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Strategies to Reduce Costs Caused by Medication Errors in US Hospitals

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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2021

Abstract

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by

Janice Chobanuk

MN, University of Alberta, 2006

BScN, University of Alberta, 2000

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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June 2021

Abstract

Medication errors result in patient harm, including deaths, costing American hospitals over $20 billion annually. The financial impact and reduced public confidence in safe patient care create a business problem for hospital leaders trying to contain costs, maintain a competitive edge, and sustain patient satisfaction. Grounded in the sociotechnical conceptual framework, the purpose of this generic qualitative study was to identify strategies hospital leaders use to reduce costs caused by medication errors in hospitals. Data collection involved semistructured interviews with 10 hospital leaders from various high-reliability hospitals across the United States and a review of documents related to medication management policies, medication reporting, and medication error–related indicators. The themes derived from a thematic analysis included multilayered error prevention and a high-reliability approach, leadership support, open communication with feedback loops, sustaining a culture focused on error prevention, and patient partnerships. One key recommendation is that hospital healthcare leaders invest in a multilayer error high-reliability prevention program in their organization and cultivate a medication error reduction culture. The implications for positive social change include the potential to reduce costs to the healthcare system and families and improved patient quality of life.

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Dedication

I dedicate this dissertation to the patients and families harmed by preventable medication errors in hospitals. I would also like to dedicate this study to my husband, Dave, for his continuous support through this lengthy and challenging educational journey. Additionally, I thank my parents for instilling the importance of lifelong learning in me. I am also thankful for God and his unyielding guidance and love. Words are insufficient to express my gratitude for the love, patience, and sacrifices made during this educational journey.

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My doctoral journey's success would not have been a reality without the guidance and unwavering support from my chair, Dr. Erica Gamble. I would also like to thank my committee members, Dr. Edgar Jordan, Dr. Ronald Jones, Dr. Christopher Beehner, and Dr. Sue Subocz, for their support and constructive feedback to produce a quality study. I would also like to acknowledge my previous chair, Dr. Edward Paluch, for his supervision during the early stages of my doctoral study. Last, I would like to recognize my classmates for their tireless support and kind words to lift my spirits regularly throughout this educational journey.

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Section 1: Foundation of the Study

The incidence of preventable medication errors in hospitals is a costly problem for hospital leaders. Costs related to medication-associated errors in the United States has surpassed $40 billion annually and resulted in 7,000 to 9,000 patient deaths annually (Tariq & Scherbak, 2019). Errors create a lack of public confidence, dissatisfaction with the hospital, and a decrease in profit. Many hospital leaders lack successful strategies to reduce the incidence of medication errors.

Background of the Problem

Medication errors in hospitals are a serious problem resulting in higher costs, prolonged hospital stays, and patient harm. Medication errors in the United States have resulted in extended hospital stays from 2.2 to 4.6 days and increases in costs from USD $2,595 to $4,685 annually (C. C. Chen et al., 2017). Despite efforts to reduce medication errors in hospital settings, the economic impact continues to escalate. The mistakes lead to more extended stays in hospitals, more adverse reactions, and more deaths, resulting in a reduction in the public's confidence in the hospital, higher costs for the hospital and patient, and the potential risk of a lawsuit. Consequently, hospital leaders are trying to find effective strategies to reduce medication errors and associated costs.

Problem Statement

Medication errors can result in patient harm, requiring readmissions to hospitals, extending hospital stays, creating adverse drug reactions, and leading to more deaths, while also causing financial burdens for hospital administrators (Kang et al., 2017). Medication errors are estimated to cost over USD $42 billion annually globally (Riaz et

al., 2017). The general business problem was that medication errors result in increased costs for hospitals. The specific business problem was that hospital leaders lack successful strategies to reduce costs caused by medication errors in hospitals.

Purpose Statement

The purpose of this generic qualitative study was to identify successful strategies that hospital leaders can use to reduce costs caused by medication errors in hospitals. The target population for the research was leaders in acute care HR hospitals with experience implementing strategies to reduce costs caused by medication errors in the United States. The implications of this study for social change are that patients, families, and communities have the potential to experience reduced adverse drug events (ADEs), fewer hospitalizations, and reduced deaths from medication errors. A reduction in patient harm and improved hospital safety may lead to families participating in community events, living more productive lives because of improved health and lower health costs, and enhancing the community's trust with their healthcare providers. The findings from this study may be used by hospital leaders to possibly reduce the economic burden caused by ADEs, such as unemployment and reduced lifetime productivity.

Nature of the Study

The research method chosen for this study was qualitative. Experts agree that the qualitative approach is an effective method for exploring the human experience from the respondents' perspectives and gaining a deeper understanding of the participants' insights, observations, and expertise on the topic of interest in their natural environment (Bradshaw et al., 2017; McKim, 2017; Mohajan, 2018). This study's principal objective

was understanding the successful strategies used to reduce medication errors and costs from hospital leaders' insights and experiences. Due to this research question's explorative nature, a quantitative approach would not have been suitable for gathering detailed and rich information about this complex problem. A quantitative approach shows statistical relationships between variables rather than an in-depth exploration of the topic (Rahman, 2016). Likewise, a mixed-method approach, comprising both quantitative and qualitative methodologies, would be challenging because of the empirical requirements (Bressan et al., 2016).

The design selected for this research was a generic qualitative approach. According to Bellamy (2016) and Merriam and Tisdell (2016), researchers use the generic qualitative approach to understand how people make meaning of experiences and interpret them within their world. The focus of this research was to learn who, what, where, and why some hospital leaders in HR hospitals have reduced the incidence and costs of medication errors. The generic qualitative approach is an ideal method when a description of a phenomenon is essential, focusing on the who, what, where, and why of an experience and when researching with healthcare professionals (Bradshaw et al., 2017).

Other qualitative designs considered for this study include narrative inquiry, ethnography, phenomenology, and case study. A narrative inquiry would have been too restrictive for the research question, and therefore not the best choice for this study, because this approach limits the researcher to explore an individual's physical, social, and cultural story (Haydon et al., 2018; Lindsay & Schwind, 2016). Similarly, an

ethnographic research design would not have been an appropriate design for this study question because ethnography focuses on people's lives and cultures (Cappellaro, 2016; Jones & Smith, 2017). The phenomenological design is limited to individuals' lived experiences and perspectives (Errasti-Ibarrondo et al. 2018.; Peat et al., 2019; Rodriguez & Smith, 2018), which was not the focus of this study. The case study design is a strategy researchers use to address "how" and "why" questions to understand a program or process within a sustained period in a real-world situation (Alpi & Evan, 2019; Heale & Twycross, 2018; Yin, 2018). Although an appropriate design for this type of study, many hospital administrators and the associated hospital research departments experience numerous resource constraints and liability issues and limit research to clinical and internal researchers. At the time of this study, emergency departments in hospitals in the United States were stretched to capacity and anticipated massive arrivals of COVID-19 patients (Mareiniss, 2020). COVID-19 pandemic was causing severe medical and financial challenges for the U.S. healthcare system (Khullar et al., 2020). Due to the pandemic challenges, finding a partner hospital for a case study would have been challenging. Based on the limitations of qualitative designs such as narrative inquiry, ethnography, and phenomenology, the generic qualitative approach was the most appropriate for this study.

Research Question

What successful strategies have hospital leaders used to reduce costs caused by medication errors in hospitals?

Interview Questions

1. What successful strategies have you used to reduce costs caused by medication errors in your hospital?

2. What types of performance measures do you use to monitor the impact of these strategies on reducing medication errors and the associated costs?

3. What changes in practices did you have to implement to reduce medication errors and costs?

4. What barriers did you encounter when introducing strategies to reduce medication errors and costs?

5. How did you and your clinical team overcome these barriers?

6. What are the key factors that have contributed to sustaining a reduction in errors and costs over time?

7. Is there anything further that you would like to share regarding your successes with reducing medication errors and costs?

Conceptual Framework

The conceptual framework for this study was the sociotechnical framework, created by Trist, Bamforth, and Emery in 1949 at the Tavistock Institute of Human Behavior (Ngowi & Mvungi, 2018; Trist & Bamforth, 1951). The framework focuses on optimizing performance and quality by understanding the interrelationships of humans, technology, and systems in the workplace (Pasmore et al., 2019). The theory is a structure that helps to explain, predict, and understand the interaction between humans, technology, change, and complicated work settings in a systematic manner (Pasmore et

al., 2019). The underpinning tenets of this framework are compatibility, sociotechnical criterion variances, minimal exacting specification, multifunctionality, boundary location, information, support congruence, design and human values, and incompletion (Trist, 1981).

The sociotechnical conceptual framework provides a means for examining and describing the interrelationships between humans, hospital systems, and technical aspects of medication management. The structure also provides a platform for describing the relationship between humans, technology, and strategies used to reduce costs caused by preventable drug errors. According to Dickson et al. (2018), a conceptual framework provides an integrated way of looking at the research problem and describing the relationships between the main concepts and research question.

The foundational principle of the sociotechnical framework is the impact of the interactions between human, social, environmental, and technical factors in complex organizations. This conceptual framework aligns with the worldview of the investigator as well as the research problem. The research question was broad, and the data collection involves the views and experiences of the hospital leaders in their work setting and relevant public hospital documents on error prevention. Qualitative researchers need to understand and recognize how their own experiences shape the research process (Roger et al., 2018). The sociotechnical framework was foundational for investigating the concepts of this study, including the interrelationships between medication management, technology, human behaviors, and the complex hospital environment.

Operational Definitions

Adverse drug event: An adverse drug event is an injury caused by medication management rather than by the underlying disease (C. C. Chen et al., 2017; Falconer et al., 2018).

High-reliability: High-reliability (HR) is a science with a focus on organizations in industries like aviation and nuclear power that operate under dangerous and high-risk conditions but maintain high levels of safety (Cochrane et al., 2017).

High-reliability organization: An HR organization is an enterprise that is consistently involved in high-risk activities with low occurrences of adverse events (Padgett et al., 2017).

Medication error: A medication error is an avoidable incident that can result in inappropriate medication usage or harm to a patient while the medication is in the control of the healthcare clinician, the patient, or the consumer (Assiri et al., 2018).

Assumptions, Limitations, and Delimitations

Research is a robust and systematic process that includes assumptions, limitations, and delimitations. By identifying assumptions, limitations, and delimitations unique to the topic of interest, a researcher can further enhance the transparency, trustworthiness, and objectivity of a study (Theofanidis & Fountouki, 2019).

Assumptions

An assumption is an unexamined belief accepted as accurate or plausible by other researchers and readers (Koh & Owen, 2000). An assumption associated with this qualitative study was that the participants would respond to the interview questions

honestly. To encourage honesty and truthfulness, I explained the importance of speaking frankly and openly during the interview. Additionally, I reinforced to the participants that the study was voluntary and that the conversations and their names would remain confidential.

Another assumption associated with this study was that the participants would share their natural and current work environment experiences rather than other job experiences gained from different hospital settings. To address the assumption, I limited the recruitment criteria to hospital leaders currently employed in an HR hospital and included a sentence in the interview script that emphasized responding to the questions based on their current workplace experiences. A final assumption was that the researcher is an instrument for collecting information from the respondents. Strategies such as member checking and interview protocol are part of the research process to mitigate the risk of researcher bias and improve credibility.

Limitations

Limitations are the constraints and other factors that the researcher has no control over that can affect the study design and findings, and thus they need to be identified (Ross & Zaidi, 2019). A principal limitation of the generic qualitative design is that the researcher cannot generalize the findings to other similar populations or situations (Almeida et al., 2017). Another limitation of this study was that I would not be able to apply the results to other HR hospitals in other states. An additional limitation of the study was that the interview data were self-reflective and subjective information provided by the subjects, not supported by statistical evidence.

Delimitations

Delimitations are specific criteria defined by the researcher to establish the boundaries of a study to ensure that the aims of the research are possible to achieve (Theofanidis & Fountouki, 2019). A key delimitation of this study was identifying subjects with knowledge about successful strategies to reduce medication errors and costs in hospitals. To address this delimitation, the participant criteria specified hospital leaders with medication error and budget experience. The interview questions were also designed to target this issue.

Another delimitation was the time allotment to complete a doctoral study. I limited the sample size to 10 participants in HR hospitals in the United States. Given that most leaders in hospitals have busy schedules and limited availability, I restricted the interview period and member checking process to 60 minutes. As the researcher, I needed skills and ability to gather rich, meaningful information to address the research question within the 60-minute time frame. The small sample size made it feasible to complete the data collection in a reasonable time frame.

Significance of the Study

This study's findings may be valuable to other hospital leaders who are experiencing challenges finding effective strategies to reduce costs related to medication errors. According to Donaldson et al. (2017), medication errors are a global issue contributing to rising healthcare costs and harm to patients and families. Even with advancements in medicine, drug errors continue to be an expensive problem for hospitals.

Contribution to Business Practice

Hospital leaders may be able to use the results of this study to help generate

knowledge on strategies to reduce the rising costs of medication errors in hospitals and

the financial and physical burden to patients and their families. Salhotra and Tyagi (2019)

found that medication errors contribute to ADEs, patient morbidity, increased healthcare

costs, and litigations. Additionally, hospital leaders can use the findings from this study

to identify quality performance indicators in medication safety and a new decision-

making framework to assist hospital leaders in preventing sentinel events that harm

patients and families caused by medication errors.

Implications for Social Change

Preventable errors could cause financial, psychological, and emotional stress to

the patient, the family, and healthcare providers. The harm caused by medication errors

could potentially result in unemployment, mental health issues, lawsuits, and the public's

loss of trust and confidence in the hospital system. Leaders in hospitals could use the

findings of this study to strategize how to successfully reduce errors and harm to patients

and enhance the community's confidence and trust in the quality of their healthcare

services. Birkhäuer et al. (2017) found that patients were more satisfied with healthcare

services, experienced fewer symptoms, and had a higher quality of life when they trusted

their healthcare providers.

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A Review of the Professional and Academic Literature

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The objective of this literature review was to understand the existing research and

insights of experts on the business problem that medication errors result in increased

costs for hospitals and that hospital leaders lack successful strategies to address this issue. The research question— what successful strategies have hospital leaders used to reduce costs caused by medication errors in hospitals—and the sociotechnical conceptual framework formed the foundation of this literature review.

The literature review included a comprehensive search of the literature using the following search terms: *costs of medication errors*, *prevalence of medication errors*, *drug error reduction*, *medication error prevention*, *preventable medication errors*, *economics of medication errors*, *strategies to reduce medication errors*, *statistics on medication errors and costs in hospitals*, *medication management*, *drug error management*, *ADEs*, *HR principles in healthcare*, *sociotechnical conceptual framework*, and *sociotechnical theory*. The databases accessed were EBSCOhost Business Source Premier, Business Source Complete, ProQuest ABI/INFORM Global, CINAHL Plus, PubMed, ProQuest Nursing and Allied Health Source, Sage Premier, and Academic Search Complete. The search strategy was limited to English peer-reviewed articles and included 254 publications. The search strategy was limited to English peer-reviewed articles and included 254 publications. Of the references, 239 (94%), were published within the last 5 years (see Table 1).

Table 1

References Published Within the Last 5 Years

Type of reference	$\leq$ 5 years	> 5 years	Total	$\leq$ 5 years %
Journals	232	12	244	95%
Books	6	2	8	75%
Reports & papers	1	2	3	33%
Total	239	16	254	94%

Sociotechnical Conceptual Framework

The sociotechnical model was the conceptual framework underpinning this study. Researchers use frameworks to link concepts, empirical research, and theories to explain and understand a study's problem (Booth et al., 2017; Dickson et al., 2018). This framework was a suitable approach for understanding and analyzing complicated relationships between human behaviors in hospital settings, technology, preventable medication errors, and costs. The sociotechnical framework is a systems perspective that addresses the harnessing of appropriate tools and techniques to ensure that the transformational changes created are meaningful for the involved stakeholders, including managers (Bednar & Welch, 2020).

The foundational principles of the sociotechnical framework were created by theorists to address reduced productivity with the introduction of technology into the mining industry and provide workers with more meaningful work experiences (Trist & Bamforth, 1951). The sociotechnical framework provides researchers with a means for

looking at the interrelationship of concepts such as human interdependencies, social dimensions, and technology in complex environments such as hospitals. One of the limitations of this framework is that it was created in the 1940s. I chose this framework as a lens for exploring the strategies some hospital leaders use to reduce medication errors and costs in complex environments. Politics, the workforce, business models, and technology have evolved substantially since then.

During the 1940s, limited training was available to staff in the coal mines, technology was more primitive, and levels of education workforce skills were lower. Despite these differences between then and now, the principles in the sociotechnical framework are still relevant to research problems involving complex systems and the intersection of human behaviors with technology. According to Pasmore et al. (2018), sociotechnical principles and thinking have resurfaced as new technologies emerge, and as they outpace organizational workflow, culture, and designs. The focus of this research problem involved the intersection of multiple professionals, the complications of medication management, new technologies, and a complex hospital environment. Therefore, the sociotechnical framework is a useful means for supporting and informing the researcher in this research problem. Collins and Stockton (2018) pointed out that theories in qualitative studies assist the investigator in establishing goals, creating research questions, making methodological choices, and addressing the research's validity and relevance.

Another limitation concerning the sociotechnical framework was that although it was appropriate for understanding complex cases and environments, the principles can be

challenging to apply in work settings. However, Hughes et al. (2017) argued that despite the challenges, a sociotechnical model is a suitable approach for examining and comprehending complex work systems with complicated problems involving contradictory information, large numbers of people, and financial implications. Likewise, Collins and Stockton (2018) posited that the fundamental role of a theory is to help the researcher make sense of challenging social interactions and phenomena. Despite the framework's limitations, the sociotechnical model was a useful theory for exploring this complex business problem.

The sociotechnical framework originated from a period when technology was introduced in the coal mines in Great Britain to improve efficiencies, workflow, and productivity (Ngowi & Mvungi, 2018). Sociotechnical was created as an approach to enhance productivity while providing more meaningful work and job satisfaction (Pasmore et al., 2019). Tenets of this framework are compatibility, sociotechnical criterion variances, minimal exacting specification, multifunctionality, boundary location, information, support congruence, design and human values, and incompletion (Cherns, 1976; Trist, 1981).

Sociotechnical system principles are used to help optimize the social and technical aspects of the work environment. One of the principles, compatibility, refers to the alignment of processes with the organization (Alter, 2015; Cherns, 1976). The sociotechnical criterion variances include any deviation from identified standards. Regarding the minimal critical specification, the premise of this principle was to follow the minimum recommendations identified and not deviate from these recommendations

or add any additional requirements. The principle requires people to adjust to the fast-changing work environment, thus requiring flexible and adaptable skill sets. The tenet of boundary location refers to being able to move work activities from one group to another by developing a new set of skills and knowledge. This principle addresses the value of knowledge sharing across different departments and stakeholders taking the initiative to improve. Support congruence is the social support system for defining desired social behaviors in the workplace. Design and human values address the relevance of quality work and the need for learning and decision-making. The last principle, incompletion, involves recognizing that the work environment's changes will require continual revisions of goals and structures.

The sociotechnical approach includes work systems delivering services comprising social networks made up of people, working practices, roles, culture, and goals, and technical systems such as infrastructures, tools, and technologies (Cascio & Montealegre, 2016). The sociotechnical approach includes concepts that can help a researcher gain a deeper understanding of research problems of this nature. Hughes et al. (2017) argued that complex work systems can be improved only if an organization's leaders address the social and technical parts as interdependent elements because changes in one part of the system can impose changes in another. The sociotechnical framework principles are foundational for exploring, linking, and analyzing the phenomenon of interest in this study. Therefore, this framework was a useful guide to help explore and understand this research problem and provide structure for this study.

Costs and Incidence of Medication Errors in Hospitals in the United States

The ongoing incidence of medication errors and ADEs are a financial burden in U.S. hospitals, causing harm to patients, costing billions of dollars annually, and reducing profit. Estimated costs of medication dosage errors in the United States range from USD $21 billion (Da Silva & Krishnamurthy, 2016) to USD $528.4 billion annually (Watanabe et al., 2018). Da Silva and Krishnamurthy (2016) claimed that preventable drug errors affect over seven million patients annually. In Da Silva and Krishnamurthy's research, the authors revealed that on average patients experience a minimum of one medication error each day, and another 30% of hospitalized patients have at least one medication discrepancy when discharged. In 2011, ADEs resulted in over three and a half million physician visits and one million emergency department visits annually in the United States (Da Silva & Krishnamurthy, 2016). Similarly, Gariel et al. (2018) conducted a study on a pediatric surgical center and found a medication error rate of 2.6% in 1,400 cases over 1 year.

These preventable medication-related events result in increased hospital admissions, prolonged hospital stays, reduced patient satisfaction, and higher risks for lawsuits. Strategies to reduce ADEs in hospitals would lead to cost savings, safer and better healthcare services, more informed and engaged consumers, and improved health outcomes. The costs of medication errors and ADEs in hospitals justify the need for more knowledge and research on identifying successful ways to prevent and reduce medication errors to lower costs.

Barriers to Accurate Reporting of Medication Errors and Costs

Medication errors can happen in any hospital setting and are not limited to specific disease groups, hospital wards, or populations. Although researchers have consistently identified that medication errors impact morbidity and mortality rates, and are a significant financial burden, there continues to be substantial variation concerning the actual volume of errors reported and the associated costs. Walsh et al. (2017) reviewed 4,572 studies and found many studies of poor quality and significant variability in how researchers identified the error rates and financial impact. Examples of factors in hospitals contributing to the difficulty in obtaining accurate measurements of error rates and costs include a lack of consensus on what constitutes a medication error, underreporting of errors, different error-tracking systems, and a lack of or unclear process for documenting this information.

The variability in measurements of the financial impact and error rates in hospitals makes it difficult to track the extent of the problem accurately or make comparisons between studies. The financial implication of preventable medication errors is a serious business problem for hospital leaders and the public. Understanding the causes of medication errors is integral to identifying practical, sustainable solutions to resolve the issue. Five main barriers to accurate reporting of medication errors and costs are (a) need for a standardized definition of medication error, (b) underreporting of medication errors, (c) complexity of medication management, (d) human errors, and (e) system issues.

Need for a Standardized Definition of a Medication Error

To identify sustainable and successful solutions to reduce costs caused by medication errors, hospital leaders need to understand what constitutes a preventable error and why these errors continue to occur in their organizations. Despite advances in medicine, medication errors continue to be a problem, contributing to increased patient morbidity, higher healthcare costs, and litigations (Salhotra & Tyagi, 2019). Without adopting a clear definition of a reportable medication error, hospital leaders will continue to experience challenges accessing data to determine if the error rates and costs have decreased accurately. Additionally, without a standardized definition of drug error, employees and other clinicians may not be clear on what constitutes an error that requires reporting and documentation. For example, some medication events are near misses and do not harm patients, whereas other errors reach the patient and cause harm. Without a clear definition of a reportable event, hospital leaders will struggle to establish accurate baseline data, set realistic targets, and track improvements.

Researchers have found a lack of consensus on what constitutes a drug error and a high occurrence of underreporting of medication errors in hospitals. The lack of a standardized definition of a medication error, potential error, error cause, or contributing factors make it challenging to obtain a clear understanding of the types of errors occurring and ways to reduce or eliminate the problem (Dirik et al., 2019; Escrivá et al., 2019). Likewise, Lyons et al. (2018) pointed out that researchers and clinicians often have different perspectives on the definition of a mistake, depending on the situation. The World Health Organization (2016), in its report on medication errors, found over 26

different definitions. The lack of standardized taxonomies for medication errors has

contributed to a wide variation in the reporting and classifying of drug errors, and in

tracking the volume, types of errors, and economic impact. Hospital leaders need to

identify the variety and frequency of medication errors and financial implications to

strategize effective ways to reduce errors and costs.

Underreporting of Medication Errors

Despite the surplus of literature on the harm to patients and the financial burden

of medication errors, underreporting is a crucial factor contributing to the challenges in

reducing errors and costs. Experts such as Elden and Ismail (2016) and Morrison et al.

(2018) confirmed that underreporting medication errors is a significant issue in healthcare

settings. Likewise, Higuchi et al. (2015) and Morrison et al. found that underreporting

medication errors was a common issue in healthcare facilities globally.

Unfortunately, many healthcare leaders are dependent on the clinical staff's

willingness to report errors. The combination of being reliant on employees willing to

volunteer to report errors and underreporting errors can be a barrier to understanding how

mistakes repeatedly happen (George et al., 2018). Likewise, Westbrook et al. (2015)

found that healthcare professionals did not consistently disclose medication errors and

reported only 1.2 medication errors out of 1,000. The most common errors underreported

could potentially harm patients (Westbrook et al., 2015). Other researchers have noted a

lack of a clear reporting protocol, the absence of harm to the patient due to the error,

distractions, and a lack of clarity about what to communicate about the incident were

common reasons for underreporting errors (Kang et al., 2017; Vrbnjak et al., 2016; Wondmieneh et al., 2020).

If errors including near misses are not documented or tracked, hospital leaders will not be able to analyze and strategize how to prevent another person from making the same type of error in the future. Underreporting can impact quality performance indicators such as the potential to harm a patient, frequency of errors, error reduction, and costs. Dirik et al. (2019) conducted a descriptive quantitative study with 135 hospital nurses and found that the top reason for not reporting medication errors was fear of consequences. Other barriers preventing hospital nurses from reporting errors were time, workload constraints, fear of investigation, and the negative responses from the manager or acting manager (Dyab et al., 2018; Kang et al., 2017). Likewise, in another study by Alemu et al. (2017), the researchers revealed that the unavailability of a system for reporting errors and fear of consequences related to making an error were common reasons for not reporting errors.

Based on the implications of underreporting, hospital leaders would benefit from adopting a variety of strategies to target barriers to reporting errors accurately. Although clinicians in hospitals recognize when errors occur, they are reluctant to report the mistakes for various reasons, including fear of repercussions from their managers. Rogers et al. (2017) claimed clinicians are fearful of reporting errors for risk of retribution, loss of professional licensure, and even imprisonment. Yet without access to accurate data on mistakes, hospital leaders may continue to experience barriers to finding sustainable solutions and accurately capturing the costs. Access to reliable data are essential for

understanding errors, tracking the costs, and finding appropriate strategies tailored to eliminate and reduce preventable mistakes.

Complexity of Medication Management

Medication management is a complicated process that involves numerous steps, use of technology, and a variety of clinicians at different stages in the process. Errors can be made during the prescribing, preparing, dispensing, or administering phases, or at multiple phases during the medication management process. Understanding the complexity of and weak areas in the medication management process is essential for strategizing process improvements and behavior changes to reduce errors and costs in hospitals. Experts such as Gluyas (2018) and Escrivá et al. (2019) revealed that medication errors often involve many contributing factors and events throughout the medication management process, including human errors and system complications.

Although many scholars have shown that medication dosage errors frequently occur during the prescribing phase in medication management, preventable prescribing errors continue to be problematic (Tariq & Scherbak, 2019). Therefore, hospital leaders require a comprehensive understanding of all the potential events and environmental factors contributing to the error to strategize ways to address vulnerable areas and reduce errors successfully. Gordon and Jones (2017) identified prescribing mistakes as the most frequent reason for adverse events in healthcare settings. Other scholars such as Alanazi et al. (2016) have alleged that prescribing errors have caused 29% to 56% of the medication errors in adults and 68% to 75% of the medication errors in children in hospitals. When clinicians prescribe a combination of five or more medications to one

person, referred to as polypharmacy, errors frequently occur. Researchers have found that prescribing errors and adverse reactions are higher in patients receiving polypharmacy than in patients who receive only a few prescribed drugs (Swinglehurst & Fudge, 2017; Laidig et al., 2018). Similarly, scholars such as Lavan et al. (2016) have verified that patients on polypharmacy not only experienced more medication errors and higher ADEs, but more hospital admissions and higher morbidity and mortality rates.

In addition to the potential harmful impact on patients, these drug mistakes lead to increased costs and reduced profit for hospitals. In an extensive quantitative study involving 1,942 geriatric patients receiving polypharmacy, Unutmaz et al. (2018) estimated an annual per capita savings of $153.46 by preventing the prescribing of inappropriate medications and prescribing omissions. This estimate is low given that the researchers did not include other related costs in this estimate, such as more extended hospital admission periods, added treatments, and morbidity and mortality costs (Unutmaz et al., 2018). Together these researchers illustrated the high risk of errors and cost just from prescribing and polypharmacy practices.

There is also a significant risk of errors during the preparing, dispensing, and administering phases of medication management. For example, Haghbin et al. (2016) found that incorrect drug preparation was a common factor in drug errors in the pediatric population in hospitals. These authors found that administration errors occurred on 148 occasions out of 512 drug dosages in a pediatric intensive care unit, with 28.9 chances to occur every 100 orders; transcription errors were 4.88; and dispensing errors had a 0.78 chance in every 100 orders (Haghbin et al., 2016). In another study, Bar-Dayan et al.

(2017) investigated medication mistakes in 600 elderly hospitalized patients and found an error rate of 2.17% caused by ingesting duplicate drugs. Bar-Dayan et al. claimed that discrepancies in names, colors, shapes, and sizes for various medications have contributed to confusion and errors. Likewise, Alemu et al. (2017) found that lookalike drugs and distractions were crucial factors contributing to medication errors.

Also, the constant addition of new generic medications in hospitals with different names, shapes, and sizes can result in confusion, duplication, and drug errors. Clinical research has shown that any hospital unit involved with complicated medication administration processes, frequent dose changes, and intricate mixing procedures experiences higher rates of errors (Muroi et al., 2017). Muroi et al.'s (2017) research results demonstrate the complexity of medication management and how mistakes can occur at various medication management stages, contributing to the difficulty in resolving the problem. The more complicated the procedure, the higher the risk for an error. With the frequent changes in the pharmacy industry, such as polypharmacy, new intricate therapies, and generic drugs, medication management is at high risk for errors in hospital settings.

Human Errors and System Issues

Other factors contributing to medication errors are system issues such as human errors and environmental factors. Although many hospitals have implemented various interventions to target specific types of errors to reduce patient harm and costs, the overall incidence of errors has not decreased substantially. Bates and Singh (2018) claimed that over the last 20 years, the frequency of preventable medical errors remains

high despite the execution of targeted interventions. Bashkin (2018) offered an explanation claiming that healthcare systems are not designed for patient safety and have not fully incorporated human-factors engineering to reduce the risk of errors. The human-factors approach provides research methods and empirical data-based tools to prevent human errors and promote patient safety (Bashkin, 2018).

A hospital's design may not include human factor safety, which includes recognizing human and system workflow issues. Research has shown that approximately 251,454 deaths occur annually in the United States because of human medical mistakes (Makary & Daniel, 2016). The human errors and system factors contributing to these deaths include communication breakdowns, diagnostic errors, poor judgment, and inadequate skill (Makary & Daniel, 2016). With organization system issues such as emerging technologies, interactions between people and the system, and ongoing changes in medication management, error reduction and cost containment require continual attentiveness and monitoring from engaged staff and hospital leaders.

Researchers have found that system issues such as distractions and other environmental disturbances during medication management can affect staff concentration and result in errors. For example, Keers et al. (2018) found that organizational failures such as interruptions, distractions, inadequate staffing levels, unbalanced staff skill mix, problems with the medication administration procedure, and miscommunication contributed to medication errors in a mental health hospital. Likewise, Yaifa and Jiju (2018) found that the main challenges in reducing medication errors included human resistance to change, incorrect use of tools, and a lack of management support. In a study

by Farokhzadian et al. (2018), the investigators found that work conditions, mental and emotional settings, shift work and fatigue, lack of control over complex and hazardous working conditions, and high workloads were factors that contributed to errors. Scholars have also identified staff shortages and fatigue as system issues associated with increased medication error rates (Gorgich et al., 2016; MacPhee et al., 2017; Roth et al., 2017; Salami et al., 2019). Other researchers have noted that increased medication errors correlate with frequent interruptions during medication management or when patient acuity was higher (Blignaut et al., 2017) and with communication issues (Keers et al., 2018; Salhotra & Tyagi, 2019).

Human and environmental factors such as distractions during administration, heavy workload, inadequate staffing, equipment failure, communications, and unclear policies or procedures can all affect error rates in hospitals. Other examples of systemic issues contributing to errors include mistakes due to verbal orders, illegible handwriting, misinterpreted abbreviations, and lookalike or sound-alike drugs. Kaboodmehri et al. (2019) found that 36% of the medication discrepancies in intensive care units were linked to poor lighting, high noise levels, and inappropriate room temperature, and 32% were associated with a high volume of patients, lack of equipment, and insufficient room for medication preparation. The hospital environment's design may not support the medication management workflow, human behaviors, and emerging technology used in medication management. To successfully strategize ways to mitigate errors and costs, hospital leaders need to consider human and environmental factors such as staffing

levels, user behaviors, day-to-day workflow in medication management, and workplace design.

Strategies to Reduce Medication Errors

Theoretically, most medication errors are preventable once a cause is determined. However, drug errors are often complex and frequently require a multifaceted solution that addresses human behaviors and technology (Chu, 2019; Gorgich et al., 2016; Wheeler et al., 2018). Considering the complexity of medication management, hospital leaders may need to shift their focus from preventive strategies to performance variability and risk-management tactics to achieve error reduction and cost savings. Although scholars such as Bashkin (2018) have recommended that healthcare leaders focus on prevention strategies, other experts believe the emphasis should be on performance and variability. For example, Bates and Singh (2018) claimed that variability in the implementation of preventive measures and lack of attention to sociotechnical factors in medication management such as workflow, training, and organizational issues are principal barriers to error reduction. Likewise, Lyons et al. (2018) recommended that tracking performance variability is a more effective method for managing risks than prevention. Prevention and tracking variability can target some types of mistakes.

Based on the evidence and the complex nature of medication management in hospitals, error reduction will likely require a multifaceted approach that includes prevention, variability tracking, leadership, education, environmental factors, human factors, working conditions, and a culture of safety. The main categories of medication error-prevention strategies found in the literature are leadership, education, health

information technology, medication reconciliation, clinical pharmacist role, and quality

improvement frameworks.

Leadership

Hospital leaders' commitment to quality and efficiency is essential in error

reduction. Many researchers have upheld that effective leadership is a core component of

quality in healthcare settings, which includes lower error rates, increased patient

satisfaction, shorter patient length of stay, lower mortality rate, and improved patient

outcomes (Cochrane et al., 2017; Liukka et al., 2017; Sfantou et al., 2017). Subramanyam

et al. (2016) and Yousef and Yousef (2017) argued that leadership's commitment to

quality and safety was essential for the sustainability of processes to reduce errors in

hospitals. Engaged hospital leadership can spearhead strategies to deliberately strengthen

safety in the organization and use error reporting and ADEs as opportunities for learning

and system improvements.

Experts have identified that leadership style is directly associated with

organizations that have a productive safety culture and positive patient outcomes.

Numerous experts have acknowledged that leadership needs to be actively engaged in

fostering patient safety and working with their clinical teams, including physicians, to

improve error reporting and focus on safety. For example, Rogers et al. (2017) pointed

out that effective leaders assist staff in prioritizing their work and promoting

organizational goals such as patient safety, productivity, and efficiency. Experts have

argued that a culture of safety requires transformational and committed leaders

(Farokhzadian et al., 2018; Hertig et al., 2018). Likewise, Sfantou et al. (2017) found that

transformational leadership styles can positively influence the quality of care and health-related outcomes, including error reduction.

A transformational leader has a positive impact on employee performance and helps build trust. Several sources have identified that clinicians' fear of consequences from their superiors, and fear of the effects on their evaluation and appraisal process, is a key reason for underreporting errors in hospitals (Stewart et al., 2018). In a study by Rua and Araújo (2016), the researchers were able to show that transformational leadership improved organizational trust and impacted employee performance to a statistically significant degree. According to these sources, a transformational leadership style correlates with fostering a culture committed to safety, establishing clear expectations regarding quality, spearheading policies on error reduction, allocating resources for safety, promoting education on error reduction, and creating a supportive environment for reporting potential and actual errors. Scholars such as Rogers et al. (2017) have asserted that healthcare leaders are essential for establishing a no-blame culture, instilling safety, and promoting a just and error-free organization. Hospital leaders can overcome underreporting with transformational traits that include building an open learning environment, leading by example, promoting safety education, offering effective coaching, and instituting a positive approach to error reporting.

The literature findings show a positive correlation between leaders in hospitals who focus on quality care and enhanced patient outcomes with reduced mortality rates and lower error rates. Together, these studies' results demonstrate the significant role

leaders play in influencing safety and error reduction. Therefore, effective and skilled

leadership needs to be prioritized as an essential strategy for error and cost reduction.

Education

Hospital leaders need to be aware of where gaps exist in education and which

stakeholders in the organization require knowledge on how to reduce and prevent errors,

the impact of mistakes, and the financial implications. In their systematic review on

avoiding or reducing prescribing errors, de Araújo et al. (2019) found education to be an

effective way to reduce prescription mistakes. Similarly, in a systematic review of 16

articles, Lapkin et al. (2016) found that knowledge combined with risk management

helped to reduce medication errors in healthcare facilities. Based on the work of these

scholars, educational interventions that address prescribing practices and error prevention

can help reduce ADEs.

Medication management is a complex multistage process involving different

disciplines; therefore, a well-coordinated educational approach needs to address each

phase of medication management and make error prevention strategies applicable to all

disciplines. Miller et al. (2016) recommended that medication education needs to include

fostering a safety culture, examining the causes and drivers behind adherence to error

prevention, and follow up. Gordon and Jones (2017) endorsed error prevention education

to include active error feedback processes, reporting of errors and near misses, a no-

blame and safety-minded culture, open communication, and knowledge to change

behaviors. Therefore, hospital leaders need to consider a multifaceted approach to

training on error reduction that includes a safety culture, prevention and follow up, and

risk-management strategies. The provision of education and adequate training to hospital staff involved in medication management is an essential strategy for reducing medication errors and costs.

Health Information Technology

Use of health information technology such as electronic prescribing, electronic medical records (EMRs), and barcoding are strategies highlighted in the literature to prevent medication errors. Alotaibi and Federico (2017) confirmed that health information technology improves patient safety by reducing medication errors, reducing ADEs, and improving adherence to best practices. Likewise, in a retrospective quantitative study, Vilela and Jericó (2019) examined 13 different technologies to prevent medication errors and found that their use resulted in a decrease in errors by 97.5%. According to Alotaibi and Federico, despite the benefits of health information technology, some products are expensive and lack evidence supporting patient safety improvements. Healthcare leaders need to know which technology to purchase and implement; some can lead to new types of errors and may not result in improved patient outcomes, error reduction, or cost savings.

Electronic Prescribing. Electronic prescribing reduces the risk of errors at various phases of the medication management process and helps clinicians prevent mistakes before injuring a patient. Electronic prescribing has been found to improve prescribing practices and reduce medication errors in clinical settings (Y. Chen et al., 2019; Keasberry et al., 2017; Wheeler et al., 2018). The advantages of electronic prescribing include improving the legibility of the medication orders to reduce the risks

of misinterpreting the handwriting (Pearce & Whyte, 2018), the standardization of medication orders, clinical alerts for potential drug errors, and the ability to identify dangerous doses of medications and reduce the risk of a mistake and patient harm (Farid, 2019; Pearce & Whyte, 2018).

Other electronic prescribing features include automated provider order entry and decision support software. Wheeler et al. (2018) found that the automated provider order entry combined with the clinical decision support could reduce prescribing errors by 36% to 87%. The automatic alerts and flags are activated by the software each time a clinician recommends an unusual or incorrect medication order and helps to prevent some errors. On the other hand, in a systematic review and meta-analysis of 38 articles from 2007 to 2018, Roumeliotis et al. (2019) found that although electronic prescribing reduced medication errors and ADEs, improvements were limited on other patient outcomes such as length of stay, preventable ADEs, or mortality. Similarly, other experts found that electronic prescribing was effective in reducing incorrect doses and illegible or incomplete orders, but duplications, omissions, incorrect medications, and wrong formulations were still prevalent (Franklin & Puaar, 2019). Based on the evidence, electronic prescribing can prevent specific types of errors from occurring and lower error rates, but in isolation, electronic prescribing is not robust enough to reduce patient harm and system failures.

Electronic Medical Records. Transitioning from paper medical records to EMRs has reduced medication errors and improved adherence to best practice guidelines. Numerous researchers have found that EMRs in healthcare have resulted in fewer

medication errors, reduced patient morbidity and mortality rates, and lowered costs (Campanella et al., 2016; Qureshi et al., 2015; Riahi et al., 2017). Features of the EMRs such as accessible patient information, electronic flag systems to alert clinicians of potential medication errors, and the legibility of medication orders have contributed to a reduction in mistakes and ADEs. Similarly, Hoover (2016) found that EMRs improved patient outcomes and reduced ADEs by 52% in hospital settings. They have improved communications, reduced prescribing errors, reduced errors caused by poor handwriting, and improved the clarity of multiple orders (Atasoy et al., 2019). Although there is evidence that EMRs can help reduce errors in hospitals, there are numerous technical, workflow, and change management issues associated with the technology.

Unfortunately, researchers are also revealing that EMRs contribute to new types of errors such as usability issues, poor information display, complicated screens, and alert fatigue. Wheeler et al. (2018) and Aldosari (2017) found that clinicians could make a significant number of medication errors using EMRs and recommended the need to use this type of technology cautiously to lower the incidence of errors and improve patient safety. Likewise, Ratwani et al. (2018) pointed out that although EMRs have reduced errors and improved safety in some situations, usability issues related to design, implementation, customization, or application contributed to different errors. In addition to usability challenges, other researchers have found problems between the EMR workflow and the clinical workflow in hospitals, technology failures, maintenance issues, and staff resistance to change (Atasoy et al., 2019).

The introduction of new technology into hospitals can be costly, requiring ongoing staff training, technical support, maintenance, and upgrades. In a systematic review, Reis et al. (2017) found that although the EMR systems did provide some preliminary benefits in quality of care, there were no measurable improvements on cost effectiveness. Electronic prescriptions and EMRs can help reduce the risk of errors, yet there are still chances for different types of mistakes. Consequently, clinicians still need to monitor and check electronic prescriptions for potential errors. Although EMRs have the potential to reduce some errors in hospitals, further research is needed to determine if there are significant cost savings.

Barcoding. Another technology that has contributed to a reduction in medication errors is barcoding. Barcode technology reduces medication errors by electronically authenticating the correct patient, drug dose, drug, time, and route at the patient (Shah et al., 2016). In a review of research from 2013 to 2017, Larson and Lo (2019) found that technology such as barcoding and computerized provider order entry had the potential to reduce 72% of medication errors and save $1.4 million. Likewise, in a systematic review, Shah et al. (2016) found that barcoding technology can prevent administration errors, transcription errors, and medication errors.

Other researchers have found that barcoding technology and EMRs resulted in a decrease in ADEs, transcription errors, and administration errors (Farid, 2019; Thompson et al., 2018; Truitt et al., 2016). Barcoding is a useful type of technology for reducing certain types of errors, but the software can be time-consuming, staff can be distracted using the scanner, and there are costs associated with maintenance of faulty equipment

issues (Rishoej et al., 2018). Healthcare leaders may need to do a cost-benefit analysis to justify the benefits of this technology to minimize medication mistakes.

Although technology has been useful for reducing errors, there are still challenges associated with electronic solutions. A few of the obstacles related to technology include costs to purchase and maintain, costs and time for training clinicians, fatigue caused by the alerts and alarms identifying errors, compatibility with other technology, the complexity of the software, equipment failure, costs to update the software regularly, and human error in using the software.

Hospital leaders need to consider the advantages and disadvantages of technology to reduce errors and cost savings. Although technology has contributed to some successes in reducing error rates in healthcare, the software has also created new challenges and new types of errors. Based on the evidence available, hospital administrators need to be willing to invest in technology and the required resources to support this strategy. In addition to technology, there is a significant amount of research supporting medication reconciliation at various patient care points during hospitalization.

Medication Reconciliation

Another common strategy used to reduce medication errors is medication reconciliation. Medication reconciliation is a procedure generally performed directly by healthcare professionals or by using technology to acquire an accurate medication history from a patient or family member and resolve any discrepancies (Karaoui et al., 2019). In a quantitative study involving 1,581 patients, Chiewchantanakit et al. (2020) found that medication errors in patients who underwent medication reconciliation decreased by 75%

compared to those receiving usual care. Researchers such as Karaoui et al. (2019) have shown that 50% of medication errors occur at transitions of care, and 67% of medication histories expose at least one error. Similarly, Abdulghani et al. (2018) and Baker et al. (2018) revealed that medication reconciliation reduced the risk of potential ADEs on admission. A study by Tamblyn et al. (2019) affirmed that 8.3% to 16.2% of patient ADEs resulted in visits to emergency departments in hospitals and 7% of admissions costing over $5.6 million per hospital annually. Since many of the ADEs are identified in the emergency department or during admissions, medication reconciliation is one type of intervention to prevent and detect ADEs.

Another susceptible area for possible medication errors is in clinical trials. Clinical trials are at high risk for mistakes as they often are comprised of complex protocols involving new pharmaceutical agents or combinations of agents. Medication reconciliation can reduce some types of errors during research with new pharmaceutical agents and procedures. Redic et al. (2017) found that only 40% of patients in clinical trials had the correct medication dose ordered. They claimed that medication reconciliation would reduce error rates.

Although medication reconciliation is a successful strategy to reduce medication errors, it has some limitations. For one, it is limited to identifying discrepancies at points of transitions such as time of admission and discharge. As well, it can be costly if pharmacists are assigned to carry out this task. The strategy does not address the numerous other sources of errors, such as staff fatigue or mistakes made during the mixing or administration of the agent.

Finally, emerging findings suggest that medication reconciliation takes a significant amount of time and has not resulted in improved patient outcomes. Redmond et al. (2018) argued that reconciliation interventions are unclear due to low evidence showing clinical benefits such as a reduction in ADEs and healthcare utilization. Likewise, Tamblyn et al. (2019) found in a randomized study involving 3,491 hospitalized patients that medication reconciliation did not reduce ADEs, emergency visits, or readmissions. Other experts such as Walsh et al. (2019) have alleged that there was no association between pharmacists' added time on medication reconciliation and a reduction of clinically significant errors. Other experts have pointed out that medication errors of commission increased by 24% 48 hours after the reconciliation (Hohl et al., 2017).

Medication reconciliation is useful for revealing medication discrepancies at points of care with high error rates such as admission and discharge and has some potential for clinical trials. Establishing processes and policies to support medication reconciliation practices in hospitals has resulted in some error and cost reductions, particularly at admission and discharge points of care. This intervention has some benefits, but this strategy in isolation will not address the myriad of additional systemic factors contributing to other categories of preventable drug errors in hospitals.

Clinical Pharmacist Role

Having a clinical pharmacist available to review medications before the drug reaches the patient, participating in medical rounds for education, and addressing medication problems has been discussed extensively in the literature as an effective

evidence-based strategy to prevent and reduce medication errors in hospitals. C. C. Chen et al. (2017) found that clinical pharmacists' inclusion in in-hospital medical rounds reduced preventable ADEs by 66% to 78%. Similarly, Chia-Chi et al. (2017) found that the clinical pharmacist role not only reduced ADEs but shortened the length of stay in the hospital by 2 days. Other scholars have also found that pharmacist-led interventions resulted in lower rates of medication error in hospitalized patients (George et al., 2019; Khalil et al., 2016; Mostafa et al., 2020; Naseralallah et al., 2020). In a systematic review of 17 studies, Sassoli and Day (2017) found the clinical pharmacist role to be instrumental in preventing errors before they reached the patient.

A key challenge with this intervention is that clinical pharmacists are costly and have limited capacity to cover a department or a specific location within the hospital. Even so, the combination of shorter length of hospital stays, reduction in ADEs, and reduction in errors could result in significant savings for hospitals. C. C. Chen et al. (2017) estimated the clinical pharmacist role resulted in a cost savings of USD $168 per ADE in a hospital in Taiwan and reduced length of stay from 13.22 days to 11.10 days. Clinical pharmacists not only prevent and reduce errors but provide indirect cost savings. Jacob et al. (2019) also found that having a pharmacist involved in safety reviews resulted in a significant indirect and direct cost benefit and the prevention of major ADEs. Khalil et al. (2016) pointed out that having a clinical pharmacist assisting with medication reconciliation and charting for admitted medical patients saved medical staff time, permitting them to carry out other responsibilities. However, other scholars such as Tamblyn et al. (2019) have pointed out that the cost of pharmacists conducting

medication reconciliation was high, costing approximately USD $3,200 per 1,000 prescriptions.

In contrast, other researchers have found evidence of the clinical pharmacist's role in error reduction to be inconclusive. For example, Lapkin et al. (2016) and George et al. (2019) identified the need for more research and evidence to determine if pharmacist-led interventions had a significant impact on error reduction. Likewise, other experts such as Ravn-Nielsen et al. (2018) were not able to conclude that pharmacist-related interventions such as medication reviews, patient interviews, and follow-up contacts with patients resulted in a statistically significant reduction in drug-related readmissions. Although several researchers have found this role in hospital settings to be influential in the prevention and reduction of medication errors and costs, other experts recommend additional research to determine if the use of a clinical pharmacist is a cost-effective strategy or makes a statistically significant difference in error reduction.

Based on this evidence, the clinical pharmacist role is a pharmacist-specific intervention that could reduce preventable medication-related problems. However, this role would be confined to one area in the hospital and would not have the capacity to screen for errors in every department. Consequently, the pharmacist position would have a limited impact on the overall error reduction rates in the entire hospital. Also, the pharmacist would have no control over errors caused by system factors such as workload, frequent interruptions, workflow, technology issues, and fatigue.

Quality Improvement Frameworks

There is growing evidence that a system-based approach, such as a quality improvement framework, may be a more effective way to minimize medication-related events in hospitals. According to Djulbegovic et al. (2019), a quality framework provides a strategy for aligning quality improvement initiatives to improve efficiencies and safety. Debono et al. (2017) also found that a framework helped healthcare organizations overcome barriers and enhanced collaborations with frontline clinicians to make behavior changes to improve medication management and reduce drug mistakes. Other researchers, such as Foster and Tagg (2019), have recommended applying a person-centered approach or systems approach to address human error challenges in clinical environments. Despite the plethora of research on discrete interventions and medication problems in hospitals, many scholars are looking at a more comprehensive approach to this complex problem and the successes of quality improvement frameworks to address the technical, environmental, and cultural changes needed to reduce errors, trim costs, and improve quality in hospitals. Other widespread quality system-based frameworks are continuous quality improvement (CQI), patient safety culture (PSC), and high reliability (HR).

Continuous Quality Improvement

The CQI framework is a system-based approach to improve efficiencies, patient safety, and quality, and reduce errors, in hospital settings. Organizations that have adopted the CQI approach have had some success in improving work processes and influencing their organization's culture to become more quality and safety-focused

(Mormer & Stevans, 2019). Creating a culture of safety and quality generally involves identifying and controlling risks such as medication errors that can harm a patient. For example, Subramanyam et al. (2016) and Yousef and Yousef (2017) found that the CQI process reduced medication infusion administration errors in hospital settings. In both studies, the CQI process was low cost and resulted in measurable outcomes but required engaged clinicians and management and identified behavior changes.

The CQI approach provides hospital leaders with a comprehensive strategy for influencing human behavior, improving outcomes, and tackling the multitude of factors sustaining ongoing medication errors. Changing practices and behaviors organization-wide rather than at an individual level for quality and safety requires a strategic commitment of the organization (Stewart et al., 2018). Organizations adopting CQI need to be willing to address the facility's culture, including policies, structures, resource allocation, and process changes to promote patient safety (Stewart et al., 2018). In addition to enhancing quality and profits, CQI is an effective strategy for reducing unnecessary variation that often results in errors (Kacholi & Mahomed, 2020; Mormer & Stevans, 2019). Based on the evidence, CQI in hospitals is an effective way to process transformations, monitor progress, and change behaviors to achieve quality improvements.

Patient Safety Culture

Another system approach used to reduce errors in hospitals is to establish a PSC: a culture of safety that fosters the values, attitudes, beliefs, and norms that are central to healthcare organizations as well as the attitudes and behaviors expected for patient safety

(Lawati et al., 2018). Researchers have shown that a weak PSC is a common factor underpinning adverse events in healthcare settings (Danielsson et al., 2019). Although there is a range of evidence-based effective interventions available to reduce medication errors, staff workarounds in hospitals continue to prevail (Bates & Singh, 2018). The main reasons for workarounds are lack of understanding about safety, lack of commitment to patient safety, and focus on saving time (Bates & Singh, 2018). A PSC involves organizational infrastructure, leadership support, teamwork, and keeping up with international standards, including the identification of medical errors analysis to prevent reoccurrences (Farokhzadian et al., 2018). Adapting to a PSC requires hospital leaders to make an organizational culture shift to supporting behaviors that promote patient safety. For example, Tigard (2019) found that a change towards a culture of safety lowered the incidence of medical errors.

An integral component of patient safety is stakeholders understanding the value of reporting medication errors and feeling supported by the administration to report the mistakes and near misses. Hospital teams need to feel safe and encouraged to review the mistakes and implement strategies to reduce reoccurrences and share information with other healthcare providers (Sheikh et al., 2017). To improve safety, stakeholders need to understand the significance of a safety culture to adjust practices, communications, and attitudes (Lawati et al., 2018). Leaders in healthcare need to ensure that staff and clinicians feel comfortable to report errors and encourage documenting and reporting errors in a non-blaming environment (Sheikh et al., 2017). Patient harm exerts a resource burden on the health system and society more broadly. Injury to patients in hospitals

results in high financial costs due to the need for added treatment, more diagnostic

testing, readmission to the hospital, or extended length of stay in the hospital

(Slawomirski et al., 2017). A shift to PSC to reduce medical errors can improve public

confidence and lead to cost savings for hospitals.

High-Reliability

Another comprehensive systems approach for improving safety is HR. Essential

attributes of HR organizations are their ability to detect hazards in advance and rebound

when errors occur (Sutcliffe et al., 2016). A core principle of the HR approach is that

mistakes or near misses are recognized as opportunities to improve system design and

performance to further enhance safety in the organization. This principle leads to a

blame-free culture and improved communications about error reporting and learning.

Hospitals designated as HR organizations concentrate on delivering reliable performance

in complex environments with a focus on safety (Vogus & Iacobucci, 2016; Woodhouse

et al., 2016). The fundamental principles for HR are improving safety, minimizing waste,

and removing redundancy. High-reliability hospitals adopt process changes that include

staff understanding, anticipating, and preparing for potential ADEs caused by errors

(Guttman et al., 2019). Healthcare leaders in HR hospitals need to be committed to zero

medication errors and no harm to patients.

Hazardous industries with the potential for deadly accidents have adopted HR

principles to avoid catastrophes in complex environments with high-risk factors. High-

risk industries, such as aviation, have used a comprehensive systematic framework such

as HR to sustain safety compared to individualized, targeted interventions adopted by

hospitals (Bates & Singh, 2018). Alotaibi and Federico (2017) pointed out that healthcare organizations can learn from other industries recognized for safety to improve safety and mitigate errors. Based on the successes in safety in the nuclear and aviation industries, some healthcare leaders have taken an interest in adapting HR principles to reduce medical errors (Hendrich & Haydar, 2017; Polonsky, 2019; Roney et al., 2017). For example, Schmidt et al. (2017) found that hospitals using a sociotechnical probabilistic risk assessment and HR principles were able to lower intravenous errors by 22%. Other researchers such as Cooper et al. (2016) found that over time, hospitals that have transitioned to become HR organizations experience successes in error reduction.

As discussed earlier, an understanding of the types of errors occurring is integral for organizations to transition to a safety culture to reduce the mistakes and associated costs. A transformation to an HR organization requires healthcare leaders to implement strategies such as safety awareness, best practices, and infrastructure changes to enhance quality and reduce errors. According to Cooper et al. (2016) and Mountasser (2017), implementing HR principles in hospitals takes a tremendous amount of change, time, and strong support from hospital leadership. An HR strategy requires leadership involvement, a commitment to a culture of safety, and CQI processes to reduce errors. Based on the evidence, hospital leaders who have adopted system-wide frameworks such as CQI, PSC, or HR are experiencing successes in error reduction and some cost savings.

Transition

Section 1 contains the background of this study, the problem, and the purpose statement. This section included the following subsections: the research question, interview

questions, a detailed review of the academic literature on the sociotechnical framework, medication errors and their costs, complexity of medication errors, and strategies to address this business problem. Section 2 consists of the purpose statement, the researcher's role, methodology, the study design, the description of the population, and the sample. Section 2 also includes details about ethical research, data collection instruments and technique, data analysis, and finally, reliability and validity. Section 3 includes a reintroduction of the study, the research findings, and a discussion of the potential social change implications. This section also consists of the final recommendations for action, future research possibilities, and reflections, followed by the study's summary and conclusion.

Section 2: The Project

Section 2 includes the purpose statement, a detailed description of the researcher's role, and the criteria for selecting participants for this generic qualitative study. Other topics covered are the method, design, ethical principles underpinning the proposal, and the data collection and analysis process, including reliability and validity.

Purpose Statement

The purpose of this generic qualitative study was to identify successful strategies that hospital leaders can use to reduce costs caused by medication errors in hospitals. The target population for the proposed research was leaders in acute care HR hospitals with experience implementing strategies to reduce costs caused by medication errors in the United States. The implications of this study for social change are that patients, families, and communities have the potential to experience reduced ADEs, fewer hospitalizations, and reduced deaths from medication errors. A reduction in patient harm and improved hospital safety may lead to families participating in community events, living more productive lives because of improved health and lower health costs, and improving the community's trust with their healthcare providers. The findings from this study may be used by hospital leaders to possibly reduce the economic burden caused by ADEs, such as unemployment and reduced lifetime productivity.

Role of the Researcher

The researcher's principal role involves acting as a research instrument in conducting interviews and interpreting collected data. The qualitative researcher becomes an instrument in qualitative studies by partnering with the respondents to create

knowledge about the phenomenon of interest (Bansal et al., 2018; Chauvette et al., 2019). A significant part of my role as the primary data collection instrument is to gain insight into the research problem and accurately reflect and analyze the respondents' perspectives and feelings about the topic of interest. Although I did not have any relationship with the potential subjects for this study or research site, I have an extensive background in healthcare leadership, medication safety, and management.

To ensure that my study aligns with the ethical norms in research, I was compliant with the requirements outlined in the *Belmont Report* and by Walden University's Institutional Review Board (IRB). The *Belmont Report* includes the ethical principles and guidelines for any type of research that involving humans (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). The main requirements addressed in this report include respect for persons, beneficence, and justice (Tajir, 2018). Obtaining ethics approval from a research ethics committee is an essential step to protect the participants, ensure quality, and monitor the researcher's qualifications and liability risks (Mallia, 2018).

Qualitative research may be subject to researcher bias. According to Yin (2018) and Galdas (2017), researchers are at risk for biases since they spend time researching and understanding the study's issues in advance. Similarly, Wesely (2018) pointed out that in the interview exchange, the researcher's identity, experiences, and values can influence the interview process. Four main strategies incorporated into this study to mitigate my biases as the primary researcher are bracketing, member checking, data saturation, and adhering to an interview protocol.

Bracketing helps reduce the risk of preconceived ideas and biases of the researcher and mitigates the risk of influencing the data or the analysis of the research findings (McNarry et al., 2019). I achieved bracketing by journaling my reflections, thoughts, biases, and insights throughout the study. To further mitigate risk of biases, I remained reflective of my worldview and personal lens and how my personal beliefs had the potential to influence the interpretation of the data and the findings. Qualitative experts agree that reflective processing and journaling contribute to transformational learning and critical thinking throughout the research process (Castillo-Montoya, 2016; Rich, 2015).

Along with bracketing, I ensured the respondents had an opportunity to review the interview summary to authenticate the accuracy of the data interpretation. According to Candela (2019) and Thomas (2016), member checking is a useful qualitative strategy to confirm validity. To accomplish saturation, I ensured that the sample size was adequate for a qualitative case study design and reviewed the data until no new codes or concepts emerge, and observed redundancy in the data during the analysis. Most experts agree that saturation is the gold standard for evaluating quality in qualitative research (Saunders et al., 2018; Thorne, 2020).

To further reduce the risk of biases, I used an interview protocol (see Appendix) for each interview and for collecting public documents on medication management and error reduction that aligned with the topic of interest. Researchers use interview protocols to assist them in focusing on the respondents' viewpoints to gain a richer understanding of their perspective on the study topic (Yeong et al., 2018). As the investigator for this

study, I used the combination of ethics, bracketing, member checking, data saturation, and an interview protocol to mitigate any biases that could affect the findings.

Participants

The participants of this study were hospital leaders working in HR hospitals in the United States, with experience implementing successful strategies to reduce costs caused by medication errors. Bradshaw et al. (2017) suggested that researchers use sampling techniques that reflect the research design and question and have relevant experiences. Organizations seeking HR focus on workplace practices to reduce unsafe incidents, improve staff perceptions of the organization, and reduce expenses attributed to hazardous events (Padgett et al., 2017; Vogus & Iacobucci, 2016). Researchers have identified numerous well-known hospitals in the United States as highly reliable, focusing on patient safety as a core value (Chassin & Loeb, 2013). Therefore, a hospital leader employed in an HR hospital with responsibilities associated with medication management, quality, and budget was an appropriate candidate for participation.

Establishing a working relationship with participants is integral to conducting a quality interview. Strategies for creating a working relationship with the respondents included providing information about the purpose and value of the topic, confidentiality, and the informed consent process, as well as applying engaging communications skills such as attentive listening, encouraging open dialogue, and being respectful. According to DeJonckheere and Vaughn (2019), interviews are a unique relationship that entails rapport, excellent listening skills, authenticity, and respect. To further enhance like-

mindedness and relationship building, I shared my healthcare leadership background and interest in error reduction with potential candidates.

To gain access to participants and as part of recruitment, tactics included purposive sampling and snowball sampling. Purposive sampling helps researchers identify and select respondents with insight and an in-depth understanding of the topic of interest. Principal benefits of purposive sampling are finding subjects with knowledge on the topic of interest who can answer the research question in detail (Gaganpreet, 2017; Wright et al., 2016). Benoot et al. (2016) posited purposeful sampling as an effective and time-efficient approach for accessing relevant information and expertise for a study. I used social media platforms such as Facebook and LinkedIn and public hospital directories to contact the potential leaders in HR hospitals, inviting them to volunteer to participate in this study. Gelinas et al. (2017) have found social media to be a popular and promising method for recruiting potential research subjects. Additionally, I contacted these potential subjects and asked if there are other individuals from their hospital whom they would recommend that I contact. This tactic, known as snowball sampling, is an approach that qualitative researchers use to recruit potential subjects (Kirchherr & Charles, 2018).

The recruitment communication included a social media post with a brief description of the research and the potential value for their organization and patients. The post also contained details about the interview process, eligibility criteria, consent process, ethics approval, and researcher's contact information. Another recruitment communication was a flyer with a short synopsis about the study, the volunteer

requirements, and contact information. Isaksson et al. (2019) claimed that including

factors such as the relevance of the research question, time allotment, the consent

process, and interview protocol, and identifying the researcher who will be responding to

inquiries, could be helpful when recruiting. The combination of strategies such as using

social media, employing clear communications about the value of the study, and using

snowballing and purposeful sampling were included in the recruitment process.

<div align="center">**Research Method and Design**</div>

The focus of this study was to explore successful strategies that hospital leaders

use to reduce medication errors and costs in U.S. hospitals. This subsection contains the

rationale for selecting the qualitative method and the justification for a generic qualitative

design.

Research Method

The research method selected for this study was qualitative. Researchers can gain

an in-depth and holistic understanding of a topic of interest in everyday life based on

people's experiences (Bradshaw et al., 2017; Hammarberg et al., 2016; Thirsk & Clark,

2017). The qualitative method was appropriate for this research question because I did

not require numerical data. The focus was on the real-life experiences of hospital leaders

in their current workplace and the strategies they have used to reduce medication errors

and costs successfully.

A quantitative approach would not have worked for this research topic because I

required descriptive and explorative rich descriptions of the topic of interest to address

the study question and did not require empirical data (as used in the quantitative

approach). The quantitative method is useful for researchers interested in addressing how much and how often types of research questions and analyzing relationships between variables for generalizations rather than understanding human experiences (Aspers & Corte, 2019; Bradshaw et al., 2017; Makrakis & Kostoulas-Makrakis, 2016).

Mixed-method research includes a quantitative and qualitative component (Halcomb, 2018). The vital disadvantages of mixed-methods research are that the process can be time-consuming and quantizing multidimensional qualitative data can limit the data's richness and flexibility. Additionally, researchers need to be experts in both methods and have skills to effectively mix each method (Timans et al., 2019). Methodological purists have argued that research should be either a qualitative or a quantitative paradigm but not both (Timans et al., 2019). The mixed-method approach would not have been the best design for this study due to the time limitations and the quantitative aspect. Therefore, the qualitative method was the preferred approach for this study because I could focus on exploring meanings, interpretations, and the processes that hospital leaders used in their local settings to reduce errors and costs successfully and also due to my time constraints.

Research Design

The research design chosen for this research study was a generic qualitative approach. The focus of the study question was finding out what, how, and why some hospital leaders have been successful in reducing medication errors and costs. According to Bradshaw et al. (2017), the generic qualitative approach is appropriate when data are required directly from individuals experiencing the phenomenon of interest, where

resources, including time, are limited. A main advantage of this design was flexibility. A
researcher can address complex questions and produce practical results with an approach
that does not fit precisely into established qualitative methodological boundaries (Doyle
et al., 2020; Burdine et al., 2020). The generic method was ideal for gaining a deeper
understanding of concepts such as choices, decision-making, and associated outcomes
(Ridder, 2017) and examining a topic of interest through the interactions between a
researcher and interviewees and other forms of data in a natural setting (Harrison et al.,
2017).

The generic qualitative design aligns with the complex nature of the topic, the
research question, and my worldviews as the primary researcher. Experts agree that a
generic qualitative design helps a researcher capture the topic of interest and the
complexity of the subject matter holistically and comprehensively without compromising
the investigator's worldview, values, and beliefs (Bradshaw et al., 2017). Based on these
sources of evidence, the generic qualitative approach was a suitable design for this study.

Strategies integrated into the research design for ensuring the trustworthiness of a
qualitative study are interviewing, establishing a suitable sample size to capture detailed
and thick data, data triangulation, and reviewing the data until no new codes or themes
occur. Data saturation is integral to the quality of the research and a qualitative standard
for discontinuing data collection and analysis (Braun & Clarke, 2019; Lowe et al., 2018).
A general principle for achieving data saturation involves reviewing and analyzing the
data until no new codes, concepts, or themes emerge (Braun & Clarke, 2019; Fusch &
Ness, 2015; Saunders et al., 2018). Experts such as Fusch and Ness (2015) found that

processes such as interviewing, having an adequate sample for achieving data depth, and triangulating the data are effective processes for ensuring saturation in qualitative research.

I employed multiple sources of evidence for cross verification to achieve triangulation. The sources included 10 leaders from different hospitals. To perform rigorous thematic analyses on the data, I used NVivo 12 to assist with coding, followed by an in-depth analysis and interpretation of the data. According to Elliott (2018), coding software can help researchers develop complex stratified sets of codes in different layers and detect data relevant to the research questions. Data saturation helps to gain a richer understanding of the meanings derived from the data (Hennink et al., 2016; van Rijnsoever, 2017). Therefore, using triangulation and a comprehensive coding process were effective processes to achieve saturation.

Population and Sampling

This study's scope was limited to 10 leaders employed in HR hospitals in the United States. Hospitals classified as HR are associated with a safety culture, quality, collective mindfulness, risk reduction, improved process outcomes, and efficiencies (Chassin & Loeb, 2013; Veazie et al., 2019). Experts in the literature have recognized HR hospitals for their potential to increase patient safety and reduce the volume of medical errors (Chassin & Loeb, 2013; Veazie et al., 2019). Therefore, recruiting leaders with accountabilities in medication management and budgets who are working in established HR hospitals would generate rich data to answer the study question.

This population is familiar with hospital strategies, guidelines, and policies on error reduction and cost implications. According to Moser and Korstiens (2018), participants selected for a study should be knowledgeable on the topic of interest and be willing to reflect and discuss the phenomenon in-depth with the researcher. The interviews were virtual; therefore, the interviewees would be able to select a setting based on their schedules and comfort. Researchers such as McGrath et al. (2019) have recommended organizing the interview at a time and place convenient for the respondents and free from possible distractions.

Snowballing and purposeful sampling were the sampling methods for this study to identify subjects with knowledge about the topic of interest for this study. Qualitative researchers use snowball sampling to access and target specific groups of people with the knowledge and/or experience in the research topic (Ames et al., 2019; Naderifar et al., 2017). Similarly, Sarstedt et al. (2017) recommended purposive sampling as a strategy for qualitative researchers for tailoring the sample population to the study. Combining snowballing and purposeful sampling helped target the most appropriate subjects to address the study research question.

In addition to selecting the most appropriate sample, researchers need to ensure their sample size aligns with the research design to reach saturation. There is a broad range of sample sizes in qualitative research and no consensus on standardized sample size for achieving saturation (Malterud et al., 2016; Sim et al., 2018). However, most researchers agree that the number of participants is typically small and dependent on epistemological, methodological, and practical factors (Vasileiou et al., 2018). Experts in

generic qualitative research such as Bradshaw et al. (2017) also support a small sample so researchers can obtain more robust information and focus on data saturation.

To ensure there are adequate data to address the research problem and reach saturation, a researcher must ensure that no new codes or themes emerge. Likewise, the researcher can improve validity by providing enough details to replicate the study and achieve the same results (Fusch & Ness, 2015; Vasileiou et al., 2018). Experts such as Sim et al. (2018) and Vasileiou et al. (2018) argued that strategies such as member checking and triangulation help to ensure data saturation. Therefore, given that I incorporated member checking and triangulation into the research process to confirm saturation, 10 subjects were an adequate sample size to obtain enough information to address the research question and attain saturation in this study.

Ethical Research

This study is compliant with the ethical requirements of the Walden University IRB, including obtaining informed consent. According to Nakkash et al. (2017), IRBs are responsible for establishing the guidelines for research with human participants, including the requirements for informed consent. The informed consent is a legal and ethical requirement in research established to protect the rights of study participants (Grady et al., 2017; Guloy, 2018; Nusbaum et al., 2017; Øye et al., 2016). Experts such as Tajir (2018) have emphasized the importance of aligning the research process with the *Belmont Report's* principles, including treating respondents with respect, beneficence, and fairness. As the primary researcher, I was respectful to all prospective participants,

ensuring they were informed about the study's purpose, benefits, encouraging them to ask questions, and ensuring they aware that the research is risk-free.

The participants were made aware that participation is voluntary, with no monetary incentives to participate, and that they can withdraw from the study at any time by contacting the researcher. I provided each participant with a 15-dollar gift certificate as a token of appreciation for participating. All participants who consented to partake in this study received a summary of the final study's findings and were encouraged to ask questions throughout the study. Researchers such as Grady et al. (2017) and Nusbaum et al. (2017) have recommended that researchers encourage participants to ask questions and offer them a choice to become involved in the research or be able to decline.

To protect privacy, I removed all identifiable information about the participants and the employing hospitals from the study and any recognizable research notes. Researchers have a responsibility to respect respondents' confidentiality while sharing the findings (Turcotte-Tremblay & McSween-Cadieux, 2018). Five years after completing this study, I will destroy all the electronic data (secured on a password-protected external drive), transcripts, and interview tapes according to research records storage and disposition best practices. The Walden University's IRB approval number is 01-20-21-0527250.

Data Collection Instruments

As a qualitative researcher, I was the primary data collection instrument in this study. Experts affirm that the investigator becomes the principal instrument in the data collection and analysis phases of qualitative research (Cypress, 2017; Denny &

Weckesser, 2019; Mohajan, 2018). The primary data collection method for this study was interviews. The most popular data collection process in generic qualitative research is semistructured interviews (Bradshaw et al., 2017). For obtaining rich, in-depth information about the successful strategies to reduce costs related to medication errors in hospitals, I used a semi structured interview process. DeJonckheere and Vaughn (2019) claimed that semi structured interviews are valuable for gathering open-ended data and exploring the interviewees' perspectives about the study topic, particularly in qualitative health services research. Other scholars such as DeJonckheere and Vaughn (2019) have found that researchers commonly use semi structured interviews as a data collection method in qualitative studies. An interview protocol is a valuable tool for guiding the interview process and ensuring a uniform approach with each participant (Castillo-Montoya, 2016; Cypress, 2017). Based on these experts' recommendations, I followed an interview protocol (see Appendix A) for the interview process with each participant.

To further enhance validity and reliability during the data collection and analysis phase, I incorporated a detailed audit and journaling process. Scholars have found journaling to be an effective procedure for helping researchers to reflect and critically think about their data (Cook et al., 2018). Additionally, I provided a summary of the data for member checking with the respondents to validate the data's accuracy from their perspectives. Birt et al. (2016) and Yin (2018) recommended verifying the accuracy of the interpretation of the conversation by using member checking with the participants. The application of processes such as an interview protocol, auditing, journaling, and

member checking helped to strengthen the credibility and validity of the data collection instrument and the quality of the study.

Data Collection Technique

The primary data collection method for this study will be interviews. The most popular data collection process in generic qualitative research is semistructured interviews (Bradshaw et al., 2017). To obtain rich, in-depth information about the successful strategies to reduce costs related to medication errors in hospitals, I used a semistructured interview process. DeJonckheere and Vaughn (2019) claimed that semistructured interviews are valuable for gathering open-ended data and exploring the interviewees' perspectives about the study topic, particularly in qualitative health services research. An interview protocol is a valuable tool for guiding the interview process and ensuring a uniform approach with each participant (Castillo-Montoya, 2016; Cypress, 2017). Based on these experts' recommendations, I followed an interview protocol (see Appendix) to maintain consistency with each participant throughout the interview process.

To further enhance validity and reliability during the data collection and analysis phase, I incorporated a detailed audit and journaling process. Scholars have found journaling to be an effective procedure for helping researchers to reflect and critically think about their data (Cook et al., 2018). Additionally, I provided a summary of the data for member checking with the respondents to validate the data's accuracy from their perspectives. Birt et al. (2016) and Yin (2018) recommended verifying the accuracy of the interpretation of the conversation by using member checking with the participants.

The application of processes such as an interview protocol, auditing, journaling, and member checking helped to strengthen the credibility and validity of the data collection instrument and the quality of the study.

Data Organization Technique

A variety of techniques were used to organize the data for this study. Data sources included audio recordings of the interviews, a USB flash drive (back-up system), and a research journal. I cataloged the dates and data collected with a spreadsheet. I stored all the audio recordings and electronic records in an encrypted confidential electronic folder on the flash drive. Electronic data storage and security are essential components of clinical research to ensure confidentiality and accuracy (Dos Santos et al., 2017). All the paper data collected from the interviews, journal entries, notes, and the flash drive are stored in a locked storage file in an office and secured for 5 years. I will shred all the paper information and permanently destroy all the study-related electronic data after 5 years following the study's completion.

Data Analysis

The data analysis process for this study was methodological triangulation. Fusch et al. (2018) and Honorene (2017) recommended that qualitative investigators use methodological triangulation to enhance the reliability and validity of their data and research findings. In methodological triangulation, the researcher uses various strategies such as interviews, observations, and relevant documents to gather data and ensure objectivity (Ashour, 2018, Abdalla et al., 2018; Hayashi et al., 2019). To achieve triangulation, I examined the following data sources, the interview data from leaders from

HR hospitals. Based on recommendations from other qualitative experts such Hayashi et al. (2019), I used the data triangulation approach to validate the findings as well as explore the data from different dimensions.

To analyze the data, I followed the recommendations Yin (2018) identified, which include examining, categorizing, tabulating, and testing the evidence. After transcribing the data obtained from the interviews, member checking, and journal notes into a single document, I used NVivo 12 software for coding the data. Although NVivo 12 does not provide an analytical process, the software offers a comprehensive data management and retrieval process for supporting a rigorous analysis (Dollah et al., 2017; Maher et al., 2018). The data analysis process requires the researcher to group the data into categories and concepts, starting with common words and phrases (Bengtsson, 2016). Following the coding process with NVivo, I continued to explore the codes and journal notes to identify patterns, contrasts, and concepts until saturation. Following saturation, I identified the main themes and correlated them with the literature and the sociotechnical framework. According to Collins and Stockton (2018), researchers can use a conceptual framework to define the research questions, select the methodology, show validity, and show the study's importance.

Reliability and Validity

Reliability

Reliability, referred to as dependability in qualitative research, is essential for demonstrating the rigor and systematic approach of a qualitative study. According to Rose and Johnson (2020), qualitative researchers need to demonstrate dependability to

prove to the readers that the study is replicable, the research method is appropriate, and the analytical process is transparent. To address dependability, I incorporated the following strategies into this study: an interview protocol, a transcript review, member checking, journaling, and data saturation.

A comprehensive interview protocol is a valuable tool for systematically collecting quality data for qualitative research and managing those data consistently. According to Yeong et al. (2018), qualitative researchers use interview protocols to collect comprehensive information from the respondents within the assigned time frame of the interview and to improve the overall effectiveness of the interview process. The ability to capture detailed, rich data during the interview helps the researcher gain a deeper understanding of the participants' perspectives on the topic of interest and demonstrate dependability.

Having the respondents review the transcripts following the interview helps ensure that the researcher has accurately captured all the interview information. The respondents also had the opportunity to add other insights or thoughts missed during the interview meeting in the transcript review process. Chase (2017) and Madill and Sullivan (2017) highlighted the value of having participants undertake a transcript review for helping to ensure the credibility and dependability of a qualitative study.

By engaging the respondents in member checking, I was able to validate the accuracy of the interpretation of the transcribed interviews. Member checking is a qualitative procedure that includes having the respondents review the findings and the descriptions of the interview results for truthfulness and accuracy (Candela, 2019; Chase,

2017; Naidu & Neil, 2018). I combined detailed notetaking, journaling, audits, and precise coding throughout the research process to enhance reliability further. To ensure my coding accuracy and reach data saturation, I used NVivo 12 software. Forero et al. (2018) recommended that investigators apply comprehensive, detailed descriptions; an audit trail; and valid codes to ensure dependability.

Validity

Qualitative investigators need to incorporate methods to enhance their study's validity throughout the research process. Despite the lack of universally accepted measures for evaluating validity in qualitative studies, most researchers discuss member checking, triangulation, and data saturation in their approach to assure readers of the rigor of the study. The criteria for evaluating the validity of this qualitative study included credibility, transferability, conformability, and data saturation.

Credibility

A key component of trustworthiness in qualitative research is credibility, the validation of findings obtained from the participants 'perspective. To demonstrate the credibility of this study, I used strategies such as prolonged engagement, transcript review, triangulation, an audit trail, an interview protocol, and member checking. According to Korstjens and Moser (2018), strategies such as prolonged engagement, triangulation, and member checking ensure the credibility of a study.

To accommodate prolonged engagement, I incorporated 1 hour into the interview protocol and limited the interview to seven questions, to allow adequate time for relationship building and the interview discussion. Following the interview, I validated

the interview transcript with each participant to verify their responses and provide an opportunity for the participants to add additional information. Nascimento and Steinbruch (2019) recommended including the transcription review process details to improve research validity. I journaled detailed notes at each phase of the study and triangulated multiple sources of information to enhance the trustworthiness of the data and findings. According to Dikko (2016) and Tonkin-Crine et al. (2016), detailed notetaking and triangulation are essential steps for ensuring credibility.

For triangulation, I used multiple data sources, including the perspectives of hospital leaders from different HR hospitals, to gain a full understanding of the phenomenon of interest. Triangulation strategies include asking the same research questions to different participants to answer the same research questions (Dikko, 2016; Johnson et al., 2020). The detailed records and descriptions of the research process and triangulation helped the researcher demonstrate credibility.

In addition to the above strategies, I kept a detailed audit spreadsheet that included tracking events such as data collection, interviews, and analysis. An audit process helped to verify the research steps, ensure alignment with the research question and situation, and created a process for checking for internal consistency of the identified categories in the data. A sound approach to assess a qualitative study's data credibility is to conduct an audit trail of materials and methods (Maher et al., 2018). To arrange for member checking, I asked the participants to review a summary of the interpretation of the data and findings for accuracy. The combination of initiatives such as prolonged

engagement, transcript review, triangulation, an audit trail, an interview protocol, and member checking helped increase the study's trustworthiness and overall quality.

Transferability

Transferability, the evidence that the findings may apply to other contexts, is integral for ensuring trustworthiness in a qualitative study. Strategies including purposeful sampling, thick descriptions of each step of the research process, member validation, and data saturation were integrated into the research process to ensure transferability. Purposeful sampling helps identify respondents with expertise in the research topic (Ames et al., 2019; Forero et al., 2018; Nowell et al., 2017). To ensure other readers can judge transferability, I provided robust and detailed descriptions of the data collection and the analysis process, as Kim et al. (2017) and Nowell et al. (2017) have recommended. Likewise, Fusch et al. (2018) emphasized the importance of collecting accurate data and validating the interpretations with the subjects throughout the study to demonstrate transferability. Finally, I reviewed the data until no new material or themes were detected to achieve data saturation. According to Forero et al. (2018) and Nowell et al. (2017), data saturation is a credible way for qualitative researchers to ensure transferability. Therefore, by combining these strategies, I addressed the criterion for transferability in the qualitative approach.

Confirmability

Confirmability, or the readers 'confidence in the accuracy of the findings, is another crucial indicator of quality in qualitative research. Scholars such as Mandal (2018) and Forero et al. (2018) have endorsed providing detailed descriptions of the

methodology, data triangulation, and analysis as a credible way to accomplish confirmability. As such, I regularly tracked new ideas related to the data, assumptions, and conclusions in a journal. According to Moon et al. (2016) and Johnson et al. (2020), reflective thinking and journaling help researchers identify biases, new insights, and the potential effect of their worldview on the research findings. Recording main decisions and feelings throughout the research process also allowed the writer to expand their knowledge during the research process.

Researchers generally accept data saturation as a methodological standard in qualitative studies. Scholars agree that when no new issues show up in the data, no new codes or ideas emerge, and other researchers can replicate the study, saturation is achieved (Aldiabat & Navenec, 2018; Fusch & Ness, 2015; Hennink et al., 2016). Although saturation is considered the gold standard in qualitative research, there is a broad range of approaches to achieve saturation and no standard format or guideline for ensuring saturation (Fusch & Ness, 2015; Hennink et al., 2016). Constantinou et al. (2017) recommended that researchers provide a detailed and transparent discussion of how they achieved saturation so readers can be confident about the study's validity.

To achieve saturation, I used NVivo 12 software to provide a methodical approach for coding. Researchers have found NVivo to be a useful tool for mapping patterns of keywords and ideas, coding, finding themes, and organizing thematic representations of the data (Dollah et al., 2017). I also used notetaking and functions in NVivo software as tools for identifying redundancy in the data.

As indicated by qualitative experts, triangulation is integral to achieving saturation and proving validity in qualitative research (Fusch et al., 2018). According to Fusch and Ness (2015), multiple sources of data help enhance the reliability of results and achieve data saturation. I triangulated the data derived from the 10 hospital leaders from various HR hospitals. I also included comprehensive descriptions of the interview and data collection processes in a journal.

The journaling and notetaking processes included discoveries in the interpretation of the data and self-reflection. This process also involved details about the setting, sample, data collection, and analysis so that readers can evaluate the findings and transfer them to similar environments. Self-reflection helps qualitative researchers identify their personal beliefs and experiences and how they might have an influence on the study (Assarroudi et al., 2018). To ensure reflection, I kept comprehensive field notes and a journal to identify any biases and improve the credibility and conformability of the findings.

Transition and Summary

Section 2 covered the purpose statement, the researcher's role, methodology, and the study design. The section included the description of the population and sample, data collection instruments and techniques, and ethical research considerations. Section 2 also included subsections on data collection instruments, data organization techniques, data analysis, reliability, and validity. Section 3 includes a reintroduction of the study, a presentation of the research findings, and a discussion section with the implications for potential social change. This final section also contains the final recommendations for

action, future research possibilities, and reflections, followed by the study's summary and

conclusion.

Section 3: Application to Professional Practice and Implications for Change

 The purpose of this generic qualitative study was to identify successful strategies that hospital leaders can use to reduce costs caused by medication errors in hospitals. In this section, I present my study results, the implications for social change for successful strategies to reduce costs caused by medication errors, recommendations for action, and suggestions for future research. I complete this section with reflections about my educational journey in carrying out this research study and a conclusion. These data came from 10 hospital leaders from HR hospitals in various locations across the United States. The findings indicate key strategies that hospital leaders have successfully used to reduce costs caused by medication errors.

Presentation of the Findings

 This paper's overarching research question was, what successful strategies have hospital leaders used to reduce costs caused by medication errors in hospitals? I incorporated transcription reviewing, journaling, triangulation, and member checking to analyze the data sequentially and logically to reach saturation. The sociotechnical framework aligns with the existing literature on this topic and the themes generated in the findings. Thematic analysis revealed the following themes and findings: (a) multilayered error prevention and an HR approach, (b) leadership support, (c) open communication with feedback loops, (d) sustaining a culture focused on medication error prevention, and (e) patient engagement and partnerships.

Theme 1: Multilayered Error Prevention and an HR Approach

The first theme that appeared frequently during the analysis was a multilayered approach for preventing and eliminating errors and the associated costs. See Table 2 for frequency of this theme found during the coding process.

Table 2

Multilayered Error Prevention and HR Approach

Theme 1: Participants	*n*	% of contribution to the emergent theme
P 1	10	7%
P 2	14	9%
P 3	15	10%
P 4	12	8%
P 5	17	11%
P 6	14	9%
P 7	17	11%
P 8	14	9%
P 9	18	12%
P 10	19	13%
Total	150	99%

Note. n = frequency of concept resulting from coding references. Percentages do not total 100% due to rounding.

All the participants mentioned being proactive and implementing an overarching preventive multilayered strategy to reduce medication errors successfully. Participant 10

noted, "We have a team which is very proactive. We plan a variety of training sessions and the staff often request for added training and education based on errors." Participant 4 stated,

> We have to put many strategies in place to help reduce and prevent medication errors and costs. Medication errors were widespread, so something had to be done to address this problem. Our management team decided to develop and implement better procedures and policies that targeted the problem areas.

Likewise, Participant 2 stated,

> We combined different strategies such as installing alarm devices in case of a reaction, double-check the labeling of medications, proper labeling of medications, and adding checks with pediatric patients and patients receiving high-risk drugs such as anticoagulants and chemotherapeutic agents.

Evidence in the literature has revealed similar findings. Organizations investing in a multiprong approach to error reduction that contains preventive interventions, safety, and HR principles have been able to sustain successes in error reduction (Veazie et al., 2019). The participants elaborated on how the combination of strategies helped target common high-risk areas, including system-related errors, technical types of errors, environmental factors, and human factor-related medication errors.

A medication mistake can occur at various phases of the medication management process in a hospital. The participants identified various interventions to address this problem, such as adequate staffing levels, ongoing education, training, staff

accountability, proper medication storage, reducing clutter, double-checking high-risk

drugs, medication reconciliation, mentoring, and error tracking. Participant 5 commented,

> I would emphasize patient education, staff training, listening to what the
>
> employees have to say, encouraging the use of current policies, regular updates
>
> that remind all employees, regular meetings, teamwork, and collaboration
>
> amongst the staff. These strategies are all crucial for cutting down errors and the
>
> costs.

Other researchers' work supports these findings and endorses a multifaceted approach

and combining strategies to prevent medication errors and reoccurrences in healthcare

settings (Chu, 2019; Wheeler et al., 2018).

Coupled with the multilayered preventive approach, all participants talked about

principles for enhancing HR to reduce variability for evaluating the effectiveness of this

multilayered approach. According to Makary and Daniel (2016), unwarranted variation is

a widespread problem in healthcare, contributing to medical errors and healthcare costs.

The participants discussed various processes for determining whether the preventive

strategies were effective to reduce costs and errors, such as error reports, patient

satisfaction surveys, and direct patient feedback. For example, Participant 3 stated,

> Suppose there are more complaints or fewer complaints about errors; we are still
>
> getting the data and facts. . . . If the patients experience errors like further
>
> complications, this will lead to further costs and issues. We monitor such things
>
> and follow up. . . . Measures include getting to know how many errors, the

financial impact, allocation to staff education, and added visits to see if the
strategies are really working.

Similarly, Participant 3 commented, "We work at getting feedback from our patients and track the types and numbers of medication errors occurring in a certain period so we can compare the data to previous data." The findings show that the layering of strategies to prevent an error from occurring, joined with HR processes for reducing inconsistencies and providing performance measurements, have helped leaders reduce errors and the associated costs.

The sociotechnical framework helped contextualize the applicability of a multilayered approach in a complex hospital further complicated by human factor and technology issues. According to sociotechnical framework research, organizations can improve safety by examining the intersection of human behaviors and technical processes, work design, and change (Ngowi & Mvungi, 2018; Pasmore et al., 2019). As identified in the literature, healthcare leaders need to recognize the impact of sociotechnical factors such as workflow, training, and organizational issues to address variability while implementing preventive measures to reduce errors (Bates & Singh, 2018). This study has shown that investing in a multilayered approach coupled with HR tactics can help reduce errors and costs in some U.S. hospitals.

Theme 2: Leadership Support

The second theme that was frequently described in the data was leadership support (see Table 3).

Table 3

Leadership Support

Theme 2: Participants	*n*	% of contribution to the emergent theme
P 1	5	6%
P 2	13	14%
P 3	5	6%
P 4	9	10%
P 5	14	16%
P 6	6	7%
P 7	11	12%
P 8	7	8%
P 9	7	8%
P 10	12	13%
Total	89	100%

Note. n = frequency of concept resulting from coding references.

This category emerged from the participants' discussions about their role as leaders in providing support, including resources to prevent errors. All of the participants talked about the importance of allocating adequate resources to support error reduction, such as educators, technology, and adequate staffing. Participant 4 stated, "We also made sure we have the right financial resources in place. This includes resources for continuous education, adequate technology, and human resources." Half of the participants commented on error prevention as being costly, but the financial impact of medication

errors was much worse. Researchers have estimated that medication-related mistakes cost over $40 billion annually, resulting in 7,000 to 9,000 patient deaths in the United States (Tariq et al., 2021). Researchers such as Rodziewicz et al. (2021) found that hospital leaders who reduced nursing staff and staffed registered nurses below target levels to reduce overhead costs experienced increased patient harm and mortality. Leaders are responsible for appropriate staffing levels, allocating budgets for ongoing education in error reduction, and facilitating linkages with the senior leadership levels about the need for system changes to address error prevention and costs.

All of the participants frequently commented on the importance of the leadership role to empower their staff members and hold them accountable for safety, preventing errors and costs. Participant 1 stated, "We ensure the staff are qualified and dedicated to error prevention. We work at ensuring our staff is motivated for safety." Eight participants discussed the importance of establishing a leadership role such as a manager, supervisor, or educator on each shift in their setting for supporting staff and continually promoting error prevention. Participant 8 commented,

> We ensure we can have a manager or leader role available on every shift to oversee safety without overshadowing staff or intimidating them. We ensure the supervisors in all department work hand in hand with staff to lower errors. The educators and supervisors play an important role because they are very much available and supportive.

To successfully strategize ways to mitigate errors and costs, hospital leaders need to recognize the importance of their role and influence over human and environmental

factors such as staffing behavior, staffing levels, workflow, and workplace design, as those factors affect errors and costs. Seven of the participants identified the importance of leaders supporting one another and creating a no-blame environment. Participant 7 noted,

It is important that as managers we are all informed about that type of errors and new information because if we are on shift, we need to know about the risk of a problem. You have to know what type of pumps staff are using or if there's a new type of medication, or if there's an incident.

Scholars such as Rogers et al. (2017) have also declared that healthcare leaders are crucial for establishing a no-blame culture, instilling safety, and a just and error-free organization. Participant 8 stated, "Some errors happen accidentally and not on purpose; for example, pharmacy mislabeled the drug, and the nurse missed that error. We do not blame the staff but look at what happened so we can prevent it next time." Other researchers have supported this same finding and have shown a positive correlation between supportive leaders and reduced error rates, increased patient satisfaction, shorter patient length of stay, and improved patient outcomes (Cochrane et al., 2017; Liukka et al., 2017, Sfantou et al., 2017).

Thematically, the sociotechnical conceptual framework helps to contextualize the significance of the leadership role in complex organizations dealing with the intersection of systems, human factors, and technological issues. Hughes et al. (2017) noted that complex work systems can be improved only if the organization's leaders address the social and technical parts of their settings as interdependent factors because a change in

one part of the system affects change in another. The evidence generated from this study supports the influence of the leadership role in lowering medication errors and costs.

Theme 3: Open Communication and Feedback Loops

The third most frequently quoted theme that appeared in the data was open communication and feedback loops (see Table 4).

Table 4

Open Communication and Feedback Loops

Theme 3: Participants	n	% of contribution to the emergent theme
P 1	5	8%
P 2	8	13%
P 3	5	8%
P 4	1	2%
P 5	9	15%
P 6	4	6%
P 7	10	16%
P 8	7	11%
P 9	1	2%
P 10	12	19%
Total	62	100%

Note. n = frequency of concept resulting from coding the data.

All of the participants discussed the importance of supporting and promoting open communication and sharing information with their clinical and leadership teams on what

strategies were working and discussing ways to solve new types of errors. All 10 participants talked about the need for open communication between the different disciplines, such as nursing, pharmacy, and the medical team, as well as with the patient. Participant 5 commented, "You want an environment where the patients and staff feel that they can openly discuss error prevention and identify any potential issues." Participant 2 talked about using meetings with management to ensure open communication between the leadership team with frontline staff, physicians, and families to improve safety. Likewise, Participant 3 stated,

> If you do not involve staff in communications about errors, they will feel like management is imposing things on them. So do the right thing and include them in upcoming changes and policies. This action allows them to contribute to the change.

> In a study by Keers et al. (2013), the researchers found that communication breakdown between physicians, pharmacists, nurses, and patients contributed to a wide variety of medication errors, and strategies to improve communications were fundamental to error prevention. Likewise, Makary and Daniel (2016) claimed that communication failures in hospitals contributed to patient harm and deaths. Analyzing, addressing, and learning from reported errors and sentinel events includes responsiveness and closure to cultivate continued reporting (Singer & Vogus, 2013). The combination of open communications between the leadership team, clinicians, and patients, and follow-up on errors to close the loop, has been instrumental for creating transparency, trust, and accountability in error reduction and prevention.

Eight of the respondents commented on the value of having strategies such as clear formal written communications (e.g., policies and procedures) on medication management and error reduction, support staff in place to reduce interruptions, educators to support and teach staff about new drugs and technologies, suggestion boxes for patient feedback, and regular meetings for sharing information and seeking input. Participant 5 noted, "We need to make sure we listen and are fair. So, listening to staff is very important. The more information about an error, we can find ways to prevent it from happening again." Additionally, all the participants mentioned the importance of follow-up processes with staff after an error to obtain their input on preventing a reoccurrence and closing the loop. Participant 10 commented, "We wanted an environment whereby the staff feel safe when they come to us to talk about errors. So, it is important to have that level of communication between the clients, the patient and the hospital." Participant 8 stated, "We have so much communication underway. That is one of the main things leading to the sustainability of error and cost reduction." Rodziewicz et al. (2021) found that deficiencies in education, training, and orientation; inadequate policies to guide healthcare workers; failure to disclose the errors; or teams lacking in problem-solving ability resulted in communication gaps and led to errors. With COVID-19, five of the respondents identified the need for more communication due to increased staffing shortages and the volume of new staff being hired. With the increased need to hire and orient new staff due to staffing shortages caused by the pandemic, effective communication practices are essential for staff education, training, and team building.

Open communication and the feedback loop also include ensuring all the stakeholders from different shifts and departments have access to the same information and an opportunity to engage in a meaningful discussion about processes to reduce errors. Effective communication between human agents is essential for safety in sociotechnical systems such as healthcare settings to mitigate risks and increase performance (Knox et al., 2018). Participant 4 stated, "You do not get success in getting collaboration of staff if you only focus on errors. We do not focus on individuals or individual errors at group meetings, but look for ways to improve." The sociotechnical tenet of the meaningfulness of tasks aligns with this theme. To engage the clinical teams in error reduction, they need to be engaged and understand the meaning and value of the various processes and procedures to prevent errors. All the participants talked about the importance of open dialogue about mistakes and seeking staff input to resolve the problem and to reduce the financial impact. The evidence from this study shows that the combination of open communication with a feedback loop for shared learning is instrumental for error reduction.

Theme 4: Sustaining a Culture with a Focus on Medication Error Prevention

The fourth theme that was derived from the data was sustaining a culture with a focus on medication error prevention. This theme had the fourth highest frequency of codes (see Table 5).

Table 5

Sustaining a Culture with a Focus on Medication Error Prevention

Theme 4: Participants	*n*	% of contribution to the emergent theme
P 1	2	4%
P 2	2	4%
P 3	5	10%
P 4	4	8%
P 5	7	14%
P 6	3	6%
P 7	9	17%
P 8	6	12%
P 9	4	8%
P 10	9	17%
Total	51	100%

Note. n = frequency of concept resulting from coding.

Collaboration amongst healthcare providers is essential for reducing medication errors and creating a safe culture in hospitals. All participants emphasized the importance of collaboration and teamwork amongst their clinical staff, physicians, managers, and patients to reduce medication errors and costs effectively. Participant 9 stated,

Our qualified staff is committed to keeping errors down and promoting patient safety. The staff do the work the right way and not because someone is supervising them. They do it because it is the right thing. And with time, it

becomes a culture that they can adapt to and instill safe practices to prevent
errors.

The research has shown that attitudes and behaviors focused on a safety culture
positively influence quality in healthcare and reduce patient harm (Lawati et al., 2018).
Participant 7 stated,

Teamwork is especially useful for reducing mistakes, so if they don't want to
work as a team, that is a significant barrier. Even if you try as much as possible to
reduce the errors, they can happen unless everyone is working towards safety.

Other researchers have found that reducing patient harm in hospitals has been
shown to not only lower costs but increase profitability for hospitals (Adler et al., 2018;
Slawomirski et al., 2017). A workforce with common goals such as quality, error
reduction, and safety can help to reduce drug errors and costs.

The sociotechnical conceptual framework contains concepts on the effect of
human behaviors and how the application of knowledge can produce actions that align
with the culture (Ngowi & Mvungi, 2018). Tenets of the sociotechnical framework
include a social system for defining desired social behaviors in the workplace and a need
for learning and decision-making. A team committed to error reduction, and safety helps
to role model, mentor, and promote social behaviors, focusing on accountability,
collaboration, error prevention, and safety.

Despite the complex hospital environment and the sociotechnical challenges, all
the participants mentioned the importance of using strategies such as engagement, staff
accountability, open communication, and education to reduce errors and prevent

reoccurrences. According to Rodziewicz et al. (2021), the establishment and maintenance of a workforce that recognizes the value of safety and is motivated to find ways to reduce risks is an effective way to reduce healthcare errors. The evidence from this study supports the significance of a culture focused on error prevention and how this strategy contributes to lowering errors and the associated costs.

Theme 5: Patient Engagement and Partnerships

A serendipitous theme resulting from the interview data was partnering with patients and patient engagement to prevent errors from occurring. Although there was a lower frequency of codes compared to the previous themes, all the participants emphasized the significance of this observation (see Table 6).

Table 6

Patient Engagement and Partnerships

Theme 5: Participants	*n*	% of contribution to the emergent theme
P 1	2	7%
P 2	3	11%
P 3	1	4%
P 4	2	7%
P 5	3	11%
P 6	1	4%
P 7	3	11%
P 8	3	11%
P 9	4	15%
P 10	5	19%
Total	27	100%

Note. n = frequency of concept resulting from coding.

Patients and families can help prevent a medication error, but the organizational leaders need to be supportive and engage them to be involved. With the U.S. healthcare system's shift towards a patient-centered model of care, there is a corresponding move towards the involvement and collection of health data from patients (Wesley et al., 2019). A number of the participants described examples of how patient behaviors can result in medication errors. They discussed the importance of encouraging patients to update their clinicians about any allergies to medications, disclosing the types of drugs, including

vitamins they are currently using, and always speaking up when they notice a potential medication error. To help involve patients and mitigate the risks of patient-related errors, all 10 participants emphasized the need for their staff and physicians to partner and engage in discussions with patients about their medications throughout their admission. Participant 6 noted,

> The managers and staff engage with the patient, and when a patient is admitted, they make sure that they are well educated about their medications. This education helps to inform the patient so that if they notice a possible error, they will speak up.

> Likewise, Participant 3 stated, "We encourage the patient to be involved. For example, to listen and also ensure that the nurses know how to probe to see if the patient understood the drug information." Other researchers have also found that targeted strategies can help to get patients to participate and engage in their care in the hospital. J. M. Kim et al. (2018) found interventions directed at patients such as coaching, education materials, and patient-reported outcome measures have improved patient involvement in their care.

According to Sharma et al. (2018), patient engagement in healthcare safety has been underexplored, and healthcare staff often have limited error prevention interventions to medication reconciliation and education. All the participants discussed various tactics to engage and partner with patients, including meeting with the patient to discuss their accountabilities, written and oral instructions, medication reconciliation processes, patient suggestion boxes, follow-up procedures, and safety posters. They also mentioned

finding an interpreter if there is a language barrier and ensuring staff received patient engagement training. Other tactics included involving the primary caregivers, particularly with vulnerable populations such as pediatric or geriatric patients. For example, Participant 3 stated,

> If you give oral instructions to a family member on how to administer a quarter of a spoon of a particular drug to their child, that person does not understand and ends up giving an overdose. You have to ensure that they understand the information and are involved in the process. This can mean going the extra mile for the doctors and nurses, so that they have to have the skills to determine if patients have low health literacy rates.

The findings show the importance of partnering with patients and engaging them in discussions to prevent errors. Staff and physicians need to recognize that patients are partners in care and ensure they have the opportunity to discuss their medications and other concerns to prevent potential ADEs, sentinel events, and related costs.

The sociotechnical framework addresses patient consequences with organizational outcomes with feedback loops between processes, results, and the work system (Carayon et al., 2015). The framework helps to contextualize how patient engagement aligns with the identified strategies to reduce hospital errors and costs. The active engagement of patients in open conversations with their healthcare providers about the patient and family responsibilities in error prevention and safety in hospitals can help prevent errors, improve patient satisfaction, reduce litigations, and reduce costs associated with medication mistakes. The findings from this study highlight how patient engagement and

partnering can contribute to system-level medication safety improvements and cost savings.

Applications to Professional Practice

The application of this study's findings to professional practice includes the ability to learn about system-wide successful strategies to prevent medication errors from occurring in the first place. This system-wide approach could offer a different model for leaders working on reducing errors and measuring results. Another benefit to professional practice is that these strategies could result in healthcare professionals experiencing less shame, guilt, and self-doubt associated with patient harm and medication errors by engaging them in open dialogue about strategies to prevent reoccurrences of these errors.

Healthcare leaders can also apply the results of this study to establish steps towards building a medication error reduction culture and creating a multilayer error HR prevention program in their organization. These strategies could help hospital leaders avoid lengthy investigations, litigation, reaccreditation, and legal settlements. Last, these strategies could help eliminate repeated errors that could damage a hospital's reputation.

Implications for Social Change

Implications of the finding for social change are that patients, families, and communities can experience a reduction in the risks of ADEs, fewer hospitalizations, and reduced deaths from preventable medication errors. A reduction in patient harm and improved hospital safety may lead to patients and their families participating in community events and living more productive lives because of improved health and lower health costs. Hospital leaders can use this study's findings to develop an alternative

decision-making framework and quality performance indicators not only to reduce the economic burden caused by ADEs, such as unemployment and reduced lifetime productivity but also to improve overall patient safety and satisfaction. If hospital leaders successfully reduced preventable medication error rates and costs of chronic illness, the United States would become closer in alignment with other developed countries in the amount spent per capita (Einav et al., 2018). Additionally, hospital leaders committed to using effective strategies such as those presented in this study can improve the community's overall trust in their local hospitals and with healthcare providers.

Recommendations for Action

This study's final themes were a multilayered approach to error reduction, leadership support, open communication with feedback loops, a culture to eliminate the risk of making errors, and patient engagement and partnerships. The findings from this research can help increase public awareness about this societal issue and the potential physical and financial harm to patients and caregivers from preventable medication errors. Healthcare leaders can also use this study's results to establish steps to build a medication error reduction culture and create a multilayer HR error prevention program in their organization. A key recommendation is that hospital leaders should adopt a decision-making framework and quality performance indicators that encompass these strategies to reduce medication errors and costs successfully. I plan to present the results of this study at a healthcare conference focusing on safety and quality. Additionally, I am planning to publish the results of this study in a healthcare peer-reviewed journal.

Recommendations for Further Research

A limitation of this study is that the findings cannot be generalized to other hospital settings. Opportunities for further research would be to conduct a quantitative approach concentrating on successful strategies to reduce computer-based errors. Due to the interview data being self-reflective and subjective, there would be value in conducting a research study focusing on empirical data and statistical evidence. As many of the participants in this study identified the impact of the COVID-19 virus on staffing and recruiting qualified staff and error rates, there is an opportunity for further research in this targeted area. An unexpected theme that emerged in the findings was patient engagement and participation in error and cost reduction. There is a need to further explore the patient's and caregiver's roles and responsibilities in reducing errors and healthcare costs in hospitals.

Reflections

The Doctor of Business Administration academic process has been an exciting and challenging journey. I acquired new knowledge about the research process and skills in academic writing. I valued the expertise and support I received from my chairs and classmates throughout each milestone of this educational journey. Due to my experiences as a healthcare leader and involvement with medication errors and quality improvement work in hospital settings, I reflected on my potential biases and preconceived ideas frequently during the interview, analysis, and writing process to reduce the risk of unconscious biases. I also learned to recognize how my worldview and values could shape and influence the findings and the importance of mitigating these potential risks.

Conclusion

The purpose of this generic qualitative study was to identify successful strategies that leaders can use to reduce costs caused by medication errors in hospitals in the United States. I used the sociotechnical theory as the conceptual framework. The respondents who participated in the open-ended semistructured interviews were 10 hospital leaders from HR hospitals in various locations across the United States. I incorporated transcript reviewing, member checking, journaling, triangulation, and thematic analysis to achieve saturation and validity. The emerging themes identified are multilayered error prevention and an HR approach, leadership support, open communication with feedback loops, sustaining a culture focused on medication error prevention, and patient engagement and partnerships.

The participating hospital leaders have successfully engaged their clinical teams and patients in various strategies to prevent medication errors and costs. The strategies include an HR decision-making framework, quality performance indicators, and a culture of error prevention and reduction. This study's findings can help healthcare leaders develop a decision-making framework with quality performance indicators to reduce sentinel events, medication errors, and costs and have a tangible impact on positive social change. A key benefit to professional practice is that these strategies could result in reduced risk of shame and guilt about preventable errors by involving professionals and patients in open dialogue about ways to prevent errors and their reoccurrences.

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Appendix: Interview Protocol

Protocol for Strategies to Reduce Costs Caused by Medication Errors

I will begin the face-to-face virtual interviews with introductions and an overview of the study topic. The participants will be made aware that the researcher is sensitive of their time and grateful for their participation in the study. Additionally, I will ensure they are aware that the interview is being recorded and the conversations are strictly confidential.

After the digital recorder is turned on, each participant will be given an identifying code, and the code, date, and time of the interview will be recorded. The interview will last 60 minutes. Each participant will be made aware of the process used for member checking and validating the interpretation of their responses. After ensuring the answers are to the participants' satisfaction, I will conclude the interview, indicating that I will share the notes with them to ensure I captured the meaning of their responses accurately as well as the final themes. Last, I will thank respondents for participating and let them know that their perspective is valuable for this important work.

Script

Good morning (afternoon). My name is Janice Chobanuk. Thank you for participating in this interview. The purpose is to get your perceptions about the successful strategies used in your facility that have resulted in a reduction of medication errors and the associated costs. My background is leadership, and I have encountered many challenges in reducing medication errors and their costs. I am very interested in learning about the successful strategies you and your clinical teams have used. The interview will

take 60 minutes. I will be taping the session so that I do not miss any valuable pieces of

information that you mention. Please let me know if you are comfortable with me taping

our conversation. Your comments will remain confidential since the final paper will not

reference any individuals. The next step is obtaining your consent. Please take a few

minutes to review and confirm you understand the study and have signed the consent

before we get started. Again, I will ensure your information will remain confidential, and

if you decide you do not want to participate, you can withdraw from the study at any

time.