency of the questions asked, support the content validity of the study (Radhakrishna, 2007). Five colleagues in the health care field reviewed the interview questions to help establish content validity. The selections of the five participants were three individuals from separate health care acute care settings and two University health care professors. Following the expert validation, I debriefed each participant in a phone discussion regarding the interview questions and inquired if each question was necessary and easy to understand. Based on the expert validation review of questions, I may need to re-write questions that were not easy to understand. The weight of evidence suggests that if every stakeholder who was looking at the issue from a different point of view, academia, and health care, see outcomes similarly, this is likely a true outcome (Flick, 2011). Assessment of the measurement tool supports validity by the accuracy of the responses and by measuring what needs to be a measure (Golafshani, 2003). Interviews discover the meaning and understanding subjects are experiencing (Keele, 2011). This expert validation confirmed the questions were valid, easy to understand, and reveal applicable data for the study.

Both qualitative and quantitative research need to demonstrate reliability. While the reliability in quantitative research depends on the accuracy of the measuring and testing instrument, in qualitative research, the text is the rich source of data. The principle text of each item must be a consistent measurement and correlate with other items (Burns & Grove, 2011). The purpose of measurement is to provide practical appraisal for relevant theories of interest (Malhotra, Mukhopadhyay, Xiaoyan, & Dash, 2012). In qualitative research, trustworthiness of the research demonstrates reliability (Golafshani, 2003).

The idea of testing is a way of extracting information, and the most important test of any qualitative study is its quality, thereby increasing the trustworthiness of the research (Golafshani, 2003). According to Cohen and Crabtree (2006), the measures from Lincoln and Guba's Evaluative Criteria note that trustworthiness of a qualitative research study is important in evaluating its worth. Trustworthiness encompasses credibility, transferability, dependability and confirmability (Cohen & Crabtree, 2006). Credibility is the believability of the data (Shenton, 2004). High-quality qualitative research is evident by data richness delivered by the participants (Tracy, 2010). Transferability of research, defined by the detailed descriptions of the situation and methods noted in the study allow for replication (Shenton, 2004). Dependability examines the consistent, and repeatability of the study (Cohen & Crabree, 2006). The achievement of reliability embraces ensuring all steps and procedures are documented, and the method and design are consistent throughout the study occurs (Flick, 2011). Reliability in this study included highly detailed descriptions of the process and procedures in the ability to repeat the study.

Finally, confirmability supported by an audit trail at the conclusion assisted in demonstrating how each decision transpires (Shenton, 2004).

Strategies, to address the threats to validation and reliability included discussion of the characteristics, application and maturation (Burns & Grove, 2011). Thick description with standardizing data collection and data organization strengthened the transferability of the information. Participation selected by purposive sampling ensured all participants had an equal chance of participation, therefore limiting the self-selection threat. Awareness of the possibility of maturation recognized the awareness of the event.

Completion of the interviews took place in two hospitals in Minnesota and Iowa. An on-site face-to-face interview research method provided the evidence for the study. Interviews were an essential source of case study information (Yin, 2009). I delivered the interview questions to participants in an identified room within the organization. Through this interview process, participants' had the opportunity to take time to answer the semistructured questions asked. In utilizing an interview research method, both advantages and disadvantages occurred. Advantages included allowing the participant to provide detailed information about personal feelings, perceptions and opinions, a high response rate and the observation of nonverbal cues, such as tone or body language that can lead to a more in-depth discussion. Additional cost of travel and the extra time required for the interviews were disadvantages of the interview process (Flick, 2011). Clear instructions with a perception of ease of use, time efficient length, and understandable questions enhanced the completion rate in the interviews.

I explained the Informed Consent Form (Appendix A), the interview process, and the ability for the participant to withdraw at any time. Noted in the explanation, I conduct the interview. I only have access to the completed information and will keep it in a locked cabinet for a 5-year period. For disposal of the collected data, I will shred all collected data, and delete all electronic data following the 5-year period.

Data Collection Technique

Data collection occurred utilizing a face-to-face interview process. I collected policy and procedures on barcode administration process from each hospital during the first interview. Interviewing possesses the strength of targeted and focus topic questions and insightful explanations (Yin, 2009). The interview allowed the participant the freedom to describe the event under investigation (Englander, 2012). I took the following actions for interview delivery: (a) started the interview with an introduction of the research topic to establish a bond with participants and to ease their comfort, (b) introduced and explained the consent form (Appendix A) and allowed time for clarification, questions, and signature, (c) introduced the recording device, scribe writing folder, as described in the consent form, and begin the interview process, (d) reviewed the questions, pursued clarification as necessary, and summarize each answer for clearness during the interview, (c) emphasized confidentiality throughout the interview, (d) encouraged participants to answer questions freely, (e) asked each participant to elaborate more about the topic during the interview, and (f) thanked the participants for their time participating in this study.

The expert validation conducted prior to the interviews validated the questions in the interview section for reliability and consistency to ensure validity. The interview questions and open-ended study questions administered to five colleagues in the health care field established content validity. Each participant in the expert validation read the interview questions, introduction, and informed consent form and participated in reviewing the questions. I engaged each participant in a phone conversation to discuss if each question was easy to understand. I reviewed each answer for consistency in responses. Rewording of any questions occurred when answers were not applicable to the intended response.

Data Organization Techniques

Responses collected from the interview provided the data information. The data information was loaded into NVivo software. The NVivo software captures specific information and determines if a theme and trend in other responses occurs (QSR International, 2011). I determined themes and common notations to complete the analysis of the study.

Each interview response and the policy and procedure documents saved on a jump drive. The secured jump drive is located in a locked safe in my home office for five years. For disposal of the collected data, I will shred all collected data, and delete all electronic data following the 5-year period. Organization of data was the interview questions and policy and procedure documents by hospital. Description was one way of moving from data organization to meaning, using data as originally written (Flick, 2009). Research participants and other stakeholders within the organization received a copy of

the completed results of the study. Appendix C reflects the interview questions utilized for the study.

Data Analysis Technique

Data analysis is to understand, characterize, and interpret the data. The data analysis followed the steps that Yin (2009) recommended (a) transcribe interviews, (b) read the transcribed notes to get the general meaning of the data, (c) code the data, arranging it into manageable themes, and (d) interpret the meaning of the case study. Interview participants answered the following questions:

1. What are your views and perceptions of barcode medication administration systems?
2. What are the benefits of implementing barcode medication administration systems?
3. What are the challenges you experience when implementing barcode medication administration systems?
4. What did you do to contribute to the implementation or designing of barcode medication administration systems?
5. What strategies did you use when implementing or designing the implementation of barcode medication administration systems?
6. What other additional information would you like to add about implementing or designing the implementation of barcode medication systems?

I used NVivo software to evaluate the data gathered from the interviews. NVivo software assisted with the identification and organization of themes in qualitative data.

(QSR International, 2011). Leech and Onwuegbuzie (2011) found NVivo software can take qualitative data analysis much further than is possible manually, by assisting in recording, storing, indexing and sorting the data. The software does not analyze the data; rather assists in visualizing the relationships within the data (Leech & Onwuegbuzie, 2011). Throughout the analytical process, the value of using the NVivo software was in the ability to ensure the coding remains consistent (Hutchison, Johnston, & Breckon, 2010). I loaded the data from the interview questions into the NVivo software to identify themes and common notations. The coding of patterned themes illustrated the stories express by the participants. The identification of themes from the contributors provided insights into the perceptions of the strategies hospital leaders need to implement BCMA systems.

Analysis of policy and procedure information for the two hospitals occurred at the completion of the interview process. Examination of each hospitals policy and procedure for similar themes and processes documented in an excel spreadsheet. Notations for unique information on the policy and procedures occurred in the spreadsheet. Information analysis resulted during method triangulation.

Examining the data within the sociotechnical theory combined the relationships and qualities of people with technology together. A single event in a system approach requires globalization to an interactive process that requires modification and improvements (Poon et al., 2010). Optimizing human performance in collaboration with technology requires the balancing of perception, performance, and technology in one.

The ultimate goal was to explore the strategies hospital leaders used to implement barcode medication administration systems.

Reliability and Validity

Precise understanding of data leads to valid and reliable results (Tracy, 2010). Several methods ensured validity and reliability of a study include, investigating, developing tools, data collection and data interpretation (Yin, 2009). Reliability and validity complete this section.

Reliability

Although reliability and validity are separate in quantitative studies, these terms in qualitative research are interactive. Instead, terminology that encompasses both, such as credibility, transferability, and trustworthiness is used (Golafshani, 2003). The trustworthiness of research defines the reliability of the study (Tracy, 2010). Reliability of a study by the repeatability of the study with the same results accomplishes validation (Yin, 2009). Explaining data collection process and technique allow another researcher the ability to replicate the study, thus demonstrating reliability of the systematic process (Burns & Grove, 2011). To verify the reliably of the current study, I (a) used the same questions for all interviews, (b) ensure transcribed data was accurate by sharing the findings with the participants involved, (c) completed member checking by empowering the participants the opportunity to correct errors and challenge the information transcribed, offered participants to add additional information and assess the adequacy of the collected data, (e) utilized a consistent data analysis process with NVivo software,

and (f) ensured replication of the study by providing explicit explanation of the data collection and technique process.

Validity

A measurement method must be reliable if valid for a study (Burns & Groves, 2011). Validity transpires by how well the instrument tool reflects the items examined (Tracy, 2010). The discovery and richness of detailed experience gained from open-ended questions provide a method of data collection where participants control the input consequently removing biases from interviewers or pre-selected answers (Keele, 2011). Utilization of member checking seeks to define validation in qualitative methodology (Harper & Cole, 2012). Validation the interview questions occurred when five colleagues from the health care field provided the tool in an expert validation review to determine if the questions were easy to understand, and would reveal applicable data for the study. Purposeful sampling ensured this study included knowledgeable participants representing the health care field by using a maximum variation sampling method,

To ensure the validity, I provided detailed descriptions of development and data collection; therefore, anyone interested in transferring this framework can do so for comparison purposes. Providing rich description allows for repeatability of the study. To improve the validity, I conducted member checking during the interview process by empowering the participants the opportunity to correct errors and challenge the information transcribed. Harper and Cole (2012) note member checking, respondent verification, as restating the participants' interview response to determine accuracy. Member checking gave participants the opportunity to correct errors and challenge

interpretations, by agreeing or disagreeing with the interpretation, allowing for changes if necessary to achieve accuracy and completeness of the data collected and overall themes. Member checking offers participant to volunteer additional information. Member checking allows participants to review the preliminary findings, while providing participants the opportunity to assess adequacy of data and preliminary results as well as to confirm specific aspects of the data (Patton, 2015). I offered the participants to assess the adequacy of the transcribed data, and initial themes analysis, and add additional information to complete member checking. Furthermore, Yildirim (2010) notes raising the quality of research by getting feedback validation from participants' supports member checking. In addition, I performed an expert validation review of the interview questions to validate the questions used in the study. Triangulation of data demonstrated an additional confidence in the validity. I used method triangulation to achieve credibility by supporting the responses from the participants' interview with policy and procedures on barcode administration process obtained from each hospital. Rowley (2012) noted that a representation of 5 to 25 individuals represents a typical sample size for a qualitative study. Qualitative research studies help to uncover new meaning known only to the individual living the experience (Cypress, 2011).

Transition and Summary

The purpose of this qualitative comparative case study was to explore the strategies hospital leaders used to implement barcode medication administration systems. As a worthy topic, barcode discoveries emerged from relevant, timely and significant priorities. Section 2 detailed the role of the researcher, participants involved in the study,

research method and design, population and sampling, and data collection details. A semistructured interview delivered to participants in two hospitals in Minnesota and Iowa provided the data intended for investigation. I collected policy and procedures on barcode administration process from each hospital. I used NVivo software and a excel spreadsheet to finalize data collection. An analysis completion is an effort to illuminate the essence of the experiences of the participants (Cypress, 2011). The information in Section 3 includes the research findings, application to professional practice, implication for social change, recommendation for action and further study and a conclusion in self-reflection of the research experience.

Section 3: Application to Professional Practice and Implications for Change

The objective of this qualitative study was to explore the strategies hospital leaders used to implement barcode medication administration systems. This section provides the research findings, application to professional practice, implication for social change, and recommendation for action and further study. This section also includes recommendations for strategies hospitals leaders can use to implement barcode medication administration systems. This section will conclude in a self-reflection of the research experience.

Introduction

The purpose of this qualitative comparative case study was to explore the strategies hospital leaders used to implement barcode medication administration systems. A qualitative case study design was the approach implemented to address the desired outcome of a diversified group of participants by gathering information via semistructured interviews in two hospital settings. The research process focused on 20 hospital leaders from two hospitals in Minnesota and Iowa.

After comprehensively reviewing the transcripts of the interviews, I entered the interview material into the NVivo software. NVivo does not analyze the data, but assists in visualizing the relationships within the data (Leech & Onwuegbuzie, 2011). I developed common themes and trends from the information provided by the participants as recommended by Yin (2011). The data collected from the policies and procedures of barcode medication administration and consequent themes gathered from the interviews provided a basis for understanding strategies hospital leaders used to implement barcode

medication administration. Four themes emerged from the analysis of the data, and four recommendations provided a review of the interviews coupled with the conceptual framework and literature review in Section 1. The themes involved (a) strategic communication, (b) technology and end user support, (c) training, and (d) audits. The four recommendations are embrace strategic organizational communication, technology and end user support, hands-on training, and application of audit reports.

Presentation of the Findings

The presentation of the findings of this study addressed the overarching central research question: What strategies do hospital leaders use to implement barcode medication administration systems? Face-to-face semistructured interviews provided the data from the participants. I used purposive sampling to ensure that the sample represented key participants whose knowledge and expertise were relevant to the study (Trotter, 2012). Each participant signed a consent form and agreed to permit audiotaping of the interviews. I used method triangulation by supporting the responses from the participants' interviews with policy and procedures on barcode administration process obtained from each hospital. The data collected were analyzed using NVivo software, which aids in the identification of themes and trends (QSR International, 2011). I demonstrated the connectivity to the conceptual framework and literature review delivered in Section 1 of the study by illustrating actual examples provided by the participants.

The conceptual framework for this study was the sociotechnical theory developed by Emery in 1950s. The theory reflects both technical and social factors when seeking to

endorse the change in an organization (Cherns, 1976). The sociotechnical theory was used as a framework to understand the human element in a relationship to expanding technology (Huston, 2013).

Previous research on the strategies hospital leaders used to implement barcode medication administration systems lacked academic depth, based on the literature review in Section 1. The limited knowledgebase on the strategies used by hospital leadership on BCMA opens up research opportunities as identified in this paper. The results of the interviews answered the following research question: What strategies do hospital leaders use to implement barcode medication administration systems?

Four themes pertinent to my research questions emerged from my data analysis. The themes are as follows: (a) strategic communication, (b) technology and end user support, (c) training the end users, and (d) audits reports, including documentation on the percent of scanning completed per nurse, the reasons why an override occurred, and identification of late or early dispensing errors. I refer to the hospital leadership as Participant A through T during the data analysis. Table 1 illustrates the themes in relationship to the participants' responses.

Table 1

Categories of Themes in the Study per Participant

Theme	Participant Response
• Strategic communication	• A, B, D, E, F, G, H, I, J, K, L, M, N, P, Q, R, S, T
• Technology and end user support	• B, C, D, E, F, H, I, J, K, M, N, O, P, Q, R, T
• Training	• A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, T
• Audits	• A, D, E, F, H, I, J, K, M, N, Q, S

Table 2 illustrates the findings collected during the review of the policy and procedure documents collected. Analysis for each hospital policy and procedure included the relationship of the content similarities and uniqueness. Data analysis from the policy and procedures appear in each noted theme. The triangulation of identified patterns across sources indicated the theme of strategic communication with the differences in the number of steps in each policy and procedures. Hospital IA communicated 31 steps compared to Hospital MN at 17 as identified in Table 2. Technology, end user support, and training correlated to the policy and procedures analysis of the five rights and scanning procedures. Audits identified in Hospital IA policy and procedures related to the interview audit discovery, however, policy and procedures documentation of audits in Hospital MN documentation remained absent.

Table 2

Relationship of Policy and Procedures per Hospital

Hospital Policy and Procedures	Number of Steps in Policy and Procedures	5 Rights	Scanning Wristband/ Medication	Reporting/ Audits
Hospital MN	17	Yes	Yes	No
Hospital IA	31	Yes	Yes	Yes

Theme 1: Strategic Communication

Communication was a key component to the success of the BCMA project. The implementation of BCMA has increased across hospitals from 13.2% in 2005 to 50.2% in 2011 (Pedersen et al., 2012). Noted by Bar-Dayan et al. (2013), the EHR facilitated effective utilization in the coordination of care and communication among multidisciplinary teams. However, prior research noted adoption of BCMA remains a challenge in the process of multidisciplinary collaboration (Strykowski et al., 2013). Weston and Roberts (2013) noted communication is complex and can cost hospitals billions of dollars due to inefficient communication among care providers. Participant K reflected that communicating the heart of the project, the positive outcome for patient safety, was essential in making the change from paper to computer medication delivery. The theme of positive patient safety outcomes from a barcode medication process was consistent with prior studies that indicated up to 60% to 93% reduction in medication

errors with barcoding (Rivish & Moneda, 2010; Weston & Roberts, 2013). Participants B, D, G, and K spoke of the importance of communicating with all disciplines prior to the start of the project, during and post. Many participants referred to the postcommunication as the most important. The feedback from the end users allowed for making necessary changes to the coding or workflow immediately postimplementation. Participants F, R, and T identified patients as needing communication about the project and providing them with education on how BCMA helps in patient safety. Participant M stated the best communication was a sheet of paper with all the tips and tricks of how to use the new product attached to the back of every computer in the patients' room.

Exploring the data within the sociotechnical theory combined the relationships and qualities of people with technology together. Lesselroth et al. (2011) noted sociotechnical theory as an understanding in the interdependencies that influence technology adoption. Communication is one interdependent talent humans perform. Strategic communication in written form supported analysis of the policy and procedures of barcode medication from each hospital. Four pages of the document represented one hospital's policy and procedure, while the other hospital had two pages. A consistency within the two hospitals in communicating the five rights of medication pass and a verification of orders transpired. Analysis of detailed information communicating the level of home medication distribution and the credentials of hospital employees who were eligible to pass medications occurred in one hospital's policy and procedure documents. With a drive to implement health care technology to improve patient safety, the acceptance of humans and technology, develop (Keer, Williams, Cooke, & Ashcroft,

2013). Bubalo, et al. (2014) noted multiple technological advances in the past decade not only make treatment safer, but also increase the communication and efficiencies for health care workers. Best practice alerts promoted online communication in Southern California regional hospitals, demonstrating statistically significant improvement in pressure ulcer prevention (Weston & Roberts, 2013). While documentation within the policy and procedures remained unique, the essence of patient safety in medication administration was forefront.

Theme 2: Technology and End User Support

Theme 2 focused on the technology and end user support. The basic principle of sociotechnical theory is the collaboration of technology with human performance (Lesselroth et al., 2011). All participants reported that supporting the technology and the end user were essential in a successful implementation. Seibert et al. (2014) found in a two-hospital study, the implementation of BCMA was associated with a significant increase in medication accuracy and did not introduce new types of error in the medication administration process. Participants R and T commented how technology cannot interfere with the human side of caring for patients. Huston (2013) noted that one of the most significant challenges nurse leaders will face in the coming decade would be to find the balance between maximizing the benefits of using the technology, which exists, while not devaluing the human element. Policy and procedure documentation in both hospitals supported the scanning of patient identification band and each medication. The sociotechnical theory utilized in this study supports the challenges noted by participants ensuring a collaboration of technology and human factors are essential in the

success of change. The deployment of new information technology in complex medical settings benefits from informed understandings of, and responses to, the dependent properties of human–technology relations (Ackerman et al., 2012).

The technology support was programing the scanners and troubleshooting the equipment if it did not work. Participants explained end user support as extra individuals on the units to add support during the first week of implementation. The extra staff helped with the slowness in the learning curve by providing duties normally performed by the staff. Participant A and L noted chocolate treats delivered to the floor by administration were helpful in the learning curve period because chocolate represents support and acknowledgment of a job well done. Super users, were described by the majority of those interviewed as a person who had extra training and helped each staff member on the unit with questions and support during the implementation. Recognizing, end users change practices when using BCMA as they identify workflows that they perceive more amenable to their practice, super users became a vital part of the process in keeping the BCMA practice pure (Harrington, Clyne, Fuchs, Hardison, & Johnson, 2013). The policy and procedures of medication administration did not include comments on super users or technology support in either hospital.

Theme 3: Training

BCMA is relatively new technology intended to prevent medication errors, yet the technology can generate errors when not used as designed (Harrington et al., 2013). Participant D commented that no person goes to work to hurt others. When used properly, the majority of the interviews stated BCMA decreases errors significantly. With proper

training, BCMA can save lives. To ensure workarounds do not happen, proper education is necessary and a culture of safety over expediency should be adopted (Bubalo, et al., 2014). In a qualitative study, Taliercio et al. (2014) indicated that BCMA acceptance during the implementation was determined on two factors: of use perceptions and usefulness.

Mandatory classroom training for staff occurred, in addition to on the unit hands on training, and one hospital provided practice kits. Participant B described the practice kits as an individual training strategy that allowed staff to take a kit up to the unit with systematic instructions and examples to practice orders and scanning to feel more comfortable with the process. Training too soon was an obstacle reported by Participant C. Training needed to occur within a month period so staff could retain all the material presented in a timely manner stated Participant C. Participant A, C, and J supported follow-up training once the project started. Follow-up training was most important in avoiding workarounds. Debono et al. (2013) stated workarounds occur when alternative routes in medication delivery that do not follow the expected rules or workflow of the designed process. One example of a workaround was failure to scan the patients' wristband. While both hospitals' policy and procedure requires scanning the wristband, this was not consistent with evidence from the interviewee Participants A, H and I. Consistent with prior studies from Alper et al., (2012); Debono et al., (2013); Halbesleben, (2010); and Yang et al., (2012), barcode medication systems are susceptible to workarounds because of new steps in the work process. While the notations of

workarounds occur in practice, the hospital policy and procedures outline systematic procedures on acceptable medication delivery.

Both hospitals report utilizing BCMA in the emergency room. No unit identification of BCMA occurs in the policy and procedures. Implementation of BCMA in the emergency room was associated with 90% reduction in medication errors, specifically wrong dose errors (Bonkowski et al., 2013). Training complications multiplied for the emergency room when nurses learned to enter orders in the computer system to speed the medication delivery process. The deployment of new information technology projects in complex medical settings benefits from informed understandings of the human–technology relations supported in sociotechnical theory. (Ackerman et al., 2012).

In addition, one hospital utilized tele-pharmacy in the hospital pharmacy. Tele-pharmacy is an off-site pharmacy used during the night shift. The normal turnaround time for medication review with a tele-pharmacy prior to delivery of a medication is 10 minutes, which in the emergency room can be a long wait, hence the ability to enter orders and proceed with the five rights in a manual sense. BCMA replaces manual identification of the five rights: the right patient, right medication, right dose, right route, and the right time (Harrington et al., 2013).

Theme 4: Audits

Theme 4 concentrated on the audits and reports for both hospitals. Hospitals communicated the audit and compliance reports are from the BCMA electronic tracking system. The audit reports include documentation on the percent of scanning completed

per nurse, the reasons why an override occurred and identification of late or early dispensing errors. In a study by Seibert et al. (2014), BCMA were more effective in intercepting and recoding errors and preventing medication errors from reaching the patient. The sociotechnical theory incorporates the technical aspects of the audit reports and the human aspect of communicating the results of the reports. The policy and procedure documents did not specify audit reports; however, additional documentation is required for tracking reasons for the omission of delivery and medication errors. Early, Riha, Martin, Lowdon, and Harvey (2011) noted barcoding provides the data points for electronic analysis to ensure that the administration of the correct medication occurs to the correct patient.

Participant B communicated their hospital was striving for 95% compliance on all medications scanned. Correct and consistent procedures for medication delivery decrease the potential for medical errors, thus a decrease in medical error cost. This result is consistent with prior studies that indicate medical errors are costing billions of dollars throughout the United States (Andel et al. 2012; Brunetti and Dong-Churl, 2012; Foote & Coleman, 2008; Hsiao & Hing, 2012; Van Den Bos, 2011). Participant F confronted a nurse who was not scanning the medications based on the audit, and the nurse's response was "I was not going to scan until you made me do it." Even in the presences of policy and procedures on BCMA, workarounds by nurses circumvent safety stops and can cause errors (Voshall, Piscotty, Lawrence, & Targosz, 2013). Participant N supported communicating the compliance report to all staff. Participant E posted the compliance report on the unit with the nurses' names and percentages of compliance achieved.

Participant E commented that this process provided competition within the unit in supporting each other in how to fix any workflow that was not supporting the process.

Summary of Findings

The four themes that emerged from my data analysis were: (a) strategic communication, (b) technology and end user support, (c) training the end user, and (d) audits reports including documentation on the percent of scanning completed per nurse, the reasons why an override occurred and identification of late or early dispensing errors. Strategic communication identified themes supporting verbal and written communication as essential components of successful implementation. The collaboration of technology and the end user support enhanced the dedication of the sociotechnical theory. Hands-on and timely training in conjunction with increasing compliance with audit reporting reinforced the findings. Participants' interview results and policy and procedure documentation channeled the themes. Supported throughout the study findings, sociotechnical theory demonstrates the collaboration of technology and human factors remained supported. The themes that emerged from the study may be factors that are critical for hospital leaders in the strategies necessary for barcode medication implementation.

Application to Professional Practice

Identifying the best practice business strategies is imperative to organizational success. The most significant contribution of this study was the focus on patient medication safety designed to decrease medication errors and save lives with the application of barcode medication systems. Poon et al., (2010); Swibedi et al., (2011);

Tsai, Sun, and Taur, (2010), focused research on the percent of medication error reduction while Halbesleben, (2010); Halbesleben, Rathert, and Williams, (2013); Yang et al., (2012), discussed workarounds associated with barcode medication administration systems. I introduce potential applications to professional practice from findings of this study to address the gap in the existing literature on what strategies hospital leadership practice to implement barcode medication systems. Several of the participants in this study supported best practice strategies for the success of barcode implementation. Identifying the themes from the interviews and policy and procedures was important to add consistency and reliably on the data for this study.

This study contributes to informatics, nursing, and hospital leadership about the continued issues with patient safety and the quality of care through reliable medication error detection methods. The application of the doctoral study has implications for hospital leadership success in barcode implementation. Finally, the documented results serve as reference material for future studies.

Implications for Social Change

The implication for positive social change includes potential reduction in the negative effects of medication errors on patients' lives such as death, thus, reducing the grief and financial burden on families and U.S. hospitals. The majority of barcoding implementations have responded with a reduction of medication errors ranging from 60% to 93% (Weston & Roberts, 2013). Community members may benefit by the increase awareness of the number of deaths occurring due to medication error and request admission to hospitals demonstrating the use of barcode medication systems. Thus, the

potential for society changing behaviors to choose hospitals with barcode medication administration technology for safer patient care and less medication errors.

The results of the study might add additional information for the FDA to use in supporting mandating barcode medication administration systems in hospitals and eventually all facilities in the United States administering medications to patients. Sharing successful methods to accelerate the implementation of BCMA may reduce medication errors afflictions of cost and potential disabilities encountered by patients and their families affected by the medication error. Andel, et al. (2012) reported medical errors cost health systems well over seven hundred thirty-five billion to nine hundred eighty billion dollars per year. Results could lead to a reduction in the taxpayer's burden of supporting the cost of medical errors by a reduction of health care cost associated with medication errors.

As hospitals prepare for barcode implementation by investigating published research, my findings might bring foresight with the recommendations discovered in my study. This may influence social change by accelerating other hospital implementation of barcode, thus decreasing medication errorsto the community population. Understanding the findings may help other health care providers explore how barcode implementation might help in preventing medication errors. Results of this study revealed how the acceleration of BCMA may reduce medication errors and save lives.

Recommendations for Action

Patient safety and quality of care are among health care's greatest priorities (IOM, 1999). To ensure the highest level of quality and safety, new developments in technology

continue to emerge. IOM (1999) identified the practices related to patient medication are those at the greatest risk for errors and adverse outcomes. The results of this study produced four recommendations. The recommendations include strategic organizational communication, technology and end user support, hands on training and application of audit reports.

Strategic organization communication illuminated a predominate theme in this study. The findings identified organization communication as an important phase in implementation success. Communicating the benefits and attributes of increasing patient safety, decreasing medication errors and improving the quality of care for all patients provided the framework for the start of the project. Recommendations for multidisciplinary work teams with a number of hands on user on the team transpired. The findings support the importance of addressing communication throughout the process and continuing throughout the evaluation phase. Communication is apparent in the verbal form of support, the written form on tips and tricks to address challenges and through positive measures such as delivering candy to the floors in support of the major change.

Technology and end user support is a necessary component of successful implementations. Recommendations include a complete discovery of all barcodes and scanning compliance of the barcodes. All too often, the drug manufacture includes an additional barcode in its product quality control process. The additional barcode will not scan properly for nurses, leading to the frustration and in some cases overriding the barcode safety features, possibly causing a medication error (Cohen, 2014). The recommendation would be to identify medications with two barcodes up front and

provide the education necessary during training. If medications do not scan, the recommendation is to have a protocol in place to call pharmacy rather than trying to work around the problem. The benefits of using specific protocols could reduce medication liability for the organization, which is a cost savings (Pape, 2013).

End user support is instrumental at the time of implementation. The use of super users on each unit is highly recommended. Call centers to field questions and concerns and additional staff on the units to assist in the daily duties of the unit during the first week are essential in an implementation success.

Recommended is hand on training as an effective training tool, in addition to classroom training and post training follow up. Post training recommendation is to avoid possible workarounds in the future. Workarounds are noted when the nurse administering the medication using a BCMS deviates from the defined workflow (Voshall, Piscotty, Lawrence, & Targosz, 2013).

The final recommendation is for the successful application of audit reports. Audit reports identify the potential challenges occurring on the units. Recommendation of posting audit reports supported immediate change in behavior. Communicating the results via one-to-one conference, staff meetings and hospital wide reporting occurred.

Nursing needs to lead the way in the design and implementation of practice and policies that improve outcomes and reduce medication errors. I plan to publish my findings in nursing research journals. Additionally, I would welcome the opportunity to share my information with others in nursing or health care conferences. This study makes an important contribution to research on the importance of optimizing the common

strategies used by hospitals to implement barcode medication systems to ensure safety and increase the quality of patient care.

Recommendations for Further Study

This study makes an important contribution in research on the importance in strategies hospital leaders used to implement barcode medication administration systems. The development of safe medication administration practice is essential in preventing harm to patients. Barcode medication administration systems are excellent additions to the medication error prevention strategies (Pape, 2013).

Limitations included a small sample size, a hospital in Minnesota and one in Iowa. Future studies may take into consideration hospitals in other regions of the United States A limitation was the possibility that study participation may not honestly express their views and perceptions due to of concerns of confidentiality. Future studies may consider off-site interviewing in place of onsite interviewing achieving a greater level of confidentiality. The length of time of the interviews may have limited attendees because of busy work schedules or unavailability of the time I was present on site. Scheduling in the future may be more advantages at the beginning or end of a workday.

Further studies might strengthen opportunities to address the compliance of BCMA based on the audit reports. Additionally, further studies are necessary on how effective BCMA systems are in significantly reducing deaths due to medication errors. Finally, the findings might add information for the FDA to use in supporting mandating barcode medication administration systems in hospitals and eventually all facilities administering medications to patients.

Reflections

As a Registered Nurse with over thirty years of experience in bedside nursing, hospital administration, consulting on information systems, designing and developing barcode medication systems and as a professor of nursing, I have a unique perspective on how human elements respond and react to the advancements in health care technologies. When I began the study, I had no preconceived conclusions about what the results would be. An expert panel of health care professionals and academic professors reviewed the research questions, to mitigate personal bias within the research questions. I mitigated personal bias by using member checking during the interview allowing the participants the opportunity to correct errors and challenge the information transcribed and the initial analysis of the overall themes. I provided participants with my interpretation of the narrative and themes for verifying plausibility, finding out whether the data analysis was congruent with the participants experience. I allowed participants to review the study results, hence, completing member checking. I identified my known bias up front, and was open to contrary findings. Additionally, I triangulated the qualitative data collected through interviews, data collection of policy and procedures and the review of case studies to substantiate the findings.

Reflecting back on my study, there were unique challenges in obtaining the number of hospital leaders to conduct the interviews. Most of the participants were able to recall their experiences in BCMA implementation. Some of the participants had changed position or were new to the organization. Only the participants can contest to their honesty and legitimacy of the information they provided. It would be interesting to

expand the study to end users of BCMA in addition to the information provided by the hospital leaders.

Retrospectively, I found the study to be beneficial in developing the themes and recommendations for hospitals to move forward with BCMA implementation. I plan to publish the information in hopes of sharing my knowledge with others going through this process. Finally, and most importantly, I gained a true appreciation for all doctoral recipients, respect, and admiration for academia.

Summary and Study Conclusions

The objective of this qualitative study was to explore the strategies hospital leaders used to implement barcode medication administration systems. Section 1 provided an overview of the study. Documentation included the background, problem and purpose statements, nature of the study, and the research question. Section 1 also included a review of sociotechnical theory as the conceptual framework, operational definitions, assumptions, delimitations, limitations, significance of the study and implementations for social change, and review of the literature.

Section 2 detailed the role of the researcher, participants involved in the study, research method and design, population and sampling, and data collection details. A semistructured interview delivered to participants in two hospitals in Minnesota and Iowa, provided the data intended for investigation. Policy and procedures on barcode administration from each hospital, in addition to utilization of NVivo software, finalized data collection.

Section 3 delivered the research findings, application to professional practice, implication for social change, and a reference to action and further study. This section also included recommendations for strategies hospitals leaders used to implement barcode medication administration systems. This section concluded with a self-reflection of the research experience.

The research findings emerged with four themes from the analysis of the data, and four recommendations. The themes involved (a) strategic communication, (b) technology and end user support, (c) training the end user, and (d) audits reports including documentation on the percent of scanning completed per nurse, the reasons why an override occurred and identification of late or early dispensing errors. The most significant contribution of this study to professional practice was the focus on patient medication safety designed to decrease medication errors and save lives with the application of barcode medication systems. The implication for positive social change included the potential for some hospital leaders to accelerate the adoption of barcode medication systems in hospitals resulting in a decrease in medication errors, reduced risk and harm to patients resulting from those errors. The four recommendations embrace strategic organizational communication, technology and end user support, hands-on training and application of audit reports. Further studies might strengthen opportunities to address the compliance of BCMA based on the audit reports. Additionally, the findings might add information for the FDA to use in supporting mandating barcode medication administration systems in hospitals and eventually all facilities administering medications

to patients. Reflecting back, I found the study to be beneficial in developing the themes and recommendations for hospitals to move forward with BCMA implementation.

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Appendix A: Consent and Confidentiality Form

Thank you for your consideration in taking part in a research study to explore the strategies hospital leaders use to implement barcode medication administration systems. You are invited to take part in the study because you are a healthcare professional, employed within a hospital and have knowledge of the topic of barcode medication administration systems. As part of a process called "informed consent" this information will allow you to understand this study before deciding whether to take part in the study. All possible conflicts of interests will be discussed.

A researcher named, Julie Frederick RN, MBA, who is a Doctoral Candidate at Walden University, conducts this study.

Background Information

Medication errors have shocked the U.S. population. The most common medication error involves the administration of an improper dose of medicine, accounting for 41% of fatal medication errors. Barcoding remains one of many advances in technology hospitals implement to minimize medication errors however, recognizing the attributes in barcoding, only 50% of U.S. hospitals have implemented barcode medication administration. The purpose of this qualitative study will be to explore the strategies hospital leaders use to implement barcode medication administration systems in U.S. hospitals.

Procedures

If you agree to be in this study, you will complete an interview process that contains six questions. The interview will take approximately 15 minutes. I will conduct the interview process. I will be taking notes on my computer and record the interview process to ensure data collection accuracy and will repeat your answers during the interview. Collected data will be coded to ensure privacy. I will only have access to the completed information and will keep it in a locked safe.

Voluntary Nature of the Study

Your participation in this study is voluntary. You have the option of not completing this study. Your decision of whether or not you want to be in the study is respected. Even if you decide to join the study now, you can still change your mind during the study and may stop at any time.

Risks and Benefits of Being in the Study

No known foreseeable risks for you by participating in this study. The potential benefits from participating in this study may accelerate the adoption of barcode medication systems in U.S. hospitals resulting in a decrease in medication errors and an increase in positive patient outcomes.

Compensation

There will be no compensation or gifts for being in the study.

Confidentiality

The information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. No personal identification on the interview data or anything else that could identify you in any reports of the study. Data related to the study will remain in a locked cabinet for a period of 5 years and will be destroyed after the 5-year period.

Contacts and Questions

You may ask any questions you have now. Alternatively, if you have questions later, or would like a copy of the research results, please contact the researcher, Julie Frederick, via her cell number: (507) 469-3389. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 612-312-1210. Walden University's approval number for this study is 11-18-14-0305501 and it expires on November 17, 2015.

Statement of Consent

I have read the above information and I understand the study well enough to make a decision about my involvement. By participating in the interview process, I am agreeing to the terms described above.

Thank you so much for your time and considering this study.

Printed Name of Participant _____

Date of consent _____

Participant's Signature _____

Researcher's Signature _____

Appendix B: Interview Protocol

Date _____ Location_____

Interviewer _____ Participant _____

Instructions:

- Explain to the participant the purpose of the study.
- Assure confidentiality and have the participant sign the release form.
- Audiotape each interview and assign a number in chronological order utilizing the digital recording device.
- Record participants assigned letters and numbers on top of page
- Ask questions and probe the participant to go deeper into their meanings.
- Share the findings with the participant, allowing the participant to analyze the findings and comment on them.
- Thank the participant for his/her participation.

Appendix C: Interview Questions

1. What are your views and perceptions of barcode medication administration systems?

2. What are the benefits of implementing barcode medication administration systems?

3. What are the challenges you experience when implementing barcode medication administration systems?

4. What did you do to contribute to the implementation or designing of barcode medication administration systems?

5. What strategies did you use when implementing or designing the implementation of barcode medication administration systems?

6. What other additional information would you like to add about implementing or designing the implementation of barcode medication systems?

Appendix D: Iowa Hospital Documentation

Letter of Cooperation

Letter of Cooperation from a Research Partner

[redacted]

November 19, 2014

Dear Julie Frederick,

Based on my review of your research proposal, I give permission for you to conduct the study Exploring Strategies for Implementing Barcode Medication Administration Systems within the [redacted] As part of this study, I authorize you to recruit and conduct 15-minute interviews to 10 hospital leadership participants and obtain the policy and procedure of Barcode Medication Administration. Individuals' participation will be voluntary and at their own discretion.

We understand that our organization's responsibilities include providing names of hospital leadership participants and the policy and procedure of Barcode Medication Administration. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting and that this plan complies with the organization's policies.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the student's supervising faculty/staff without permission from the Walden University IRB.

Sincerely,

Authorization Official
Contact Information

Walden University policy on electronic signatures: An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically. Electronic signatures are regulated by the Uniform Electronic Transactions Act. Electronic signatures are only valid when the signer is either (a) the sender of the email, or (b) copied on the email containing the signed document. Legally an "electronic signature" can be the person's typed name, their email address, or any other identifying marker. Walden University staff verify any electronic signatures that do not originate from a password-protected source (i.e., an email address officially on file with Walden).

Data Use Agreement

DATA USE AGREEMENT

This Data Use Agreement, effective as of November 17, 2014, is entered into by and between Data Recipient, Julie Frederick and Data Provider, [redacted] The purpose of this Agreement is to provide Data Recipient with access to a Limited Data Set ("LDS"), copy of the policy and procedure for barcode medication administration, for use in research in accord with the HIPAA and FERPA Regulations.

1. Definitions. Unless otherwise specified in this Agreement, all capitalized terms used in this Agreement not otherwise defined have the meaning established for purposes of the "HIPAA Regulations" codified at Title 45 parts 160 through 164 of the United States Code of Federal Regulations, as amended from time to time.

2. Preparation of the LDS. Data Provider shall prepare and furnish to Data Recipient a LDS in accord with any applicable HIPAA or FERPA Regulations

3. Data Fields in the LDS. No direct identifiers such as names may be included in the Limited Data Set (LDS). In preparing the LDS, Data Provider shall include the data fields specified as follows, which are the minimum necessary to accomplish the research: Copy of the Policy and Procedure of Barcode Medication Administration.

4. Responsibilities of Data Recipient. Data Recipient agrees to:

    a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

    b. Use appropriate safeguards to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

    c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

    d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

    e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

5. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its Research activities only.

6. Term and Termination.

   a. Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

   b. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

   c. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

   d. For Breach. Data Provider shall provide written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

   e. Effect of Termination. Sections 1, 4, 5, 6(e) and 7 of this Agreement shall survive any termination of this Agreement under subsections c or d.

7. Miscellaneous.

   a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

   b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding the HIPAA Regulations.

   c. No Third Party Beneficiaries. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

   d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER	**DATA RECIPIENT**
Signed	Signed: Julie Frederick
Print Name:	Print Name: Julie Frederick
Print Title: VP Pt. Care & Informatics	Print Title: Walden DBA Student

Appendix E: Minnesota Documentation

Letter of Cooperation

Letter of Cooperation from a Research Partner

[redacted]

November 19, 2014

Dear Julie Frederick,

Based on my review of your research proposal, I give permission for you to conduct the study Exploring Strategies for Implementing Barcode Medication Administration Systems within the [redacted] As part of this study, I authorize you to recruit and conduct 15-minute interviews to 10 hospital leadership participants and obtain the policy and procedure of Barcode Medication Administration. Individuals' participation will be voluntary and at their own discretion.

We understand that our organization's responsibilities include providing names of hospital leadership participants and the policy and procedure of Barcode Medication Administration. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting and that this plan complies with the organization's policies.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the student's supervising faculty/staff without permission from the Walden University IRB.

Sincerely,

Authorization Official
Contact Information

Walden University policy on electronic signatures: An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically. Electronic signatures are regulated by the Uniform Electronic Transactions Act. Electronic signatures are only valid when the signer is either (a) the sender of the email, or (b) copied on the email containing the signed document. Legally an "electronic signature" can be the person's typed name, their email address, or any other identifying marker. Walden University staff verify any electronic signatures that do not originate from a password-protected source (i.e., an email address officially on file with Walden).

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    a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

    b. Use appropriate safeguards to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

    c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

    d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

    e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

5. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its Research activities only.

6. Term and Termination.

   a. Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

   b. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

   c. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

   d. For Breach. Data Provider shall provide written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

   e. Effect of Termination. Sections 1, 4, 5, 6(e) and 7 of this Agreement shall survive any termination of this Agreement under subsections c or d.

7. Miscellaneous.

   a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

   b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding the HIPAA Regulations.

   c. No Third Party Beneficiaries. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

   d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER	**DATA RECIPIENT**
Signed: _____	Signed: Julie Frederick
Print Name: _____	Print Name: Julie Frederick
Print Title: Director of Nursing	Print Title: Walden DBA Student