1-1-2009

Intuitive decisions as a means of preventing medical errors

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ABSTRACT

Intuitive Decisions as a Means of Preventing Medical Errors

by

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M.S., University of Colorado, 1986
B.S.N., Central State University, 1981
B.S., Phillips University, 1976

Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
Applied Management and Decision Sciences

Walden University
February 2009

ABSTRACT

Medical errors occur despite precautionary measures. Limited research has focused on intuition in preventing medical errors. The problem addressed in this study explored the role of intuition by health care team members in preventing medical errors from reaching hospitalized patients. The research questions focused on the differences in response to medical errors by health care team members from 3 West Coast hospitals. The theoretical framework included human error, personality typing, skill acquisition, and a model of intuition. In this exploratory mixed method study 1,836 unusual occurrence reports submitted over 6 months were analyzed. Of the 710 health care team members surveyed, 201 (28%) completed an intuitive score instrument. Eight health care team members were interviewed, with responses analyzed for themes of knowledge management implicit to intuition. The unusual occurrences results were categorized as near miss or adverse event and analyzed using *t* tests. There were no differences in a comparison of mean intuition scores for type of error and levels of intuition by participant age or gender. Differences were found in the number of documented constructs of intuition by type of error and discipline in the comparison of pharmacy to nursing and diagnostic imaging. Interview excerpts were compiled for use by managers to role model through storytelling how intuition can prevent medical errors. Research is needed to understand how to incorporate skills of tacit recognition and intuition. Preventing costly and potentially life-threatening medical errors is fundamental to addressing the societal need to lower costs and provide safer patient care.

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DEDICATION

This research is dedicated to my husband, C. Warren Douglass, for his unwavering love and support. He provided the structure and foundation that allowed me to achieve my dream. I am indebted to my parents, Dale and Ethel Savage, who taught me to value education, ask questions, and be tenacious in my endeavors. Finally, I extend my thanks to my aunt, Dora Belle Ford Pratt, who taught me to articulate tacit knowledge and trust my intuition.

ACKNOWLEDGMENTS

I extend my gratitude to the members of my dissertation committee, Dr. David Metcalf, Dr. Lilburn Hoehn, and Dr. William Steeves, for sharing their expertise and knowledge. This study would not have been possible without their support and guidance. I also acknowledge the many individuals who helped me in a variety of ways to achieve this work: Martha Martin, Dorothy Rolls, Timea Vuscan, Dr. Darren Pennington, Debbie Mumford, Julie Nordeen, Sue Gray, Mary Jo Douglass, Barb Elwert, Dr. Pam Smith, Michelle Graham, Marla London, Troy Schmit, and Jeremy Huwe. Finally, I owe a debt of gratitude to the health care team members who participated in the study.

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CHAPTER 1: INTRODUCTION TO THE STUDY

Introduction

Knowledge and error flow from the same mental sources.
Only success can tell one from the other. (Mach, 1975, p. 84)

Health care team members do not intend nor want to make mistakes, yet medical errors occur. The notion that patients may suffer harm, not from an underlying illness or disease process, but from a procedure, the wrong medication, a faulty piece of equipment, or a fatigued health care team member, has led to a national focus on reducing medical errors (Kohn, Corrigan, & Donaldson, 2000; Morath & Turnbull, 2005). Health care managers and leaders, as well as state and federal agencies, struggle to find ways to prevent medical errors from reaching patients.

Part of the struggle has resulted from the normalized deviance associated with medical errors. Vaughn (1996) wrote about the tragedy of the Challenger space launch. She reported that officials in the aerospace industry, when confronted with evidence that something was wrong, normalized the deviance so that it became acceptable. Even as researchers have summarized the magnitude of medical errors, health care seemingly accepts this normalized deviance as part of doing business. The Institute of Medicine (2001) summarized the significance by commenting, "When deviant events become acceptable, the potential for errors is created because signals are overlooked or misinterpreted and accumulate without being noticed" (pp. 55-56).

A second part of the struggle comes from the embedded organizational culture surrounding errors. The basis for a prevailing culture is a set of "beliefs and expectations

about life within the organization" (Behal, 2004, p. 53). Established and documented expectations shape the culture of a company. This acceptance of normalized deviance when errors occur, coupled with the lack of error causation analysis to examine contributing factors, has shaped the existing culture of safety in health care (Haig, 2003; Latino, 1994; Leape, 1998; Poniatowski, 2004).

A third element of the resistance is that health care is perceived as one of the "most entrenched, change-averse industries in the United States" (Christensen, Bohmer, & Kenagy, 2000, p. 102). Patient advocates, business owners, employer groups, and factions of health care team members are no longer tolerating this acceptance of errors. There is a demand for health care organizations and management to amend the culture of safety (Institute of Medicine, 2001; Kohn et al., 2000); however, the change has been slow in coming.

There has to be something greater that compels health care organizations to make a social change away from the accepted normalized deviance associated with medical errors. Christensen (1997) introduced the concept of disruptive innovation, that is, when advances disrupt customary business models sufficiently to cause social change. Most product and service innovations fall into the sustaining category, perpetuating the status quo by providing "additional functionality for an organization's most demanding customer" (Christensen, Baumann, Ruggles, & Sadtler, 2006, p. 96). The status quo of a health care system is disease management. Substantial funding in terms of programs and buildings are dedicated to this fundamental work. Disruptive innovation would be placing

patient safety ahead of the existing status quo as a way to create social change in health care. Finding subsets within health care to apply disruptive innovations will shift the paradigm to patient safety. One such subset could entail understanding the dynamics of a near miss (NM), that is, when a health care team member prevents or stops an error from reaching a patient.

There is debate in the literature that studying NMs will not provide significant knowledge to prevent medical errors because the genesis of the error is hard to identify (Weick, 2002). Conversely, the Institute of Medicine (2004) focused on two primary reasons why detection of injuries and NMs contribute to patient safety. First, standardized identification and reporting practices provide information for "epidemiological analysis and comparative failure rates" (Weick, p. 178). This ranking aids in establishing research priorities. In addition, the gathered information demonstrates (a) what changes took place in work practices, and (b) whether expected improvements are sustainable over time (Institute of Medicine). Each of these makes a significant contribution to fostering safer patient care. Therefore, the intention of this study was to contribute new understanding to the existing body of knowledge on error prevention by members of the health care team. The primary focus was to explore the role of health care team members' intuition in preventing medical errors from reaching hospitalized patients. The results were organized to make it easier for managers to talk with new employees and students about ways to prevents errors from reaching hospitalized patients.

Statement of the Problem

The problem addressed in this study was to explore the role of intuition on the part of health care team members in preventing medical errors from reaching hospitalized patients. Davenport and Prusak (2000) suggested, "knowledge that is complex and initially tacit can be externalized and embedded" (p. 83). Health care team members document when an adverse event (AE) occurs. However, the impediment arises in separating knowledge, which is embedded explicitly in an organizational policy, and tacit knowledge, which keeps the process going (J. Thomas, Kellogg, & Erickson, 2001).

What causes a health care team member to stop or prevent a medical error? The results of analyzing 1,836 unusual occurrence reports (UORs) may assist in identifying and documenting behaviors transferable to less experienced health care team members in order to prevent future errors. The subsequent digital video disk containing stories abstracted from interviews regarding error prevention by 8 health care team members may serve as an educational tool for managers and leaders to use in changing the culture of safety within health care facilities. Davenport and Prusak (2001) commented that "knowledge must be transferred and absorbed; knowledge that is not absorbed has not really been transferred" (p. 101). Storytelling is one way to transfer and absorb knowledge (Cullen & Fein, 2005; Denning, 2001; Snowden, 1999). Themes derived from the analysis of the interviews with health care team members may lead to further research.

Background of the Problem

A review of health care literature suggested that between 44,000 and 98,000 patients die each year because of medical errors (Brennan et al., 1991; Institute of Medicine, 2001; Kohn et al., 2000; Leape et al., 1991). These figures provided a frame of reference for estimating the number and severity of injuries to hospitalized patients annually. The sheer volume demands further query into the causation of dramatic events such as the catastrophic antineoplastic overdose at Dana Farber or documented cases of wrong-site surgeries (Connor, Ponte, & Conway, 2002; Joint Commission, 2007a; Rosenthal & Sutcliffe, 2002).

Health care regulatory agencies have focused attention on the analysis of sentinel and preventable AEs (Institute of Medicine, 2001; Joint Commission, 2007c; Quality Interagency Coordination Task Force, 2000). Numerous types of errors have been identified, including adverse drug events (Beyea, 2002; Bogner, 1994; Boyle, Schulmeister, Lajeunesse, & Anderson, 2002; Cohen, 1999; Haig, 2003; McCarter, Centafont, Daly, Kokoricha, & Leander Po, 2003); communication breakdowns among health care team members (Cosby, 2003; M. Davis, 2004; Joint Commission, 2006a; Patterson, Render, & Ebright, 2002); fires in operating rooms (Morath & Turnbull, 2005); and electronic fetal monitoring failure (Miller, 2003). Research has identified new sources of vulnerability for health care team members that contribute to such errors, namely, fatigue, repetitive crises, miscommunication, interruptions, and time pressures (Morath & Turnbull).

The impact of medical errors has a lasting consequence on patients, families, health care team members, and society as a whole. Increased costs in health care affect private businesses' ability to provide coverage to their employees. This results in the number of uninsured individuals continuing to rise exponentially each year (Institute of Medicine, 2001; Sage, 2003; Sidorov & Schlosberg, 2005), such that the costs associated with health care are becoming a vital part of political debates (DoBias, 2006). The factors affecting medical errors are discussed in detail in chapter 2.

Federal and local regulatory agencies, in conjunction with health care managers and leaders, have begun to shift the expectations and beliefs away from the normalized deviance of accepting that errors occur. As a part of this shift, theories prevalent in other industries have emerged in health care as best practice for studying other causative factors, including an examination of accident causation, human factors research, and crew resource management (Helmreich, 1999; Leonard, Graham, & Bonacum, 2004; Lyons, Adams, Woloshynowych, & Vincent, 2004; E. Thomas et al., 2000; Wiegmann & Shappell, 2003; Wilson, Harrison, Gibberd, & Hamilton, 1999). Major themes in human factors have evolved as viable ways to reduce the number of medical errors from reaching patients: (a) reduce reliance on memory, (b) improve information access, (c) use forced functions in computers, (d) standardize tasks, and (e) reduce the number of hand-offs (McClanahan, Goodwin, & Houser, 2000; Morath & Turnbull, 2005; Poniatowski, 2004; Reason, 1997).

The first step to increasing patient safety is to recognize the contributory dynamics behind error causation within an organization. This includes careful examination of the anatomy of an error, decision-making practices, and communication among health care team members, as well as system failures that lead to errors. This transfer of knowledge, both in differentiating system error versus human error, is fundamental to the development of a knowledge management process to improve patient safety in health care (Quinn & Anderson, 1996). Additional research must be directed to all aspects associated with medical errors, including NMs.

Purpose of the Study

The purpose of this study was to understand the role of intuitive decision making in preventing medical errors from reaching hospitalized patients. A primary focus in health care has been to examine the root cause of identified medical errors in order to initiate appropriate interventions and prevent future errors (Institute of Medicine, 2001; Joint Commission, 2007b; Kohn et al., 2000). What has been missing from this critical work is an analysis of what prevents medical errors from reaching hospitalized patients, in particular, the role of intuition (Henneman & Gawlinski, 2004).

Research Questions

The study was guided by the following research questions:

1. What role does the intuition of health care team members at this integrated West Coast health care system play in preventing medical errors from reaching hospitalized patients?

2. Do health care team members document constructs of intuition when identifying near misses as compared to adverse events on unusual occurrence reports?
3. Are there differences in the response to medical errors by health care team members who rate higher on the AIM Inventory at the three integrated West Coast hospitals?

Research Hypotheses

H_{01}: There is a difference in the mean intuitive scores of health care team members who submitted medication-related UORs.

H_{02}: There is a difference in the mean intuitive scores by gender of health care team members who submitted medication-related UORs.

H_{03}: There is a difference in the number of documented constructs of intuition for AEs versus NMs.

H_{04}: All the population means are equal in the low, medium, and high intuitive scores when comparing the age of health care team members who submitted UORs regarding medication errors.

H_{05}: There is a difference in the low, medium, and high intuitive scores by gender of health care team members who submitted UORs regarding medication errors.

Conceptual Support

The conceptual support for this study was based on four theories: (a) Reason's (1997) Swiss cheese model of defenses; (b) Jung's (1971) personality types describing

intuition; (c) Benner's (1984) adaptation of the Dreyfus model of skill acquisition, novice-to-expert, to understand the development of intuition; and (d) Welling's (2005) model of intuition. In discussing the general principles of human error, Reason (1997) presented two points of reference: human versus systems. Errors made by individuals result from factors such as absentmindedness, distraction, lack of knowledge, or fatigue. For example, an employee may be more prone to making mistakes at the end of six consecutive 12-hour shifts. System failures focus on conditions under which errors occur because of processes rather than individuals within an organization (Reason, 2000). Examples include look-alike and sound-alike medications being stored side-by-side, or having similar packaging for a paralytic and a stimulant medication.

In a perfect world, defenses are always intact and functional, permitting no breakthrough by potential accidents. As an example, the reader might imagine four separate pieces of intact cardboard, standing parallel and offset, acting as a barrier to stop or prevent medical errors from reaching patients. Those same four pieces of cardboard look like slices of Swiss cheese. The slices of cheese or the sizes of the holes can vary, just as daily situations shift or change; however, the presence of a hole in one layer does not dictate a bad outcome. Reason (1997) argued that accidents occur only when "the holes in many layers line up to permit a trajectory of accident opportunity" (p. 10). This explains why a health care team member could examine a process at different times and find a safe outcome one time and an AE the next time. On Monday, the Swiss cheese holes do not line up because barriers are in place and functional, yet on Tuesday, using

the same process, something shifts or changes, a barrier fails, the holes align the trajectory, and an adverse outcome occurs. Reason's Swiss cheese model is but one shift away from blaming the individual to understanding the roles of the system, the environment, and the individual in error causation.

Jung (1971) defined the concept of intuition through personality type. He proposed that intuition is a cognitive event rather than an occult gift or activity outside the individual. "In intuition, a content presents itself whole and complete, without our being able to explain or discover how this content came into existence" (Jung, p. 453). He also believed that all individuals have a primary orientation of either introversion or extroversion that is elated through the four primary mental functions of cognition, emotion, sensation, and intuition (as cited in Riso & Hudson, 1996). The differences between the four functions are that although thinking and feeling involve judgments, sensation and intuition do not. Intuition functions as the perception of possibilities, implications, often at the expense of details. The perceptions of intuition are often taken as fact, in much the same way as the person experiences sensations. The difference for Jung was that the perceptions are just that, and may not actually be truths. This important distinction is discussed in more detail later in this study.

What is missing from that explanation is the how intuition develops, that is, how one learns to recognize patterns and build mental models. Benner (1984) explained this development through her research in nursing that examined the concept of novice to expert. Observations of professionals have demonstrated that "knowledge is gained

through practice" (Merriam & Caffarella, 1999, p. 402). Benner's nursing theory of novice to expert was based on blending the individual's experience level with theoretical knowledge, gaining knowledge through practice. Her work supported Dreyfus and Dreyfus's (1986) assertion that "humans acquire skills through instruction and experience" versus leaping from "rule-guided *knowing that* to experience-based know-how" (p. 19). She described five levels in her model: novice, advanced beginner, competent, proficient, and expert. For example, the novice nurse, who has little experiential knowledge, may theoretically understand the etiology of a patient presenting with a pulmonary embolus but may miss the observational onset because of a lack of experience. The expert nurse, who has years of experience plus theoretical knowledge, is able to identify the signs and symptoms of pulmonary embolus earlier and intervene with appropriate action to prevent the patient's deterioration. From Benner's perspective, a novice nurse has not had sufficient experience to allow intuition to play a role.

Welling (2005) presented a five-phase model of intuition based on the central idea that intuition stems from pattern recognition, not from a source of knowledge. He commented, "When something is a known pattern, one experiences a feeling of recognition. When some perception is different from what one expects, one's attention is caught" (p. 24). He concluded that for intuition to be useful, the meaning of the perceptions has to be understood. Conversely, Gladwell (2005) referred to pattern recognition as thin slicing, meaning a person's unconscious mind "finding patterns in situations and behaviors based on very narrow slices of experience" (p. 23). In

psychology, the term thin slicing is used in the study of nonverbal behaviors (Ambady & Rosenthal, 1993); sales effectiveness (Ambady, Krabbenhoft, & Hogan, 2006); accuracy of judgments in sexual orientation (Ambady, Hallahan, & Conner, 1999); and negotiations (Curhan & Pentland, 2007).

Gladwell (2005) associated the term with intuition, that is, when the individual synthesizes didactic knowledge with real-world experience. Epstein (1999), however, classified this as having knowledge through experience, that is, in a "collection of information, intuition, and interpretations that guide professional practice" (p. 834). Klein (2003) supported Epstein's view that expertly applying intuition comes from meaningful experience or knowledge and allows the individual to "recognize patterns and build mental models" (p. 36).

Welling's (2005) model depicted the five phases or processes that a clinician uses in the cognitive function of pattern discovery and recognition. These concepts explained the basis of an individual's intuitive ability; how experience develops the ability; and the clinical processes used to reach an outcome, in the case of this study, to prevent medical errors from reaching hospitalized patients. He suggested that intuition should be considered a process that consists of sequenced phases with increasing amounts of information: detection, dichotomic awareness, related object, metaphorical solution, and explicit verbal understanding. Each phase has different modes of knowledge representation. This is where Welling diverged from Jung (1971), namely, in his understanding of perceptions versus information. Welling stated that "the amount of

information contained in the intuition increases from one phase to another, thus with each phase, the specificity of and discriminative potency of the intuition phenomenon increase" (p. 25).

The work of Benner (1984) as well as Dreyfus and Dreyfus (1986) established a framework to explain how an expert may be able to prevent a medical error from occurring through thin slicing, pattern recognition, or an intuitive sense. This accumulation of knowledge comes from experiences and observations over time until it forms what this researcher terms a discerned wisdom. Welling's (2005) model provides five sequential phases that map a health care team member's cognitive processes to reach an intuitive decision. Preventing an error from reaching a hospitalized patient means that precautions must be taken to ensure that the holes in the Swiss cheese do not align. Intuitive thinking may provide a clear explanation of what occurs when a health care team member recognizes an NM and thus adds new knowledge to patient safety.

Assumptions

Five assumptions come to mind when discussing medical errors and intuition. First, humans commit errors every day. A cultural norm for high-profile professionals within health care, such as physicians, is to focus on bad rather than peak performance (Alexandersson, 2003). It is the degree and severity of the error that causes concern.

Second, human error may be the result of circumstances beyond the control of an individual. In a clinical setting, system failures include such elements as similar packaging of different products, inconsistent labeling on equipment, risky procedures

without redundant safety precautions hard-wired into the process, or undifferentiated storage of look-alike and sound-alike medications (Institute for Safe Medication Practices, 2007; Joint Commission, 2006b; Morath & Turnbull, 2005).

Third, systems or processes that depend on perfect human performance are inherently flawed (Rasmussen, 1982; Reason, 1990; Whittingham, 2004). Therefore, if it is human nature to commit errors, and even though some errors may be the result of a system failure, the need arises to use all means possible to identify potential errors in order to avert a bad outcome. If intuition plays a role in preventing errors from reaching patients, this additional mechanism would aid the health care team member in keeping the patient safe.

Fourth, intuition is a universal phenomenon of human thought (Bastick, 1982; Myers, 2002). All humans can experience intuitive thought. However, certain events may preclude the individuals from the experience. Some may not be open to the idea, have not had sufficient experience, or may become too anxious in a given situation to make use of their intuitive skills. Finally, this study was undertaken with the assumptions that all of the participants would comprehend the content and answer the complete inventory honestly. In addition, the participants who were interviewed did so voluntarily in an effort to add to the body of extant knowledge.

Scope of the Study

The intent of this study was to examine the role of intuition in preventing medical errors from reaching hospitalized patients. This research incorporated analyzing

voluntarily submitted UORs by surveying and interviewing health care team members working in an integrated health care system on the West Coast. These individuals work around the clock to care for patients in an acute care environment, including medical, surgical, emergent, and obstetrical units; procedural areas; diagnostics; and therapeutic and clinical areas. Workloads can be demanding when life-and-death decisions are the primary focus. Rotating shifts, a lack of sleep, shifts with different health care team members, new knowledge requirements, and constant demands for the most current information about a patient's condition can lead to medical errors.

NMs and preventable AEs focused on medication errors documented in UORs come from multiple disciplines within health care. Generalizability of the findings may increase when examining the potential errors identified by all members of the health care team instead of limiting the responses to specific disciplines. Therefore, for the purposes of this study, the health care team members included physicians, nurses, pharmacists, respiratory therapists, students, residents, and diagnostic imaging personnel.

Because of the diversity of errors reported in treatment, equipment, or behavioral categories, the UORs selected for analysis were limited to medication-related errors only. Excluded from the study were unsigned medication-related UORs because of the inability of the researcher to identify the health care team members. Besides analyzing voluntarily submitted UORs related to medication errors, each health care team member was asked to complete a copy of the Agor Intuition Measurement Inventory (AIM Inventory; Agor, 1984) and to be interviewed about a time when the team member prevented an error from

reaching a hospitalized patient. The health care team members' competencies were not evaluated as a part of this study.

Limitations of the Study

There were three primary limitations in this study. First, the study excluded any exploration of known medical errors in adverse or sentinel events. The literature has reported an analysis of identified errors, causation factors, and trends (Joint Commission, 2007c). Second, because of the limited number of hospitals and participants, the data from this study may not be generalizable to a larger population. Third, the researcher acknowledged that the participants may not have been able to recall events accurately. The interviews were based on the participants' memories and perceptions of the self-reported UORs.

Definitions of Terms

Several terms are used by professionals within the health care system and by patient safety advocates when defining medical errors. The terms identified relevant to this study include the following:

Adverse events (AEs): Injuries caused by medical management rather than the underlying condition that reaches a patient (Biddle & Lahaye, 2003; Brennan et al., 2004; McCarter et al., 2003; Wilson et al., 1999). AEs may not be solely due to an error (e.g., the patient received the correct medication but responded differently than anticipated). AEs run a continuum of results ranging from no adverse outcome to increased length of stay, additional hospitalization, therapy, or transfer to a different level of care (Brennan et

al.). One type of AE is a sentinel event or "an unexpected occurrence involving death or serious physical or psychological injury" (¶ 2).

Agor Intuition Measurement Inventory (AIM): The AIM is a 22-question inventory designed to "identify an individual's present overall level of intuitive ability" (Agor, 1989, p. 1331). The inventory has been used to analyze executives' intuitive decision-making capabilities in industry and health care (Agor, 1986; Familoni, 2002; Janney, 1993; Whiting, 2005).

Error: A series of planned actions that fails to achieve a desired outcome (Fortune & Peters, 1995; Kirwan, 1994; Perrow, 1999; Proctor & Van Zandt, 1994; Quality Interagency Coordination Task Force, 2000; Reason, 1990; Whittingham, 2004). Errors can occur in systems, by individuals, or in combination.

Near miss (NM): This is a term associated with classifying a type of error, regardless of the potential outcome, that is stopped before creating a negative result for a system or a person. Reason (1997) defined an NM as "any event that could have had a bad consequence, but did not" (p. 118). In health care, a system or a person would translate to the patient. Health care literature has advocated for further research pertaining to the etiology of NMs could substantially improve patient safety efforts (Henneman & Gawlinski, 2004; Killen & Beyea, 2003; Quality Interagency Coordination Task Force; Rosenthal & Sutcliffe, 2002).

System errors: Errors that are determined not to be the result of an individual's actions, but rather the outcome of a series of actions and factors related to processes or

structures (Goldman, 2006; Quality Interagency Coordination Task Force). Systems encompass the work environment; human or machine interface; technology; or even a nonphysical system such as an organizational structure (e.g., an operational procedure or a workflow process).

Tacit knowledge: This type of knowledge is "personal, context-specific, and therefore hard to formalize and communicate" (Nonaka & Takeuchi, 1995, p. 59). It is the "intimation of something hidden," which an individual has yet to discover within the self (Prusak, 1997, p. 144). Tacit knowledge or intuition may become so embedded that the individual may not consciously be aware of the knowledge and, therefore, not attentive of the need to communicate with others.

Unusual occurrence report (UOR): Facility-specific documentation of potential or real events that occur during hospitalization. These voluntary reports are completed and submitted either via paper or electronically. Analyses of documented UORs provide information to managers for process improvements.

Significance and Social Change Implications of the Study

Medical errors occur daily in all types of health care arenas. The errors are not merely about statistics and numbers; rather, there are costly human factors that require closer examination. One such area is the human toll on patients and families who experience an unanticipated or an untoward event. Second are the costs associated with longer lengths of stay for hospitalization, increased levels of care, or in the rework and waste precipitated by system failures. Third are the related human capital costs of

identifying, intervening, and analyzing medical errors in order to prevent future occurrences.

The Institute of Medicine (2001) estimated that medical errors cost approximately $37.6 billion each year in this country, with $17 billion of those costs associated with preventable medical errors. The problem is not isolated to the United States. The Canadian Institute for Health Information reported “23,750 patient deaths per year, generating 1.1 million added days of hospitalization, and $750 million in extra health care spending” (as cited in Kondro, 2004, p. 2059). The Quality in Australian Health Care study reported “81,200 preventable deaths, 1.7 million temporary or permanent disabilities, with direct cost of $6 billion” (as cited in Siddins, 2002, p. 833). These iatrogenic injuries and medical errors affect existing fiscal resources and human capital. The time, money, and human resources could be spent ensuring accessibility to care for the greater population while continuing to care for existing patients. Finding ways to prevent medical errors is in the best interests of society as a whole.

Although self-imposed cultural norms imply that health care team members must be perfect all of the time, mistakes still happen. Individuals need to learn from others’ errors in nonthreatening ways. Creating an environment that fosters the oral tradition of storytelling is one such way. Snowden (1999) described how individuals acquire new information through “ultimately forming pictures in their minds” (p. 30). Understanding occurs when the individual links existing knowledge with new information. Davenport and Prusak (2000) furthered this idea; “Human beings learn best from stories” (p. 81).

The knowledge gleaned from interviewing health care team members about the role of intuition provided a nonthreatening way to talk about preventing errors.

This study provided an avenue to depict everyday experiences of health care team members in identifying common themes of intuition. Recording what up to this point has been considered tacit knowledge about preventing medical errors would be moving from socialization to internalization (knowledge creation) by documenting thin slices of experience (intuition or pattern recognition) of health care team members (Deikman, 1998; Gladwell, 2005; Nonaka & Takeuchi, 1995). In essence, obtaining and documenting this knowledge would move organizations into a knowledge-creating dimension and possibly serve as one component of disruptive innovation and social change in health care.

Summary

Finding ways to prevent medical errors from reaching patients plays an important role for society by lessening the human suffering and, ultimately, the cost associated with health care. Understanding the dynamics that influence health care team members in making daily decisions is one way of improving patient safety. Health care regulatory agencies and patient safety advocates have focused on improving patient safety through recognition, error reporting, root cause analysis, and publicized trended descriptions of medical errors. Chapter 1 introduced the purpose and background of the proposed research including the theoretical basis and study design. Chapter 2 includes the review of literature pertaining to medical errors, human factors, cognitive learning, and intuition.

Medical errors were defined as including action for error reduction and barriers to creating a safe environment. The subject matter included adult learning, decision making, and the constructs of intuition. A model of intuition taken from psychotherapy was presented. Chapter 3 describes the quantitative and qualitative approaches to the data collection and analysis processes. The results of the research are presented in chapter 4. In chapter 5, conclusion, interpretations, and recommendations are reported based on the results of the research.

CHAPTER 2: LITERATURE REVIEW

Introduction

Intuition is not easily defined (Heath, 1998; Jacobs, 1998; McCutcheon & Pincombe, 2001; Welling, 2005). Various professionals dismiss the idea of intuition as being unscientific and lacking an evidence base (English, 1993). Intuition is difficult to describe because it appears on the surface as unquantifiable. Faugier (2005) offered that intuition is neither "mysterious nor irrational, rather something to be valued as the result of learned experiences as an expert" (p. 14).

In this chapter, the concepts of cognition, knowledge acquisition, adult learning, and critical thinking provide a foundation to clarify the dynamics and significance of intuition. A model of intuition from psychotherapy provides further explanation (Welling, 2005). Included is a review of intuition and gender. The primary database used in this review of the literature was EBSCO and included searches from health care, nursing, medicine, psychiatry, business, and sociology. Additional sources included books from the researcher's private library. Keyword searches included medical errors, NMs, adverse patient outcomes, sentinel events, patient safety, error reduction, system errors, culture of safety, medical error prevention, knowledge management, intuition, pattern recognition, tacit knowledge, gender related to intuition, communication, human factors, personality traits, decision-making, adult learning, novice to expert, thin slicing, cognition, and knowledge transfer. The second half of the chapter is a review of the components found

in medical errors, such as classification, human versus system errors, and a comparison of error perceptions from various industries.

Intuition

Intuition is a method of processing information that differs from rational or analytical processing (Dane & Pratt, 2007; Hall, 2002; Hogarth, 2005; Kahneman, 2003; Kline, 2005; Osbeck, 1999; Phillips, Klein, & Sieck, 2004). Jung's theory of psychological types embedded intuition as part of personality rather than knowledge; intuition was simply a "given function of humans," embedded in perceptions rather than details (as cited in Westcott, 1968, p. 186). Polanyi (1966) viewed human knowledge beginning with the idea that "we can know more than we can tell," as held in Gestalt psychology (pp. 5-6). The major difference between Gestalt psychology and Polanyi's perspective is that the former viewed tacit knowledge as an impression from the retina or the brain whereas Polanyi viewed tacit knowledge as physiological thought.

Bastick (1982) wrote that the mental activities involved in intuitive processes are common whenever situations are too complex for logical analysis. He observed differences between high-intuitive versus low-intuitive individuals. "High-intuitive types, because of their confidence in the intuitive process, are prepared to take risks by providing answers based on information insufficient for analytic solutions. In contrast, low-intuitive types lack this confidence and demand additional information" in similar situations (Bastick, p. 168). These differences become apparent when individuals in a group session try to brainstorm or problem solve.

A study of intuition and managerial decision making recognized that the rate at which the participants processed information influenced decision making (Dane & Pratt, 2007). The researchers defined intuition as an "inborn ability to synthesize information quickly and effectively" (p. 33). This is supported by the theory of unconscious thought, which states that unconscious and conscious thoughts have different characteristics, making each mode preferable under different circumstances (Dijksterhuis, 2006). For example, decisions made about straightforward, uncomplicated issues are processed by conscious thought, whereas complex matters are managed with unconscious thought. Sinclair and Ashkanasy (2005) described intuition as similar to assembling a jigsaw puzzle. They described the process as a "non-conscious scanning of internal or memory and external environmental resources in a non-logical, non-temporal manner in order to identify relevant pieces of information that are fitted into the 'solution picture' in a seemingly haphazard way" (p. 357).

A second study regarding intuition and decision making proposed that "decisions often require the integration of intuition; the first answer that springs to mind when one is required to make a decision," despite contradictive information (Simmons & Nelson, 2006, p. 409). Simmons and Nelson studied predictions and point spread, finding that the participants predicted intuitive options, or favorites, more often than equally valid non-intuitive alternatives or underdogs. Researchers have explained this dual processing in the context that individuals are either unmotivated (Cacioppo & Petty, 1982) or unable because they are cognitively overloaded (Gilbert, Pelham, & Krull, 1988) to process fully

applicable information. This inability to process applicable information, in part, explains why someone who is physically or cognitively busy relies on processing relevant information to make decisions by internal intuition. The inability to process differs from Gladwell's (2005) notion of thin slicing, which relies on pattern recognition as the explanation for intuitive decisions.

Epstein (1999) explained the role of intuition in daily practice for health care team members in a different way. He proposed that health care team members use a variety of means to enhance individual ability through "moment-to-moment self-monitoring, bring to consciousness their tacit personal knowledge and deeply held values, use peripheral vision and subsidiary awareness to become aware of new information and perspectives, and adopt curiosity in both ordinary and novel situations" (p. 833). He believed that this mindfulness could be cultivated through role modeling versus explicit knowledge. Perhaps it is this collection of mindfulness, a gathering of explicit and tacit knowledge, which allows a member of the health care team to prevent a medical error from reaching a patient.

Pattern Recognition

Constructivist theory maintains that learners build new knowledge based on existing knowledge (Askell-Williams & Lawson, 2006). Smolensky (1988) expanded on this assertion to suggest, "An individual's ability to learn evolves from specialized neural connections between a repertoire of potentially required responses and familiar patterns or pattern recognition" (p. 9). Benner and Tanner (1987) defined key elements associated

with intuition for nurses as “pattern recognition, similarity recognition, common sense understanding, skilled ‘know-how,’ a sense of salience, and deliberative rationality” (pp. 15-16).

Klein (2001) described intuition as “dependent on the use of experience to recognize key patterns that indicate the dynamics of a situation” (p. 31). In his research, Klein noted that because patterns can be elusive, people often have difficulty recognizing or describing the pattern. This inability causes people to dismiss the notion of intuition because it appears discordant. Intuition does become somewhat difficult to describe because it appears on the surface as unquantifiable. This may explain why a health care team member might miss a pattern presented in a patient situation. Faugier (2005) supported Benner’s (1984) ideas that intuition is neither “mysterious nor irrational, rather something to be valued as the result of learned experiences as an expert” (p. 14).

Effken (2000) speculated that instead of viewing intuition as merely a cognitive process or perception, one should consider taking a more comprehensive look at all of the factors involved. From a health care perspective, she suggested taking into account three perspectives: (a) cognitive process or perception, (b) information provided by the patient or person involved, and (c) context of care. She paired this three-prong approach with an ecological method of cognitive sciences, which described intuition as direct perception (Hsieh, 1995; Sutherland, 2000).

Zhang and Patel (2006) used the example of symbols to clarify Gibson’s (1979) theory. Symbols are arbitrary; however, once a symbol has an assigned meaning, the

information becomes easily transferable to others. A black sign with skull and crossbones signifies something dangerous; a dollar sign references money. In Gibson's argument, information as well as perception goes into forming an intuitive sense of a situation. This becomes measurable in the ability to quantify information from a patient and within the context of care. Effken (2000) proposed that by examining the three components of perception, information, and context, intuition could become measurable and therefore valid. The intuitive perception shifts from arbitrary into quantifiable information. Viewed as such, intuition is information based and legitimate, providing a plausible explanation for what occurs with an NM.

Gladwell (2005) asserted a different explanation of intuition. Gladwell saw intuition as part of the cognitive progression that occurs quicker than a methodical analytical process. He portrayed intuition as rapid cognition, or thin slicing, which is the mind's ability to "find patterns in situations and behavior based on very narrow slices of experience" (p. 23). This explanation supported the early work of Bastick (1982), who believed that intuition occurs more rapidly than analytical processing. Gladwell, in part, based the notion of thin slicing on the work of Carrère and Gottman (1999) , psychologists who could predict, with 95% accuracy, whether a couple will remain married by observing the "first [3] minutes of a marital conflict discussion" (p. 293). The researchers developed a predictive model by identifying patterns of behavior. A second example comes from Gosling, a social psychologist, who used pattern recognition to

demonstrate personality traits by observing the inhabitants of dormitory rooms (as cited in Gosling, Ko, Mannarelli, & Morris, 2002).

One example that Gladwell (1995) described came from a study in which the participants had four decks of cards (two blue decks and two red decks) and $2,000 in "fake" dollars, with the instructions to win the most amount of money (Bechara & Damasio, 1997, p. 1293). The participants, who were monitored by observation and electrical recording, received a monetary reward for turning over a card from the blue deck ($100) or a card from the red deck ($50). However, there were penalties embedded in each deck. The blue decks had twice the number of penalties. Overall, the safer way to meet the objective of winning as much money as possible was by turning over cards in the two red decks. The researcher discovered that the participants had to turn over an average of 40 cards to come to the logical, analytical decision that turning over more red cards achieved the goal of obtaining more money. However, in monitoring the participants' responses via electrical connections, the researchers found that the participants "knew" within the first 10 cards which decks held fewer opportunities. The researchers were able to document thin slicing, or finding patterns in situations and behavior, based on narrow slices of experiences by the participants. Welling (2005) used this same idea in his model of intuition.

Intuition and Gender

There is debate in the literature whether gender predominance plays a role in intuition (Belenky, Clinchy, Goldberger, & Tarule, 1997; Cappon, 1993; Dreyfus &

Dreyfus, 1986; Effken, 2000). Traditional thinking has posited that analytical thought is masculine and intuition is feminine thinking (Dreyfus & Dreyfus; Faugier, 2005). Intuition is a fundamental aspect of nursing expertise (Benner, 1984; Benner, Tanner, & Chesla, 1992; Tanner, 2006).

Cappon (1993) studied multiple aspects of intuition in 3,000 patients and concluded that females were not necessarily more or less intuitive than males. Rather, he asserted, Western society, dominated by males and science, "came to distrust intuition" (p. 42). Myers (2002) noted that "the gender gap can be easily overstated; some men are more empathic and sensitive than the average woman…women more often base knowledge on intuitive and personal grounds" (p. 46).

Hayes cautioned against "asserting that certain attributes or qualities of women's learning are innate, fixed, and uniform across situations rather than integrally connected to a particular set of situation, social, and historical circumstances" (as cited in Hayes, Flannery, Brooks, Tisdell, & Hugo, 2002, p. 218). The researchers warned that studying one gender's learning styles implicitly places that gender apart as different and infers an opposite approach that may not exist. Regardless of gender, adults learn across a spectrum. The concern is in focusing on the inclusiveness of one gender and the immediacy to assume differences. Hayes et al. suggested instead that learning should be reliant upon tracing the patterns of an individual's leaning to sources in the system of gender relations rather than identifying precedent of differences between males and females.

A Model of Intuition

Welling (2005) described intuition as a process with distinct phases of intuitive knowledge representation that forms a sequential increase of information and knowledge from one phase to another: (a) detection, (b) dichotomic awareness, (c) related object, (d) metaphorical solution, and (e) explicit verbal understanding. He used the five phases to explain intuition based on the cognitive functions of "pattern discovery and recognition" (p. 43). He proposed that intuition should provide psychotherapists and other professionals with the means to go beyond theory-driven activity.

The first phase, or the detection phase, involves "a sign of something dawning in consciousness" (Welling, 2005, p. 25). Something triggers a nagging suspicion or warning to an individual, like listening to an inner voice. Keirsey (1998) described this as "internal attention, introspection, or internalization" (p. 332). The second phase is the dichotomic awareness phase. For psychotherapy, Welling viewed this as a "pregestaltic experience," such as a lost thought or an awareness that emerges in the consciousness (p. 25). Health care team members have described this as "something not being right" or "missing something" (DeMott, 1995; Perry, 2000). Nurses have described this as knowing something is wrong with the patient, even when "on paper," the patient shows no abnormalities or areas of concern (DeMott; McCormack, 1993; McKinnon, 2005; Ruth-Sahd & Hendy, 2005).

The third phase, termed the related-objects phase, occurs when an individual is able to identify objects related to the feeling of intuition (Welling, 2005). In the second

phase, the health care team member feels that something is wrong with the related object, which in this case is the patient's condition, and yet may not be able to articulate the exact cause. Coombes (2005) described this as knowing "what has happened before you know why" (p. 9). This phase may leave the health care team member feeling incongruent when a discrepancy arises between the verbal and nonverbal responses of the patient: The actions do not match the words.

The fourth phase, or metaphorical solution phase, occurs when the health care team member is able to identify such pertinent elements as similes, words, or feelings (Welling, 2005). For psychotherapists, Welling described this phase as being able to perceive the gestalt of the patient situation, even thought the overt meaning may not yet be fully understood. Schön (1983) depicted this as knowing in action, which is the accumulation of experiences built over time. For Benner (1984), this represented one competent of being an expert nurse.

The final phase is the explicit verbal understanding phase, which occurs when the meaning of the intuition becomes clear to the health care team member. The nagging suspicion, pregestaltic experience, dichotomic awareness, thin slicing, or pattern recognition coalesce to allow the health care team member to be able to verbalize awareness or take action (Ambady, 1991; Benner, 1984; Benner & Tanner, 1987; Gladwell, 2005; McCormack, 1992; Perry, 2000; Smolensky, 1988; Welling, 2005). Welling's approach in depicting intuition as a sequential increase of information and knowledge may provide the basis to demonstrate empirically what occurs when a health

care team member prevents a medical error from reaching a hospitalized patient. At first, something appears discordant to an individual health care team member. With increasing information, this elusive something continues to cultivate, finally rising to the individual's conscious awareness. At this point, feelings arise that often turn into explicit verbal understanding. The health care team member takes actions to stop or prevent a medical error. In Reason's (1997) view, the health care team member prevents the trajectory from aligning, thus preventing the medical error from reaching the patient.

Cognition and Learning

Health care team members assess, reassess, and make critical decisions continuously as a patient's condition changes. This continual input of data, information, and results provides the basis for new knowledge and learning. Cognition is the mental processes involved in "transforming stimulation from a physical source to a representation of reality that will guide behavior" (Rosser, 1994, p. 2). More simply stated cognition is the way people think (Crandall, Klein, & Hoffman, 2006).

A basic overview of the process of cognition includes understanding the acquisition, storage, and use of knowledge, including awareness, perception, reasoning, memory, and judgment (Benson, 1994; Crandall et al., 2006; Matlin, 2002; Reed, 2000). The human brain makes associations with words, actions, deeds, and thoughts through content or context. "Every piece of new knowledge that is acquired is assigned its proper place in the taxonomies of previous knowledge and provides direction for the addition of new increments of knowledge" (Erlandson, Harris, Skipper, & Allen, 1993, p. 20).

Memories are stronger when presented in a variety of stimuli. The greatest recall occurs when multiple sensory experiences, for example, vision, hearing, sound, smell, movement, or relationships, encode a memory.

One approach (Cader, Campbell, & Watson, 2005; Hammond, 1984) described three dimensions associated with cognition: (a) analysis, (b) intuition, and (c) quasirationality. Analysis is an organized, deliberate, and systematic process. There is high cognitive control evidenced through detailed logical data processing and conscious awareness. In comparison, intuition is a rapid and unconscious manner of processing events or data. Hammond presented this second dimension, the antithesis of analysis, as involving low cognitive control, with rapid, disorganized data processing. As mentioned previously, Gladwell (2005) referred to this as thin slicing, or pattern recognition. The third area, quasirationality, is a combination of analysis and intuition. This is the "ah-ha" moment when an idea or a concept seemingly clicks or surfaces to conscious thought. The combination of Hammond's intuition and quasirationality may explain what triggers a health care team member to prevent a medical error from reaching a patient.

Nature of Learning

One way to conceptualize how individuals learn has been through a classification of cognitive processes. Bloom (1956) articulated a model of intellectual behavior in learning that portrays a conventional way of visualizing how students learn. He based his model on six competencies: (a) knowledge, (b) comprehension, (c) application,

(d) analysis, (e) synthesis, and (f) evaluation. From those competencies, Bloom worked with other educators to identify three domains of learning: cognitive, affective, and psychomotor (Caffarella, 2002; Clark, 1999; Donald, 2002).

The cognitive domain refers to the mental skills or knowledge the individual acquires through observation, mastery of subject matter, problem solving, pattern recognition, drawing of conclusions, and interpretation of new information that incorporates a combination of Bloom's (1956) competencies. However, missing from this single domain is the ability to explain how a person internalizes emotional components such as values and feelings or deals with physical movement such as psychomotor skills.

The affective domain categorizes how an individual deals with emotional content, such as feelings, values, motivation, or attitudes. Krathwohl, Bloom, and Masia (1964) developed an affective domain that orders learning by the principles of internalization: (a) receiving, (b) responding, (c) valuing, (d) organizing, and (e) internalizing values. Internalization refers to the process whereby a person's view toward an object shifts from a broad understanding to a point where the affect consistently guides or controls the person's behavior (Seels & Glasgow, 1997). This, in combination with the cognitive domain, acknowledges pattern recognition, or the intuitive part of learning. The third domain includes physical movement or psychomotor skills: (a) perception, (b) mindsets, (c) guided response, (d) mechanism, (e) complex over response, (f) adaptation, and (g) origination (Clark, 1999).

These models traditionally have appeared in educational arenas. However, the work is applicable to health care by providing a framework for understanding how individuals internalize tacit or explicit knowledge. When trying to visualize how an individual who is an expert in health care recognizes a near-miss situation, the models provide a systematic approach to demonstrate the differences in thinking between novice and expert. This model provides invaluable information to educators and managers in developing new employees or students as well as explaining how health care providers think about medical errors, including NMs, preventable AEs, or sentinel events.

There has been an emergence in business circles that a practical way to enhance company practice is by reinfusing expert content back into the organization (Davenport & Prusak, 2000; Nonaka & Takeuchi, 1995). This reinfusion takes place by managing the existing employees' intellect and converting it to valuable information. Quinn and Anderson (1996) described a professional as having a "distinct body of knowledge" that includes "cognitive knowledge or know-what, advanced skills or expertise termed know-how, systems understanding or know-why, and self-motivated creativity termed care-why" (p. 71).

Quinn and Anderson (1996) defined cognitive knowledge, or know-what, as the mastery of basics within a discipline. Benner (1984) defined this as a novice nurse or someone who could articulate assessment skills, laboratory values, and disease-based protocols. However, fundamental entry-level of skills, although essential for a nurse, is insufficient on its own.

Advanced skills, or expertise, include the ability of the health care team member to "apply the rules of a discipline to complex real-world problems" (Quinn & Anderson, 1996, p. 71). This is a secondary stage for the health care team member, when the individual is able to incorporate the theoretical concepts with tangible experience. For many organizations, this becomes the highest expectation of the employee. In Benner's (1984) model, this would be a competent nurse.

If the health care team member is able to combine cognitive knowledge with concrete experiences and move to understanding the "cause-and-effect relationships" in a discipline, then the individual can proceed to the "know-why" level (Quinn & Anderson, 1996, p. 71). This is an expert in Benner's (1984) model. This is when the nurse is able to filter or anticipate subtle interactions or unintended consequences.

The fourth level encompasses the self-motivated, creative nurse who is continually striving for improvement. This individual is testing personal and professional limits in an effort to find a better way of achieving a defined outcome. Nonaka and Takeuchi (1995) presented the foundational work on knowledge creation in organizations. For the Japanese, "knowledge means wisdom that is acquired from the perspective of the entire personality" and places emphasis on "subjective knowledge in combination with intuitive intelligence" (Nonaka & Takeuchi, p. 29). The researchers believed that knowledge creation lay in the use and transfer of tacit, or intuitive, knowledge.

Organizations that learn to nurture self-motivated, *care-why* individuals or teams are able to infuse that knowledge, expertise, and drive for excellence into the organization. The idea is similar to placing a patient who feels faint in a supine position with the legs above the level of the heart. This position acts as an internal blood transfusion, quickly returning the blood back to the heart. Organizations that nurture self-motivated and creative individuals are, in essence, giving the organization an internal blood transfusion by returning expert knowledge back into the organization.

If intuition were really only pattern recognition and learning from experiences, only experts on the health care team would be able to prevent a medical error from reaching a patient. The focus then turns to the role of adult learning.

Adult Learning

Three pertinent theories regarding adult learning include behaviorism, cognitivism, and constructivism. Behaviorism emphasizes the relationship between stimulus and response. Cognitivism examines the mental processes of learning. Constructivism proposes that adults construct new knowledge based on current and past experiences.

Knowles, Holton, and Swanson (1998) outlined six areas pertaining to adult learning in the andragogical model. Those areas specify that the learner needs to understand why and have a self-concept, previous experience, a readiness to learn, an orientation to learning, and internal motivation. These concepts supported the belief that a

decisive factor influencing learning is what the learner already knows (Merriam & Caffarella, 1999; Novak & Gowin, 1984).

Constructivism stems from the understanding that learning is what happens to a human being because of experience. It is the pattern recognition from these experiences that provides a new base of learning for the individual. Changes in behavior are simply evidence that learning has occurred. Benner's (1984) nursing theory of novice to expert is an example of constructivism.

Schön (1983) described a "reflective practitioner" as one who makes countless judgments of quality without being able to describe the criteria, or who displays skills minus the ability to depict the rules or procedures (p. 50). This is what Polanyi (1966) depicted as tacit knowledge, that is, the quality of just knowing. Schön proposed that health care team members are dependent upon skillful performance, tacit recognition, and personal judgments, even in the face of evidenced-based research. The new base of learning provides more meaning and substance because the knowledge has moved for the individual from being theoretical to real. This learning becomes the joining of theoretical knowledge with life experiences and, therefore, changes the individual's perspective.

Mezirow and Associates (2000) followed a corresponding path to Schön's (1983) work in categorizing adult learning into three areas of gaining: (a) technical knowledge (instrumental), (b) practical knowledge, and (c) emancipatory (self-knowledge). This categorization supported Benner's (1984) model of novice to expert. From these actions, Mezirow and Associates theorized that individuals create structure or make meaning

from experiences based on centrality of experience, critical reflection, and rational discourse. The theory is applicable in explaining the educational process in health care, namely, the blending of technical knowledge (i.e., didactic information) with practical knowledge (i.e., clinical experience) that leads to emancipatory knowledge (i.e., of the individual). The researchers took these beliefs and began forming a concept called transformative learning, a way for the individual to change a frame of reference.

Mezirow and Associates (2000) believed that humans have an urgent need to understand and order the meaning of events by integrating experience with existing knowledge in an effort to avoid chaos. The researchers observed that humans are in a constant struggle to negotiate conflicting experiences and information. An example would be a new nurse or intern describing a growing concern over a patient's condition in the absence of clinical data. Individuals often utilize reflection to try to make sense of an experience. Mezirow (1991) differentiated reflection from learning as "the process of critically assessing the content, process, or premise of in an effort to interpret and give meaning to an experience" (p. 104). He distinguished three levels of reflection.

First, content reflection occurs when an individual has pondered the gist or description of a problem. Second, process reflection involves thinking about the strategies used to solve the problem rather than the content of the problem itself, which is an orderly progression of reflection that does not incorporate intuition. This is similar to Dewey's beliefs that a problem is solved when the individual feels that it has been solved (as cited in King & Kitchener, 1994). Finally, a premise reflection leads the individual to

question the relevance of the problem itself, as well as the assumptions, beliefs, or values underlying the problem. This process is distinct from problem solving and can lead to transformative learning, which distinguishes an expert from a novice (Mezirow & Associates, 2000).

Minick and Harvey (2003) found an example of Mezirow and Associates' (2000) theory of reflection and transformative learning in a study where the researchers examined early recognition of patient problems among nurses. Sixteen medical/surgical nurses employed in an urban southern hospital described a patient-care experience in which the nurses felt that they had made a difference. Three themes describing ways of knowing that enabled early recognition emerged from the study: (a) knowing the patient directly, (b) knowing the patient through the family, and (c) knowing that something is not as expected (Minick & Harvey). From a clinical perspective, these themes appeared logical. In each of the cases described by the participants, the nurses gained valuable experience from previous interactions with either the patients and/or family members. Those prior experiences led to better patient care because the nurses were able to intercede on their patients' behalf before problems arose. The nurses were able to process critical information in order to interpret and give meaning to an experience. Nurses who were not familiar with the patients might have missed the early warning signs, and the patients' condition would have deteriorated.

Situated Learning

Situated learning is the study of working intelligence or the creation of practical knowledge (Rogoff & Gardner, 1984). The advocates of situated learning have argued that learning occurs as a function of the activity or context that it occurs, unintentionally, and through collaboration (Lave & Wenger, 1991; Rogoff & Lave, 1999), that is, in a social environment (Hansman, 2001). This is one explanation of how pattern recognition begins and develops for health care team members.

Critical Thinking

There is a tendency for "individual disciplines to believe their own decision-making process as unique" (Buckingham & Adams, 2000, p. 981). When applying the taxonomy of learning, it becomes apparent that there are no differences in the actual cognitive aspects of various disciplines, only in the content. This raises the question of whether there are two forms of critical thinking underlying the decision making of most disciplines: analytical and intuitive (Cader et al., 2005; Hammond, 1984; Thompson, 2003). This became a central premise in the study for examining the role of intuition in a health care team member's identification of NMs.

Critical thinking involves multiple processes occurring simultaneously. The process involves the ability to recognize the existence of a problem and obtain additional information or data to assist in concluding whether acceptable evidence is available to form a judgment (Brookfield, 1987; King & Kitchener, 1994). Traditional thinking views physicians as making analytical and empirically based decisions, compared to nurses'

decisions being seen as tacit, feminine, and emotional (Buckingham & Adams, 2000). The question that arises is whether there are there differences or similarities between the cognitive processes of different disciplines in the identification of NMs associated with medical errors. This study will examine the participants' responses based on gender as well as educational preparation.

Decision Making

Defining decision making can quickly become a quagmire. Judging a decision as good or bad at a point in time for medicine is difficult because clinical decisions often have multiple dynamic variables that are constantly changing. A decision made using available information may still have an undesirable outcome purely because of probabilistic factors, insufficient data, rapidly changing physiological conditions, or expertise of the primary person making the decision (Buckingham & Adams, 2000). For example, "approximately 35% of heart attacks in women are believed to go unnoticed or unreported" (Giardina, 2000, p. 350). Research has demonstrated that women do not always present with the classic symptoms of acute myocardial infarction, that is, crushing, substernal, left-sided chest pain. A 60-year-old female could present in a physician's office with symptoms of fatigue, general malaise, or 'achy-ness' and, in fact, have elevated cardiac enzymes with an abnormal electrocardiogram indicative of an evolving acute myocardial infarction. The physician may have made a decision based on insufficient data. The symptoms presented mimicked flu-like symptoms, not myocardial

infarction, resulting in an absence of ordered laboratory studies of cardiac enzymes, monitoring for arrhythmias, and potential fatal misdiagnosis.

Klein (2001) presented "naturalistic decision making" (NDM), or the study of how individuals use experiences to make decisions in the field or in clinical settings (p. 4). After years of observing firefighters, Klein described the differences between analytical sources of power, such as deductive logical, analysis of probabilities, and statistical models versus NDM found in intuition or metaphors and storytelling. One example of analytical sources of power is the decisions made in clinical trials. Klein differentiated NDM processes as what occurs in the field. Would NDM be part of the process involved when a health care team member identifies an NM? Would this individual use more analytical properties rather than intuition to prevent a medical error?

As one example, Crandall and Getchell-Reiter (1993) elicited knowledge from expert neonatal intensive care nurses on sepsis, a common malady in neonates. The initial study detailed precise features solicited from expert nurses regarding the assessment and care of critically ill infants. The NDM methodology allowed the researchers to abstract nine additional indicators from the nurses: "The increase in the total number of indicators reported in initial versus probed accounts was highly significant ($t = 14.18$, $p < .001$)" (p. 45). These nine additional indicators formulated a training guide developed for novice nurses orienting to a neonatal intensive care unit. The recognition, abstraction, and collection of expert awareness are examples of valuing human capital (Liebowitz & Wright, 1999). Reclaiming and documenting expert tacit knowledge in order to reframe

the information for others in the field to make use of is the essence of knowledge management (Davenport & Prusak, 2000; Fuller, 2002; McElroy, 2003; Quinn, Anderson, & Finkelstein, 1998). This study will similarly examine the evidence of additional indicators for preventing medical errors.

The first part of chapter 2 demonstrated several concepts regarding intuition. First, intuition is a non-gender-specific cognitive process that emerges from experiences and takes time to develop. Intuition comes from learning, that is, pattern recognition, and ultimately can influence critical thinking, which shapes decision making. A model of intuition provides one way to quantify the concept. The next section provides an overview of existing knowledge regarding human versus system error. The question becomes one of determining how to apply the concepts in health care.

Medical Errors

The literature provides a frame of reference with an annual estimation of injury to patients (Kohn et al., 2000). When considering all types of medical errors, "a hospital patient can expect, on average, to be subjected to more than one medication error each day of hospitalization" (Institute of Medicine, 2006, p. 4). Addressing the problem of human error requires more than classifying human failings or limitations. Understanding human errors requires examining the cause and effect as well as the tasks associated with the error (Hobbs & Williamson, 2002).

Skill-, Rule-, and Knowledge-Based Domains

Rasmussen (1982) delineated levels of behaviors involving human error as skill-, rule-, and knowledge-based performance (see Appendix A). Skill-based domains include automated, subconscious routines seen as "performance that is controlled by stored patterns of behaviors in a time-space domain" (Rasmussen, 1982, p. 316). Errors in the skill-based domain are "errors of action" (Biddle & Lahaye, 2003, p. 68). Errors are associated with mechanisms such as wrong classification or recognition of situations, erroneous associations to tasks, or memory slips in procedural recall (Johannsen, 1988; Rasmussen, 1999; Reason, 1990; Whittingham, 2004).

An example of a skill-based domain would be the mechanical process of driving a car. An experienced driver thinks nothing of starting a car, changing gears, or braking because the processes have become automated steps in a frequently repeated practice. For example, an error of omission from inattention occurs when a driver fails to signal before making a turn. To quantify skill-based errors, Whittingham (2004) turned to the work of Hannaman and Spurgin in determining average error probabilities under defined conditions. The application of Hannaman and Spurgin's work, namely, the systematic human action reliability procedure, or SHARP, to skill-based rules errors would yield a rate of "one error in 20,000 tasks" (as cited in Whittingham, p. 16).

In comparison, rule-based behavior pertains to retained relevant rules. This is a more complex or less familiar task than those using skill-based behaviors. Rule-based errors occur when someone (a) applies a wrong rule in a particular situation, or

(b) misapplies a good rule redundantly. Comparatively, error probability for rule-based behavior would be on average “one error in 2,000 tasks” (Whittingham, 2004, p. 16).

An example of a rule-based error in health care would be the application of a two-part identifier for medication administration. The rule in a fundamental way makes sense. A health care team member uses two separate patient identifiers prior to medication administration for hospitalized patients. The two identifiers could include the patient’s name and date of birth. At face value, this process seems to be a pragmatic approach to preventing wrong medication administration. However, the rigidity and redundancy of the rule when applied to a nurse asking the same patient in one consistent 8-, 10-, 12-, or 16-hour shift in which neither the patient’s name or date of birth changes, can lead to a rule-based performance error when the nurse skips the rule and administers a medication to the wrong patient. Helmreich (2000) categorized this as a procedural error whose intention is correct but execution is flawed. In contrast, Reason (1990) called this an execution failure.

In health care, an example of rule-based behavior would be a nurse adhering to the procedural requirements for a two-person verification of blood products before administering to a patient. National standards require strict adherence to procedural double checks (New York State Department of Health, 2004). This process begins with the phlebotomist drawing a sample of the patient’s blood to type and cross match through two licensed personnel, both verifying a patient by name, date of birth, and blood type

before administering a blood product. A nurse failing to follow national standards and organizational procedure would demonstrate a rule-based error.

Knowledge-based behavior is adopted when a completely novel situation is presented for which no stored rules, written or otherwise, exists, but which requires that a plan of action be formulated (Biddle & Lahaye, 2003; Reason, 1990). By comparison, error probability for knowledge-based behavior is on average "one error in 200 tasks" (Whittingham, 2004, p. 17). Helmreich (1999) categorized this as an operational decision error, in which an individual or a group makes discretionary decisions that unnecessarily increase risk. Differences among the three areas appear in Appendix B.

Slips, Lapses, and Mistakes

In his study of human error, Reason (1990) explained aberrancies in mental functioning leading to errors based on skill-, rule-, or knowledge-based behaviors as slips, lapses, and mistakes. Slips and lapses occur with interrupted automatic behavior, lack of attention, or an execution failure (Norman, 1988; Rasmussen, 1982; Reason, 1990). Mistakes result from conscious deliberations. Mistakes are rule- or knowledge-based errors that "involve a decision resulting in action or lack of action" (Kennedy, 2004, p. 117). Reason (1997) viewed mistakes as the result of planning failures. The causal taxonomy begins to focus on identifying the root cause associated with the error (Reason, 1997).

Reason (2000) viewed errors as stemming from one of two sources: personal or system failure. In the personal or human approach, errors occur because of anomalous

mental processes, such as forgetfulness, carelessness, lack of motivation, or lack of attention to detail. The natural actions applied to these types of errors, Reason observed, are the traditional managerial responses such as disciplinary measures; writing of a policy/procedure; additional training; and threat of litigation, blaming, or shaming. In health care, errors lead not only to harmful consequences experienced by patient and health care team member but also to additional expenditures because of complications (Brennan et al., 2004; McCarter et al., 2003).

In the system failure approach, the fundamental assertion that humans are fallible and errors are to be expected is seen as the normative deviance current in health care. "Errors are seen as consequences rather than causes, having their origins not so much in the perversity of human nature as in the upstream systematic factors" (Reason, 2000, p. 768). Countermeasures would look at changing the system to prevent further errors by using tools such as failure mode effects criticality and analysis, process mapping, and Kaizen or Lean thinking (Womack & Jones, 2003).

Whittingham (2004) made a valid point regarding human error, "It needs to be understood that even with the best possible systems in place, human error will never be entirely eliminated" (p. 9). He argued that there would always be some level of unpredictable error. Therefore, this becomes fundamentally imperative that error proofing take place in planning new applications, systems, or processes to reduce the risk of error to a tolerable level when evaluated against the benefits of the activity (Perrow, 1999; Whittingham).

Taxonomy of Error Types

Reason (1990) proposed that composition, intent, and delineation form the framework for understanding the anatomy of an error. First, the composition of an error contains three components: (a) the nature of the task and the ensuing environmental conditions, (b) the mechanisms governing performance, and (c) the disposition of the individual involved in the error (Reason). Compare the following scenarios. In the first scenario, a surgeon prepares for the first case of the day, namely, the insertion of a dual-lumen catheter for antineoplastic administration, in a familiar surgical setting representing the nature of the task. A full complement of ancillary staff, equipment, and supplies awaits the surgeon for the procedure or the mechanisms governing performance. The surgeon had a good night's sleep before the relatively low-risk procedure and has plenty of time to accomplish the task, as seen in the disposition of the individual.

In the second scenario, the same surgeon, paged to the coronary intensive care unit (CICU) amid resuscitation procedures, makes the determination to perform a surgical procedure to stabilize the patient's condition. Because of the patient's debilitated state, the surgeon will complete the procedure in the CICU rather than move to the main operating room. The surgeon is not as familiar with CICU staff or equipment; and she asks for several supplies that are not readily accessible. This was the fourth surgical case of the day for the surgeon, who has not taken a break in over 12 hours. The physician is tired and hungry. The two scenarios illustrate how a change in the composition of a

situation can lead to a potential error. Each part plays an integral role in determining if an error may occur.

The second component is the intention associated with an error. Reason (1990) described this as an intentional versus an unintentional act when an individual diverts attention to something other than the job at hand. Intention has two facets, that is, an expression of the desired end state, or the means by which something is to be achieved. Whittingham (2004) described this differently as the balance between random and systematic errors.

Third is the idea that a planned action can proceed but still be considered an error if the process fails to accomplish the intended outcome. Reason (1990) described the difference in this way: "The problem resides in the adequacy of the plan rather than in the conformity of its constituent action to some prior intention" (p. 8). If the intention is not appropriate, it is a mistake; if the action is unintended, it then becomes termed a slip or a lapse (Rasmussen, 1982; Reason; Whittingham, 2004). Reason's point was that the two concepts have different ramifications for corrective action, and he noted that this could be a difficult discernment for managers.

The importance of documenting AEs or medical errors over time can assist managers to identify patterns or trends related to errors. A pattern of slips or lapses by a single individual may require additional education, time with a preceptor, or a combination of the two actions. Expert health care team members also may not realize the significance of explaining pattern recognition to the neophyte when a critical event is

occurring, such as a potential medical error. The expert acts without a clear explanation of the "why" involved in the actions. It may take neophyte health care team member years to make the same associations based on experience.

Human Error

Human Error Versus System Failures

There are varieties of ways to conceptualize how humans make errors. Concepts having to do with individual behaviors were discussed previously. Other conceptual approaches recognize the role of systems and environments in error causation. Dekker (2002) proposed a new viewpoint regarding human error as a symptom of deeper trouble within an organization or system. "To explain failure, do not try to find where people went wrong. Instead, investigate how people's assessments and actions would have made sense at the time, given the circumstances that surrounded them" (Dekker, p. 59).

Ergonomic Perspective

From an ergonomic view, the individual is seldom the solitary cause of an error. Human performance involves multifaceted interactions among the work environment, the person, and the tools or machines involved in the activity. Components do not work in isolation; they require a combination of occurring events to cause an error (Whittingham, 2004). This is similar to describing a system failure. An example is research conducted at the Japan Railways (JR) East division on human error analysis. The division is part of JR, a government-subsidized group of eight private companies that took over the government-owned Japanese National Railways in 1987. Chiba, Aonuma, and Kusugami

(2003) adapted a multifaceted method of analysis on the causes that induce human error. The company had undertaken to achieve zero injury or death of passengers, and zero fatal accidents to staff. To accomplish this, Chiba et al. sought to obtain an accurate assessment of each accident and to understand the basic cause, what the researchers termed the "seeds of accident" (p. 59). This model is similar to a root cause analysis in asking the question 'why' multiple times in order to ascertain the root cause (Latino, 1994). The researchers used an assessment tool that included filtering contributing factors through eight categories: (a) causes of the error classified as human, machine, media, or management, and (b) preventive measures, sorted as education, engineering, environment, or enforcement.

Aeromedical Perspective

The aeromedical perspective sees errors from a mental or a physiological view as merely a symptom of underlying fatigue or illness. The belief is that some symptoms are suppressed until triggered by something environmentally, which then causes an error (Alexandersson, 2003; Wiegmann & Shappell, 2003). One study compared interns working 79 hours per workweek to interns working 62 hours per workweek. The study demonstrated a 36% higher error rate among the interns working longer hours (136 versus 100 errors per 1,000 patient days, $p < .001$; Landrigan et al., 2004).

Organizational Perspective

The organizational perspective on human error stems from industry. Heinrich (1959), a safety pioneer, presented the domino theory of accident causation after

reviewing and classifying 75,000 industrial accidents. He found that unsafe acts caused 88% of industrial accidents, unsafe conditions caused 10%, and the remaining 2% were unavoidable. From these data, he formulated his theory of accident causation based on basic and intermediate causes.

Picture a series of dominos set in a line, not touching. Each domino represents an aspect of an accident: (a) safety lapse or lost control, (b) basic causes, (c) intermediate causes, (d) accident, and (e) injury. Heinrich's (1959) theory stated that accidents result from a chain of sequential events, metaphorically like a line of dominos. When one of the dominos falls, it triggers the next and then the next, leading to an injury (Batson, Ray, Wan, & Weems, 2000; Harriss, 2004; Heinrich; Wiegmann & Shappell, 2003). Removing a key factor such as an unsafe condition or act prevents the start of the chain reaction. Heinrich viewed accidents as unplanned and uncontrolled events, always instigated by a human being. This is in direct opposition to the ergonomic perspective. Criticism of Heinrich's work has included his oversimplification of the control a person has in causing accidents (Abdelhamid & Everett, 2000) and the idea that management had no influence over prevention (Harriss).

Bird and Loftus (1976) adapted Heinrich's (1959) work by including management as a fundamental piece of the equation. Adams (1976) modified Bird and Loftus's work. Leamon (2006) believed that Adams kept management's role in the cascade by adding more emphasis on the objectives, structure, and operation of the organization as contributing factors to accident causation.

Reason (2000) advanced the theory by shifting the emphasis away from a cascading effect into what he termed the Swiss cheese model. He believed that defenses, barriers, and safeguards are strategic in preventing accidents. “We cannot change the human condition, but we can change the conditions under which humans work” (Reason, p. 769). He saw defensive layers as (a) technological barriers in devices such as alarms or automatic shutdown systems, or (b) human barriers, as seen in the relationship between the copilot and the pilot or the anesthesiologist and the surgeon.

Summary

Human error in health care is a complex, multifaceted phenomenon. A paradigm shift in existing beliefs regarding medical errors is needed. Foremost would be an effort to reduce the organizational stigma associated with error by moving from a culture of blame. Establishing a blame-free environment in health care will take a major realignment for senior leaders and managers. To accomplish this, three things must occur.

First, establishing a blame-free environment would change leadership’s attitudes regarding employee actions when mistakes or mishaps occur. Investigating errors in a traditional model of stated facts associated with the event is inadequate. Applying Helmreich’s (1999) threat-and error-management model provides a comprehensive way for a manager to ascertain the cause-and-effect relationship that precipitated the event. Second, applying Reason’s (1997) Swiss cheese model to event investigation would provide a visual representation of causal factors and failed barriers contributing to the error. Using Reason’s model, managers could determine whether the contributing factors

associated with the event are system, human, or a combination of the two. This would provide clear direction for creating action plans and interventions to prevent additional errors.

Third, there is a need for research focused on trends or patterns that occur when health care team members prevent errors from reaching patients (Henneman & Gawlinski, 2004: Killen & Beyea, 2003; Minick & Harvey, 2003). One approach could examine health care team members' experiences with NMs to establish themes and then apply the identified themes to Helmreich's (1999) and Reason's (1997) models in accident causation and management. A second approach would be to apply Welling's (2005) model with trended themes from health care team members' comments to understand how pattern recognition or intuition prevent errors from reaching patients.

Research has demonstrated minimally four primary barriers that contribute to the marked failure of health care institutions to improve the culture of safety: (a) clinical autonomy among disciplines, (b) fear of litigation resulting in punishment, (c) inadequate dissemination of known safety practices, and (d) institutional hierarchies (Rosenthal & Sutcliffe, 2002). To this end, the researcher suggests that patient safety may benefit from additional research into the critical thinking practices of health care team members; decision-making skills, both individually and in teams; and the role of intuition in health care team members' recognition of potential errors.

This chapter addressed the composition and classification of errors, human versus system failures, theories of accident causation, and error analysis. A description and

model of intuition presented five phases to depict the process that health care team members experience in pattern recognition. Comparisons of human error concepts from aerospace, railway, and engineering to health care demonstrated commonalities among the practices and processes. Chapter 3 examines the methodological approach used to understand the role of intuition in preventing medical errors from reaching hospitalized patients, including Welling's (2005) five-phase model of intuition and Agor's (1984) work in depicting a way to measure intuition. The data selection describes the three sequential ways the researcher explored the role of intuition for health care team members in three West coast acute care hospitals.

CHAPTER 3: RESEARCH METHOD

Introduction

Understanding the dynamics involved in preventing medical errors comes from analyzing health care team members' real-world experiences of recognizing that something is wrong and stopping the process. Two examples of how this phenomenon can be explained come from different disciplines. Gladwell's (2005) description of thin slicing was one plausible explanation of the phenomenon. Welling's (2005) model provided a conceptual framework of the processes involved in intuition. Quantifying narrative portions of UORs for intuitive thought and establishing a numeric score of intuition for health care team members may be insufficient to understand the depth and breadth of this process. To investigate the role of intuition in medical error prevention, a qualitative approach of listening to health care team members describe events related to NMs provides the opportunity to look for commonalities or themes within the experiences as depicted by the health care team members. Therefore, a sequential exploratory quantitative and qualitative model was employed.

The researcher described the research design and methodology of the study (Walden University Institutional Review Board approval #03-21-08-0189989), sample, sampling process, data collection, and analysis. Additional information from the Health Insurance Portability and Accountability Act (HIPAA) is relevant to this study and is included because of the stories relayed by health care team members regarding patients' experiences.

Research Design

This exploratory research was divided into three parts. First, the narrative portions of existing medication-related UORs were analyzed for intuitive content. Second, health care team members who signed the analyzed UORs were sent an inventory designed to establish their intuitiveness scores. The third part of the research involved interviewing members of the health care team who submitted medication-related UORs and who volunteered to talk about times when they prevented medical errors from reaching hospitalized patients.

A causal-comparative design can be used when attempting to determine rationale or foundation for existing conditions (Dundam, 2003). This type of design involves the use of "pre-existing or derived groups to explore differences between or among those groups on outcome or dependent variables" (Schenker & Rumrill, 2004, p. 117). In this case, the preexisting group comprised the health care team members who completed medication-related UORs during a specific timeframe. The analyzed UORs were classified and divided into two groups, NMs versus AEs, to compare the differences between the documented intuitive constructs. The UORs were classified by the severity of the event or outcome on a continuum of *no incident* to *error/death.* These categories were developed by the National Coordinating Council for Medication Error Reporting and Prevention (2001), which created an algorithm to determine the severity of an error based on the outcome:

1. Category A: Error had the capacity to cause incident.
2. Category B: Error occurred, but did not reach patient.

3. Category C: Error reached the patient but did not cause harm.
4. Category D: Error resulted in need for increased person monitoring.
5. Category E: Error resulted in need for treatment or intervention.
6. Category F: Error resulted in increased or prolonged hospitalization.
7. Category G: Error resulted in permanent person harm.
8. Category H: Error resulted in near-death event (e.g., anaphylaxis or cardiac arrest).
9. Category I: Error resulted in person's death. (p. 1)

Applied ethnography research typically has been defined by the subject matter, which is a study of the ethnos or culture of a discernible group (Burns, 2000; Chambers, 2000; Cohen, Kahn, & Steeves, 2000; Creswell, 1998; Marshall & Rossman, 2006; Moustakas, 1994). Ethnography provides a mechanism to study observable patterns of human behavior, which in this case was the health care team members' documentation of actual or potential medical errors. In ethnography, the researcher looks for the individuals most knowledgeable regarding a defined group's explicit standards and values. In this study, the discernable groups were health care team members working in three acute care hospitals on the West Coast. The culturally specific accepted standard of communication was the UOR (Kohn et al., 2000).

Researchers using ethnography examine facets of social order, in this case, a small subset of health care team members volunteered to describe times when medical errors were prevented. The rationale for using this approach was threefold. First, this approach documented recognizable structures of behavior, namely, the prevention of medical errors reaching patients (Gubrium & Holstein, 2000). Second, this process allowed the researcher to examine the motivation regarding medical error prevention, for example, did the motivation arise from personal values or the group norm? Third, this

method provided a glimpse into the health care team members' practical reasoning and decision-making skills.

The researcher used nonstructured, open-ended questions to solicit the stories of how health care team members prevented a medical error from reaching patients (Agar, 1986; Chambers, 2000). This type of questioning was selected to gain insight into the tacit knowledge of the practitioners in preventing medical errors. Cognitive interviewing focuses on "revealing patterns of cultural construction with in a target group that vary from the interpretations of that group by outsiders, and most particularly by those who have some authority over the group under study" (Chambers, p. 857).

Study Sample

The target population comprised health care team members working in acute care facilities in the United States. The Centers for Disease Control and Prevention (2008) estimated that there are approximately 12 million health care workers in the United States. Studying a population of this size has inherent problems. In addition, a second problem was noted in the lack of standardized definitions for UORs. Therefore, the study sample was selected from three hospitals that are part of an integrated health care system located on the West Coast of the United States. The size of the study became manageable because the three hospitals use standardized definitions of the UOR.

The three hospitals provide acute care services, including medical, surgical, and obstetrical services; emergency care; and home community services. There is one medical staff for the three hospitals, so physicians may have privileges to practice at all

three facilities. Each facility has established medical residencies and student programs in nursing and pharmacy. The primary differences among the three hospitals are bed capacity, neonatal care, inpatient behavioral health services, and advanced cardiovascular services. All health care team members participating in the study were employed by the integrated health care system and were working in one or more of the three acute care facilities during the study. The sampling frame came from the health care system's existing internal standardized UOR system.

Sampling Procedure

The integrated health care system has an established voluntary incident reporting system whereby unusual occurrences are reported electronically or via paper by all disciplines such as nursing, pharmacy, or radiology (see Appendix C). A governing policy for the organization defines when an occurrence should be reported. The UOR information is stored electronically in an access database. Signature of the reporting health care team member is optional. The UOR system provides structured questions regarding five areas: medications falls, treatment related, environmental, including equipment-related occurrences, or behavioral concerns. There is a growing concern in health care regarding medication-related errors (Beyea, 2002; Cohen, 1999; McCarter et al., 2003; Morath & Turnbull, 2005). For the purposes of this study, only medication-related UORs were analyzed. This criterion-based sampling included 6 months' worth of signed medication-related UORs, a total of 1,836, from the three hospitals.

This purposive sampling was selected based on the personal and professional knowledge of the researcher, the accessibility and availability of the data, and the researcher's acknowledgment of the lack of generalizability to a wider population (Babbie, 2004; Burns, 2000). The UOR is a traditional mechanism found in hospitals to communicate potential or real medical errors (Morath & Turnbull, 2005). The documentation was analyzed for trends or patterns in order to fix clearly identified problems and prioritize improvement projects. The health care team members selected to receive the AIM Inventory (Agor, 1984) came from the 710 submitted medication-related UORs that were signed. Volunteers from this same group also were solicited to participate in the audio- and videotaped interviews. This decision was based on the supposition of the researcher that individuals who had documented potential and real medical errors were willing to talk openly about a time when they had prevented such errors from reaching hospitalized patients.

Instrumentation

Jung believed that human behavior is not arbitrary, but "predictable and therefore classifiable" (as cited in Kroeger & Thuesen, 1988, p. 10). Jung (1971) observed that all human beings are related in the four mental functions of thinking, feeling, sensation, and intuition. Briggs and Meyers took Jung's principles into a practical application with the development of the Myers-Briggs Type Indicator (MBTI; Keirsey, 1998; Kroeger & Thuesen). The mother-daughter team created a psychometric questionnaire that revealed an individual's personality type using Jungian concepts. By adapting the MBTI, Agor

(1984) created a tool to measure both an individual's potential intuitive ability and whether that ability is used on the job to guide management decisions. He studied executives from the private sector, emergency preparedness military personnel, community college presidents, state health and rehabilitative services managers, city managers, state legislators, and professional civil servants (Agor, 1986). Agor's (1984) decision to use questions from the MBTI was based on the inventory's high reliability and validity.

Agor (1984) focused on the domain of intuition because he felt that it is how managers make decisions. He substituted thinking for sensing to make it easier for the participants in management positions to relate to daily work. By focusing on the domain of intuition, Agor (1986) decreased the total number of questions from 93 to 22, which made the inventory more manageable. He believed that the shorter instrument would contribute to an increase in the overall response rate.

The first section consists of 12 questions that measure the potential for making intuitive decisions. The number of "a" responses are totaled for Questions 1, 3, 5, 6, and 11; the number of "b" responses are tallied for the remaining questions. The "a" and "b" totals are summed to give an intuitive score. A maximum score is 12; 8 to 11 denotes a high score, 4 to 7 denotes an average score, and 1 to 3 denotes a low score for decision type. The researcher chose this instrument because of its applicability in multiple settings by various disciplines and its proven high level of reliability and validity as a test instrument (Briggs Meyers, McCaulley, Quenk, & Hammer, 1998). Multiple studies have

confirmed the efficacy of the MBTI as equivalent for decision making (Dane & Pratt, 2007; D. Davis, Grove, & Knowles, 1990; Familoni, 2002; Janney, 1993; Whiting, 2005).

The second part of the inventory focuses on 10 additional questions regarding the actual use of intuitive ability. These 10 questions were designed to obtain information related to (a) actual use of intuition, (b) when and where the use of intuition is the most utilitarian, (c) secrecy of use, (d) factors that impede, and (e) techniques used to facilitate intuitive decision making (Agor, 1984). Answers were grouped according to use of intuition, use versus nonuse, and secrecy of use (open vs. closed). Agor tested this portion of the instrument by selecting executives who had scored high on the previous questions. Based on these findings, Agor revised the inventory to clarity the questions. When compiled, the two parts of Agor's inventory measure an individual's intuitive decision-making style and use of intuitive ability. The researcher chose this inventory because of these underlying factors, which may explain how health care team members make decisions to prevent medical errors from reaching hospitalized patients.

To establish reliability and validity, the researcher field tested the AIM Inventory (Agor, 1984) with 5 health care team members not involved in the study prior to conducting the research. These individuals were asked to take the MBTI, which was scored by an individual certified in the process. Next, the health care team members were asked to take the AIM Inventory. Feedback was solicited from these individuals on the clarity of the directions and questions. The results of the AIM Inventory were compared with the results of the MBTI to establish validity. The individuals were then asked to take

the AIM Inventory one more time 30 days later to establish reliability through test-retest (Burns, 2000; Henderson, 2006).

For the qualitative portion of the study, each health care team member was asked to describe a time when the person prevented a medical error from reaching a hospitalized patient. The purpose of asking the open-ended questions was to facilitate the health care team member's memory of the event and to stimulate his or her thoughts about what triggers or ideas may have contributed to stopping the error. "Knowledge is communicated most effectively through a convincing narrative that is delivered with formal elegance and passion" (Davenport & Prusak, 2000, p. 81). In other words, what was different about the patient or the event that stimulated a behavioral change for the health care team member to prevent a medical error from reaching a patient? The questions arose from the researcher's curiosity to understand the basis of the health care team member's actions in preventing a medical error.

Each interview had the potential to be audio- and videotaped. To facilitate the storytelling, the researcher asked open-ended questions as a starting point for the interviews:

1. In your own words, what is a medical error?
2. How would you describe a medical error?
3. Tell me about a time when you prevented or stopped a medical error from reaching a patient.
4. Tell me what was significant in your mind about this medical error.

5. What factors contributed to your stopping or preventing the error from reaching the patient?

Data Collection

Six months' worth of UORs were downloaded from the hospitals' databases and stored securely on the researcher's password-protected computer. The data were sorted by category outcome, with all Category A and B UORs placed in one group, designated as NMs, and all Category C through I UORs be placed in a second group, designated as AEs. It is possible that one health care team member could have submitted two or more medication-related UORs in the period selected by the researcher. Therefore, UORs signed by health care team members were included in only one group, but not both. The randomization of which group was determined by a coin toss.

In the second part of the research, health care team members who had submitted signed medication-related UORs were ask to complete the AIM Inventory and demographic information, which generated an individual intuitive score (Agor, 1984; see Appendixes D & E). Permission to use the inventory was granted (see Appendix F). An introductory letter, informed consent, an inventory, and a return envelope were sent to a work address, requesting that the individuals complete the inventory measuring intuition versus thinking and return within 7 days (Agor; see Appendix G). Every attempt was made to ensure a representative sampling from each hospital. An e-mail reminder, including a copy of the inventory to print, were sent 5 days later in order to facilitate obtaining a higher response rate of 50% to 60% for the mailed survey (see Appendix H).

Incomplete inventories were excluded from the analysis. For the qualitative portion of the research, health care team members were solicited for 30-minute interviews at times convenient for them. Each member that participated was sent a copy of the transcript from the interview to verify the accuracy of the content. The health care team members who participated were asked to return for subsequent interviews if supplementary questions or clarification became apparent during the ongoing analysis.

Data Preparation

Table 1 presents the constructs related to intuition developed by the researcher and based on the literature review. The researcher quantified the total number of narrative-documented items related to intuition from the selected medication-related UORs, both AEs and NMs. Each construct was assigned a value of 1. Every UOR was assigned a numeric value of 0 to 10 for a total number of intuition-related constructs. To test the reliability of the researcher to abstract the constructs of intuition correctly, another health care team member not involved in the study abstracted a random sample of responses. The results were compared for interrater reliability. Quantifying the narrative responses of health care team members who submitted medication-related UORs allowed the events to be portrayed, described, and measured.

Table 1

Constructs of Intuition

Construct of intuition	References
Pattern recognition: involves a process in which environmental stimuli are matched with some deeply held, non conscious category, pattern, or feature.	Benner, 1984; Cappon, 1993; Dane & Pratt, 2007; Gladwell, 2005; Isenberg, 1989; Klein, 2003; Tanner, 2006; Westcott, 1968.
Memories: The appearance of meaningful visual images, words, memories, or kinesthetic sensations; thin slicing or detecting traits from mere second of behavior.	Bastick, 1982; Gladwell, 2005; Myers, 2002; Welling, 2005.
Hunches in selection and memory tasks.	Dane & Pratt, 2007; Klein, 2003; Welling, 2005; Westcott, 1968.
Gut feeling in decisions.	Welling, 2005.
The first impression of a person's trustworthiness.	Welling, 2005.
Inner knowing: One's knowledge of what is good for oneself.	Welling, 2005.
Warnings: Uncanny feelings, a foresight of danger that afterward proves justified.	Phillips et al., 2004; Welling, 2005.
Sense of solution: The incubation phenomenon, the sudden appearance of a solution at an unexpected moment; a feeling that a solution is pending, without knowing which, or knowing that there is a better solution than the present one.	Isenberg, 1989; Welling, 2005.
Something is wrong: Knowledge that something about a solution is wrong or lacking; acts of recognition.	Dane & Pratt, 2007; Klein, 2003; Welling, 2005.
Knowing that a certain direction is promising; the capacity for direct, immediate knowledge prior to rational analysis; the instant parallel processing and integration of complex information streams.	Agor, 1989; Myers, 2002; Welling, 2005.

There are three primary steps involved in data coding: (a) reducing raw data into a manageable form, (b) displaying the data once reduced, and (c) drawing conclusions or verifying (Miles & Huberman, 1994). Data reduction entails selecting, simplifying, abstracting, and transforming the raw data. Data display is the organized assembly of

information that allows the researcher to draw conclusions. During this phase, the researcher gradually developed a small set of generalizations. In the final stage, the researcher drew meaning from the raw data for comparison to formalized constructs or theories to develop conclusions (Auerbach & Silverstein, 2003; Gibbs, 2004; Miles & Huberman; Richards, 1999).

The researcher began the coding process by employing Welling's (2005) five phases of intuitive knowledge representation to establish the basis organization for coding, namely, detection, dichotomic awareness, related objects, metaphorical solution, and explicit verbal understanding. This primary schema provided the framework to categorize the text from the transcripts and begin the search for patterns within the structure (Auerbach & Silverstein, 2003). From there, the researcher looked for other natural thematic groupings of words or phrases.

For the interviews, the analysis included identifying common themes from the transcribed interviews by (a) creating short phrases or sentences that reflect a single, specific thought; (b) pulling group statements into meaningful units; (c) seeking divergent perspectives; and (d) constructing a composite or overall description of the phenomenon as people typically experience it (Gibbs, 2004; Leedy & Ormrod, 2001). The themes that emerged from the coded interviews were compared to Welling's (2005) five phases of intuition to the participants' responses and progression through the phases.

The researcher clustered the experiences into categories, much the way an affinity diagram does in organizing random, brainstormed ideas for quality improvement

processes. These clusters of meaning were analyzed and tied together to create a general description of the experience (Agar, 1986). A pivotal point in this process was the researcher's ability to set aside personal, preconceived notions about the content and responses during the process. The emerging themes were tested for face validity with other health care team members not associated with the study.

Data Analysis

The basis for data analysis in an exploratory study is to describe or draw a picture of the results. Thus, descriptive statistics, including measures of central tendency and frequency distributions, were used to analyze the demographic information of the participants and the UORs (Babbie, 2004; Burns, 2000; Henderson, 2006). Participant demographic information was analyzed by age, gender, educational preparation, number of years licensed, and number of years in discipline. The UORs were analyzed by hospital, reporting unit, disciple of health care team member, category, causation factors, time of day, and day of the week. An exploratory study describing the role of computerized physician order entry or electronic order entry in facilitating medication errors used descriptive statistics to summarize and present the findings (Koppel et al., 2005). Chi-square evaluates the "independence or alternatively the association of frequency counts in various categories" (Burns, p. 212). In the current study, chi-square, or nonparametric test of significance, was used to analyze the nominal data elements of gender, discipline, and type of UOR.

A *t* test was used to compare the results from the interval level of measurement for the AE group compared to the NM group on documented constructs of intuition and the means scores of intuition. This statistical technique was chosen because it is the most appropriate test to use when comparing a continuous outcome variable in two independent groups (Henderson, 2006; Triola, 2002). ANOVA was used to test "the equality of three or more populations means by analyzing sample variances" (Triola, p. 525).

A subset of the two groups was examined: (a) high-intuitive health care team members who reported NMs, (b) high-intuitive health care team members who reported AEs, (c) health care team members who were not high intuitives who reported NMs, and (d) health care team members who were not high intuitives who reported AEs. High-intuitive health care team members' responses were examined for predictors of intuition and phases of intuition trended in the audio- and videotaped interviews against age, years of experience, discipline, and gender. As an example, Whiting (2005) surveyed 113 health care executives in the United States about intuitive decision-making and leadership styles. In the analysis, she used chi-square and ANOVA statistical tests to evaluate the relation between intuitive decisions and leadership style, age, gender, and size of company where the executives were employed at the time of the study. She found no relationship between intuitive decision making and age, gender, size of company, or leadership style.

Traditionally, audio-recorded responses required transcription and coding before analysis of the content could occur. Hutchinson (2005) proposed an "innovative method of data analysis that uses audio-editing software from selected audio bytes in digital audio recordings" (p. 20). Gold Wave 5.18, a professional digital audio editor, is user friendly and economical. The advantages of processing the data in the medium in which they are collected include saving transcription costs, saving time, and enhancing validity (Hutchinson). The coded audio files could be stored for further analysis.

Transana™, software designed for qualitative work in educational settings, facilitates the analysis of video clips and audio text. The software allows for the (a) transcription, (b) identification of analytically interesting video clips, (c) assignment of key words for coding, (d) creation of complex collections of interrelated video clips, and (e) exploration of relationship between applied keywords (Transana, 2005). In comparison, this is beyond traditional qualitative software, such as N*Vivo 7 or Ethnograph v5.0, which focuses on audio transcription for analysis (Bazeley & Richards, 2005; Lewins & Silver, 2006; Richards, 1999; Seidel, 1998).

N*Vivo is qualitative software with interactive, automatic coding for audio and video materials, images, and rich text (Richards, 1999). The software supports quantitative options in exporting files for spreadsheet manipulation in statistical software (Gibbs, 2004). In addition, the software can create and transfer knowledge networks between projects for future research, and it carries minimal financial costs in the student version, when compared to the other available qualitative software packages. Because of

the flexibility of analysis for audio- and videotaped interviews and the economical costs, N*Vivo was used if there were sufficient data to merit the need for the qualitative software during the analysis. Minitab®, a statistical software application, was used for quantitative analysis (Brook, 2006; Henderson, 2006; Levine, 2006).

Reliability and Validity

To test reliability, 5 health care team members who did not participate in the study completed the AIM Inventory twice (Day 1 and Day 30, test-retest). The mean intuition score of the health care team members who completed the inventory on Day 1 ($M = 5.50$) was lower than the mean score when the same individuals repeated the inventory on Day 30 ($M = 7.33$). The p value of .444 was higher than the $\alpha = 0.05$. Therefore, there was no difference in the mean intuition scores based on the sample of health care team members who completed the AIM Inventory on Day 1 and again on Day 30.

To test validity, the same 5 health care team members completed the MBPI. The mean intuition score of the 5 health care team members who completed the AIM Inventory on Day 1 ($M = 6.60$) was lower than the mean score of the same team members who completed the MBPI ($M = 7.60$). The p value of .433 was higher than the $\alpha = 0.05$. There was no statically significant difference in the mean intuition scores based on the sample of health care team members who completed the AIM inventory on Day 1 and the MBPI.

The researcher and another health care team member who did not participate in the study independently scored 29 randomly selected comments taken from the AIM Inventory against the constructs of intuition. Each appraiser was instructed to select as many constructs that fit the comment as appropriate. Of the 297 items that were compared, 284 matched at 95.62% agreement (95% CI: 92.63-97.65). Appraiser 1 agreed 95.95% with the constructs selected per comment. Appraiser 2 agreed 99.66%. The constructs of intuition appeared to be reliable and repeatable.

Health Insurance Portability and Accountability Act

The HIPAA was relevant to this study because of the nature of the data collected, namely, stories and experiences relayed by health care team members. The HIPAA, enacted by Congress in 1996, ensures that medical records, billing, and patient accounts meet consistent standards with regard to documentation, handling, and privacy. The Standards for Privacy of Individually Identifiable Health Information, or Privacy Rule, established for patients "national standards to address the use and disclosure of individuals' health information for the protection of all patients" (U.S. Department of Health and Human Services [DHHS], 2003, p. 3). Of significance to this study were the standards specified in the HIPAA Administrative Simplification Regulation Text, §164.514. Requirements relating to protecting the use and disclosure of health information include that "health information does not identify an individual and a person with appropriate knowledge of and experience with generally accepted statistical,

scientific principles, and methods for rendering information not identifiable" (DHHS, 2006, p. 66).

The researcher first sorted and then abstracted the narrative documentation from the voluntarily submitted UORs and then subsequently transcribed the data from the audiotapes in preparation for coding and analysis. All data were stored securely on the researcher's password-protected computer. Any personal identifiers, as indicated in Table 2, were removed from the text and videotape prior to analysis.

Table 2

HIPAA Elements of Privacy Requirements

The following identifiers of the individual or of relatives, employers, or household members of the individual household, are removed:
Names
Geographic subdivisions smaller than a state including street address, city, county, precinct, zip code, and the equivalent geocodes;
All elements of dates directly related to an individual, including birth date, admission date, discharge date, date of death;
Telephone or Fax numbers;
Electronic mail addresses;
Social Security numbers;
Medical record number;
Health plan beneficiary numbers;
Account numbers;
Certificate/license numbers;
Vehicle identifiers, serial numbers, or license plate number;
Device identifiers;
Web Universal Resource Locators (URLs);
Internet Protocol (IP) address numbers;
Biometric identifiers, including finger and voice prints; or
Full face photographic images or any comparable images.

Note. From "*HIPAA Administrative Simplification: Regulation Text,"* by U.S. Department of Health and Human Services, 2006. Retrieved from http://www.hhs.gov/ocr/Admin SimpRegText.pdf

Informed Consent

For the interviews, each participant was asked to sign an informed consent dealing with disclosure and authorization. The disclosure section described the purpose of

the study, the individual conducting the study, the nature of participation, time commitment, benefits versus risks, confidentiality of the data, level of anonymity possible, and the researcher's contact information if the participant had additional questions or concerns. The agreement acknowledged that the participant understood the information and requirements, willingly participated, provided explicit instruction for use of audio and/or videotaped portions of the interview, and granted permission for data generated and dispersed through usual professional means as a part of the study (Pennsylvania State University, 2007; see Appendix I). All participants received a one-page handout that explained what constitutes patient identifiers related to HIPAA regulations (see Appendix J). The participants were asked to refrain from using specific patient identifiers during the interview process.

The informed consent gave the researcher the opportunity to offer the participants the option of audio or videotaping the interview session. The participants were given the opportunity to self-select whether to be video- and audio taped or audio taped only. Those participants who self-selected to be audio taped received unique identifiers for the purpose of analysis. They were not identified by name or profession. Data from the audio were transcribed and analyzed. Name, profession, and number of years as a licensed health care team member for teaching purposes identified each participant who chose to be audio- and videotaped. The researcher maintained the video and audiotapes securely for a period of no more than 12 months from the date of the interviews. At that time, the

tapes were destroyed. The researcher removed all identifiers that may have been mentioned inadvertently during any of the interviews.

Summary

The researcher examined the role of intuition in preventing medical errors from reaching hospitalized patients by comparing two groups of health care team members' documented narratives from UORs and responses to the AIM Inventory (Agor, 1984). A total of 1,836 UORs were analyzed, and 710 signed UORs qualified for participation in the study. Of those 710 UORs, 382 (54%) were AEs, and 328 (46%) were NMs. The analysis examined whether there were statistical differences in intuitive content documented for NMs and the mean scores of intuition for the two comparative groups. In chapter 4, the data are analyzed to compare the ages, gender, and discipline of the participants to see if there was a statistically significant difference in the two groups by type of error.

The participants were interviewed and asked to describe times when they prevented medical errors from reaching hospitalized patients. The transcribed results were coded and compared against Welling's (2005) five phases of intuition. A digital video disk containing stories abstracted from the interviews regarding error prevention was created as an educational tool for senior leaders and managers to aid in changing the culture of safety within health care facilities.

The results may show that there is no evidence that intuition plays a role in preventing medical errors from reaching hospitalized patients. If so, the findings will add

new knowledge to existing information on NMs. However, a positive correlation between high intuitive scores for health care team members and the reporting of NMs will provide new insights and knowledge into preventing medical errors. This small, disruptive innovation could change how educators, managers, and leaders look at patient safety.

CHAPTER 4: RESULTS

Introduction

The researcher examined the role of intuition in preventing medical errors from reaching hospitalized patients in this quantitative and qualitative study. The purpose was to explore the documenting of UORs, combined with measuring the intuition scores of health care team members, in order to gain insight into how medical errors are prevented. Included in this chapter is a description of the source data, unusual occurrence reports, constructs of intuition and AIM inventory; a description of the participants, along with the results of the quantitative and qualitative analyses. The results of the hypothesis testing is organized by research question and then subdivided into issues pertaining to each question.

The study involved three parts. The first part quantified the number and type of voluntarily submitted medication-related UORs from three hospitals on the West Coast. Medication errors were selected because of the national attention focused on medication safety for hospitalized patients and stratified into two groups: AE and NM (Cohen, 1999). Comments documented on UORs in each group were analyzed to quantify the number of constructs of intuition used to document each event. The two groups were compared to discern any trend or pattern. A *t* test was used to compare the results of the mean number of constructs of intuition for the AEs and the NMs.

The second part of the study compared the mean intuition scores of health care team members stratified in the two groups who took the AIM Inventory. The participants

in the two groups were analyzed by age, gender, discipline, years licensed, and years worked (Agor, 1984). A *t* test was used to compare the means scores of intuition for the two groups. In addition, subsets of the groups were examined: (a) high-intuitive health care team members who reported NMs, (b) high-intuitive health care team members who reported AEs, (c) health care team members who were not high-intuitives reporting NMs, and (d) health care team members who were not high-intuitives reporting AEs. High-intuitive health care team members' responses from the AIM Inventory were examined for predictors of intuition against age, years licensed, years of experience, discipline, and gender.

Finally, the researcher conducted interviews with the health care team members, asking them to describe a time when they had prevented medical errors from reaching hospitalized patients. The social impact of decreasing or eliminating medical errors may be significant in terms of cost and human life. The purpose of this study was to identify triggers or ideas that may have contributed to stopping medical errors. The researcher coded the transcribed interviews against Welling's (2005) five phases of intuitive knowledge: detection, dichotomic awareness, related objects, metaphorical solution, and explicit verbal understanding. The findings from the quantitative and qualitative analysis were integrated to identify the role of intuition in preventing medical errors from reaching hospitalized patients. This exploratory work made an initial examination of the documentation by health care team members on UORs, describing both AEs and NMs, comparing mean intuition scores, and analyzing interviews describing NMs.

Source of the Data

The three hospitals participating in this study received 1,836 voluntarily submitted, medication-related UORs between July 1, 2007, and December 31, 2007. The UORs were stratified into two groups: (a) an AE, when a medical error reached a hospitalized patient or (b) an NM, when a medical error did not reach a hospitalized patient. Of the 1,836 UORs submitted, 1,103 had a health care team member's name and department or nursing unit attached. The two groups were compared, and duplicate names were eliminated. This left 710 UORs signed by health care team members that qualified for participation in the study. Of those 710 UORs, 382 (54%) were AEs, and 328 (46%) were NMs.

A request to participate, the AIM Inventory, and a demographic questionnaire were mailed to 710 health care team members at the three hospitals. A follow-up electronic reminder was sent. The return rate was 201 (28%). Of those inventories returned from health care team members who completed a UOR, 112 (56%) were from AEs and 91 (44%) were related to an NM. This was similar to the proportion of inventories mailed out.

The returned AIM Inventory and demographic data were given identification numbers; the data were entered into a secure database by the researcher, who also ensured that the documents were organized; and the returned paper copies were stored securely. Ten returned inventories did not contain any demographic information. The comments from UORs, inventories, and interviews were compiled, spell checked, and

analyzed using qualitative software. Notes of comments, trends, and further research questions were logged into a research journal kept by the researcher.

An electronic request was sent to health care team members to be interviewed about times when they prevented medical errors from reaching hospitalized patients. Eight individuals volunteered to participate. Each interview took between 20 and 30 minutes. Arrangements were made so that the interviews would not interfere with the participants' regular work activities. The tapes were transcribed by the researcher. Content was qualitatively analyzed using Statistical Package for Social Sciences (SPSS) Text Analysis for Surveys 2.1™, which became available to the researcher at no additional cost during the data collection phase.

Unusual Occurrence Reports

The distribution of the voluntarily submitted medication-related UORs included 767 (42%) UORs on day shift (7 a.m.-3 p.m.), 676 (37%) on evening shift (3 p.m.-11 p.m.), and 393 (21%) on night shift (11 p.m.-7 a.m.; see Table 3). Eighty-three percent were completed by nursing health care team members, and the remaining 17% were completed by ancillary health care team members, such as laboratory or diagnostic imagining technicians as well as those in nutritional services. The UORs were stratified as AEs and NMs (see Table 4). The narrative comments were analyzed separately for constructs of intuition.

Table 3

Distribution of Medication-Related UORs by Hospital and Shift

	Days	Evenings	Nights	Total
Hospital A	77 (52.3%)	38 (25.8%)	32 (21.7%)	147 (8.0%)
Hospital B	305 (39.0%)	300 (38.3%)	177 (22.6%)	782 (42.5%)
Hospital C	385 (42.4%)	338 (37.2%)	184 (20.2%)	907 (49.4%)
Total	767 (41.7%)	676 (36.8%)	393 (21.4%)	1,836 (100%)

Table 4

Distribution of Medication-Related UORs by Hospital and Type of Error

	Total UORs	% of UORs	NMs	% of NMs	AEs	% of AEs
Hospital A	147	8%	64	8%	83	8%
Hospital B	782	43%	268	34%	514	49%
Hospital C	907	49%	451	58%	456	43%
Total	1,836	100%	783	100%	1053	100%

The 1,836 medication-related UORs fell into 16 categories. The top three categories were Other (480 or 26%), Omission (393 or 21%), and Wrong Dose (190 or 10%; see Figure 1). These three categories were consistent with previous analysis by the hospital system. A national comparison was not found primarily because of the lack of consistency in definition among the facilities regarding what constitutes a medical error. Further analysis that contributes to understanding the causes of the high percentages may be beneficial.

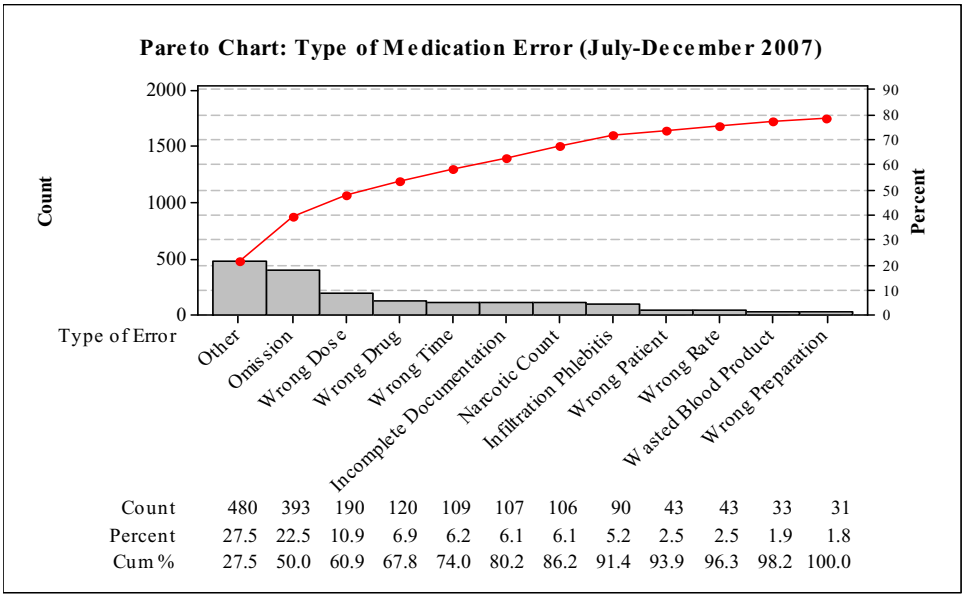

Figure 1. Pareto chart by type of medication error.

Constructs of Intuition

Each of the 1,836 medication-related UORs had comments. The researcher quantified the total number of narrative-documented items related to intuition from the selected medication-related UORs. Each construct was assigned a value of 1, and each UOR was assigned a numeric value of zero to 10 to obtain the total number of intuition-related constructs. The AE UORs averaged 4.08 documented constructs per reported event; NM UORs averaged 3.90 documented constructs per reported event (see Table 5).

Table 5

Distribution of Constructs of Intuition by Type of Error

	Sample size	*M*	*SD*	Range
AE	1052	4.07	1.449	6 (1-7)
NM	784	3.90	1.840	7 (1-8)

AIM Inventory

The results of the AIM Inventory (Agor, 1984) produced an intuitive score for each participant. Zero was a low intuitive score, and 12 was a high intuitive score. For the purposes of comparison, the results were reported by category: (a) low intuitive scores (0-4), (b) medium intuitive scores (5-8), and high intuitive scores (9-12; Agor). The mean intuition score of all participants was 5.652 (*SD* = 1.794), with a median score of 5.0. The mean intuition score for the near-miss group were higher than the AE group, with the males being slightly higher than the females (see Table 6).

Table 6

Distribution of Mean Intuition Scores

	Sample size	*M*	*SD*	Mode	Median	Range
Overall	201	5.652	1.794	5	5.0	9(1-10)
AE*	112	5.500	1.750	5	5.0	9(1-10)
NM*	89	5.843	1.840	5	5.0	8(2-10)
High Intuitive Scores*	14	9.214	0.426	9	9.0	1(9-10)
Medium Intuitive Scores*	134	6.134	1.060	5	6.0	3(5-8)
Low Intuitive Scores*	53	3.491	0.823	4	4.0	3(1-4)
Female**	170	5.641	1.766	5	5.5	8(2-10)
Male**	21	5.810	2.182	5	5.0	9(1-10)
Nursing**	167	5.575	1.775	5	5.0	9(1-10)
Pharmacy**	13	7.231	1.691	6	8.0	9(1-10)
All Others**	11	5.091	1.700	5	5.0	9(1-10)

*n = 201
**n = 191
10 participants did not complete demographic information

Description of the Participants

Of the 710 inventories that were mailed, 201 (28%) participants responded, which included responses from 170 females (84%); 21 males (11%); and 10 (5%) who completed the inventory, but did not complete the demographic information. The average age of the participants who completed the demographic information was 43 (22-70 years). The health care team members had been licensed on average 17 years (0-48 years) and had worked for the health care system for 12 years (1-36 years; see Table 7).

Table 7

Demographic Distribution of Participants

Demographic category	Overall (201)	AE (110 or 56%)	NM (91 or 44%)
Age	43 years (22-70 years)	41 years (22-63 years)	44 years (23-70 years)
Gender	Females = 170 Males = 21 No response = 10	Females = 91 Males = 13 No response = 8	Females =79 Males = 8 No response = 2
Discipline	Diagnostic imaging = 2 ED technician = 1 Laboratory = 2 No response = 10 Nursing = 167 Nutritional services = 2 Pharmacy = 13 Physician = 3 Physician assistant = 1	Diagnostic Imaging = 2 ED Technician = 1 No response = 8 Nursing = 92 Nutritional services = 1 Pharmacy = 5 Physician = 2 Physician assistant = 1	Laboratory = 2 No response = 2 Nursing = 75 Nutritional services = 1 Pharmacy = 8 Physician = 1
Educational preparation	Diploma = 14 Associate degree = 36 BS = 25 BSN = 88 MS = 5 MSN = 4 Nurse practitioner = 2 Physician = 3 Doctorate = 5 No response = 15	Diploma = 6 Associate degree = 24 BS = 11 BSN = 47 MS = 3 MSN = 3 Nurse practitioner = 1 Physician = 2 Doctorate = 1 No response = 13	Diploma = 8 Associate degree = 12 BS = 14 BSN = 41 MS = 2 MSN = 1 Nurse practitioner = 1 Physician = 1 Doctorate = 4 No response = 2
Number of years licensed	17 years (0-48 years)	15 years (0-42 years)	19 years (1-48 years)
Number of years employed at health care facility	11 years (1-36 years)	10 years (1-36 years)	13 years (1-34 years)

The second set of participants comprised 8 health care team members who were interviewed. Those individuals included 5 males (63%) and 3 females (37%). The average age of the participants was 53 (46-63 years), 10 years older on average than the participants who completed only the AIM Inventory. Health care team members were

licensed on average 27 years (18-35 years) and had worked for the health care system for 22 years (7-28 years; see Table 8).

Table 8

Demographic Distribution of Interviewed Participants

Demographic category	Overall (8)
Age	53 years (46-63 years)
Gender	Females = 3 and males = 5
Discipline	Nursing = 2, pharmacy = 1, physician = 4, and social worker = 1
Educational preparation	BS = 1, BSN = 1, MS = 1, MSW = 1, and physician = 4
Number of years licensed	27 years (18-35 years)
Number of years employed at the health care facility	22 years (7-28 years)

Quantitative Analyses Results

To describe the results of a sample statistically, four fundamental factors were considered: (a) central tendency, (b) shape, (c) variation, and (d) normality. Each factor assimilates the raw data and assists in transforming the results into information. Central tendency is an estimation of the center of a distribution of values. The three major types are mean, median, and mode. The shape represents the pattern of distribution of the data, such as symmetrical or skewed (see Figure 2). Measures of variation refer to the range and standard deviation associated with the data. The normality speaks to the shape, the central tendency, focusing on the two main characteristics of the mean and standard deviation (Brook, 2006; Levine, 2006). The data appeared to be normally distributed; therefore, *t* tests and chi-square were run for analysis.

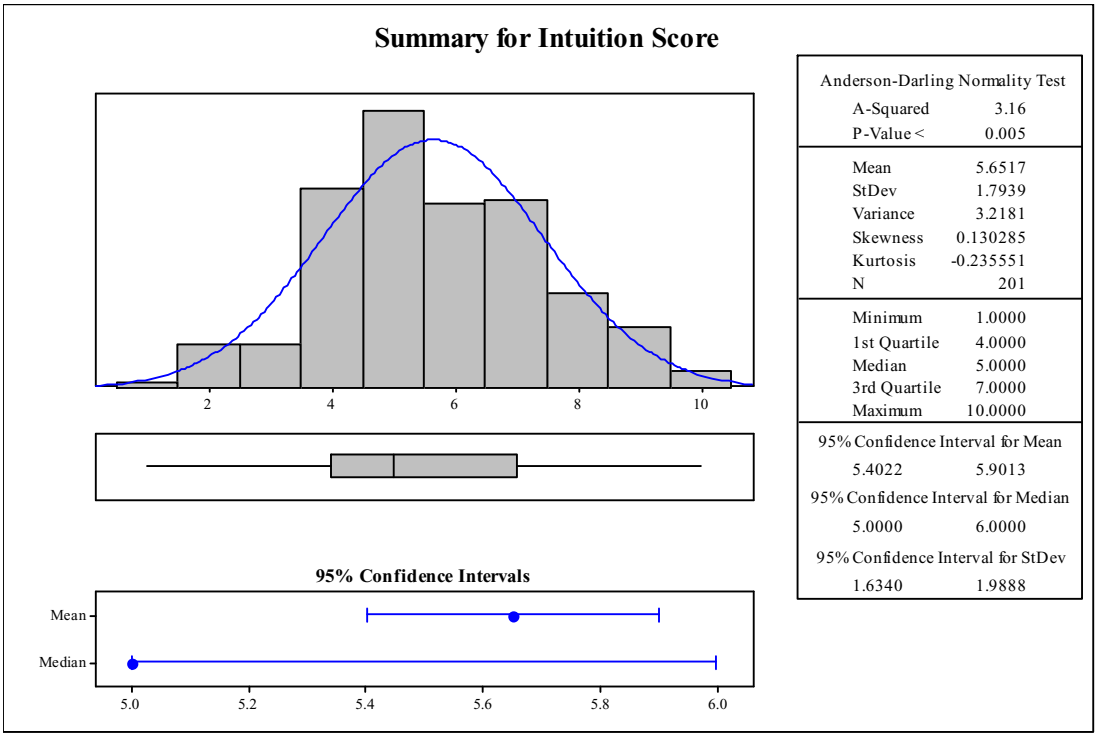

Figure 2. Histogram of intuition scores.

As mentioned in chapter 1, three research questions were posed to facilitate the understanding of the role of intuition for health care team members in preventing medical errors from reaching hospitalized patients. Five hypotheses were tested based on the results of the data analyzed from AIM Inventory in an effort to understand the differences among the health care team members in preventing medical errors from reaching patients. Each hypothesis is presented with a summary of the findings.

Those hypotheses included comparisons of (a) intuitive scores grouped by AEs and NMs; (b) intuitive scores grouped by gender of the participants; (c) number of documented constructs of intuition for AEs and NMs; (d) low, medium, and high intuitive scores by age of participant; and (e) low, medium, and high intuitive scores by

gender. A comparison of the participants' ages explored the possibility that the older, more experienced health care team member would be more intuitive. An examination of gender led to the perception that the females in the study were more intuitive than the males. Further exploration led to analyzing the results of gender by discipline. Following is an iteration of each research question, along with the issues and hypotheses raised based on the analysis of the data gleaned from the AIM Inventory.

Research Question 1: What role does the intuition of health care team members at this integrated West Coast health care system play in preventing medical errors from reaching hospitalized patients?

Hypothesis 1

Issue 1: Is there a difference between the mean intuitive scores of health care team members who submit an AE versus an NM?

H_{01}*:* There is no difference in the mean intuitive scores of health care team members who submitted medication-related UORs.

Issue 1 was answered by comparing the mean intuition scores of health care team members who submitted AEs versus NMs. Based on the results of a two-sample *t* test using a significance level of .05, the researcher failed to reject the null hypothesis, $t(-1.34)$, $p = .181$ (two-tailed), $df = 184$. There was no difference between the mean intuition scores of the two groups when examined by type of medical error. Intuitive scores of health care team members would not clarify the role of intuition in preventing errors.

Hypothesis 2

Issue 2: Is there a difference between the mean intuitive scores by gender of health care team members who submitted an AE versus an NM?

H_{02}*:* There is no difference in the mean intuitive scores by gender of health care team members who submitted medication-related UORs.

Issue 2 was answered by comparing the mean intuition scores by gender of health care team members who submitted UORs. Based on the results of a two-sample *t* test using a significance level of .05, the researcher failed to reject the null hypothesis, $t(-0.34)$, $p = .736$, $df = 23$. There was a modest difference between the mean intuitive scores of the two groups by gender (see Figure 3). However, the results did not substantiate a statically significant difference of intuition score by gender and did not clarify the role of intuition in comparing females to males.

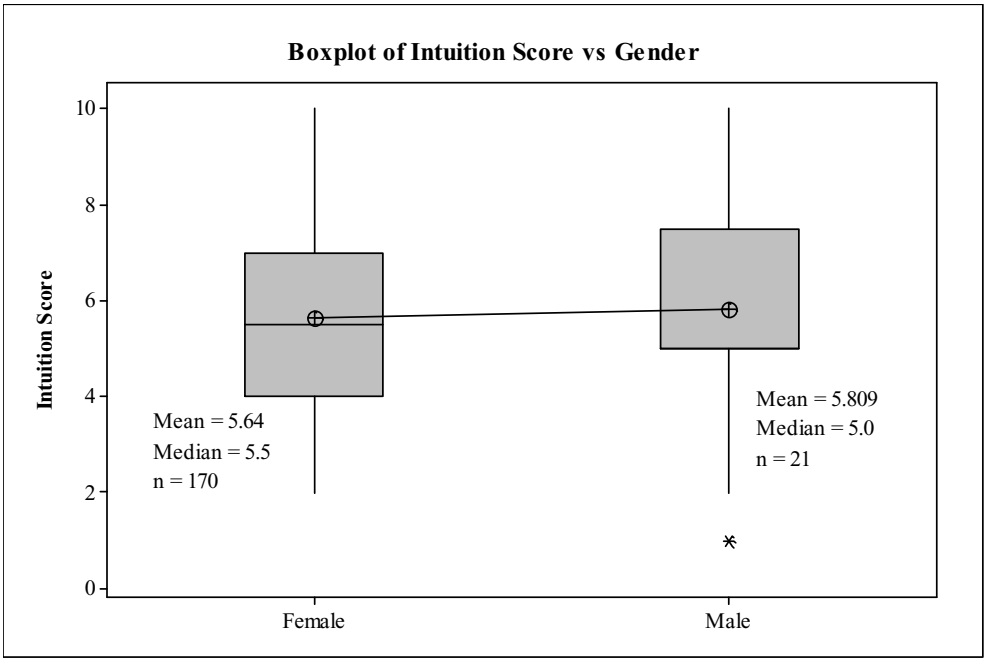

Figure 3. Boxplot of intuition scores by gender.

One difference was noted in stratifying the participants by gender within disciplines. The level of intuition score did differ by disciplines between the groups, $F(7, 51.09) = 7.30$ $p < .05$, and within the groups, F (183, 571.79) = 3.12, $p < .05$ (see Table 9). When stratified by type of error, there was no statistical difference by discipline for AEs (see Tables 10 & 11). Of importance was the statistically significant difference by discipline for NMs (see Tables 12 & 13). This difference noted between AE and NM leads to additional questioning regarding gender and the use of intuition in preventing medical errors.

Table 9

ANOVA by Intuition Score by Discipline

Source	*df*	*Sum of squares*	*Mean squares*	*F*	*p*
Between groups	7	51.09	7.30	2.34	.026
Within groups	183	571.79	3.12		
Total	190	622.88			

Table 10

ANOVA by AE Intuition Score by Discipline

Source	*df*	*Sum of squares*	*Mean squares*	*F*	*p*
Between groups	6	18.08	3.01	0.97	.451
Within groups	97	301.91	3.11		
Total	103	319.99			

Table 11

t Test by AE Intuition Score by Discipline

Type of error	*Sample*	*Sample size*	*M*	*SD*	*t value*	*p value*	*df*
AE	Pharmacy	5	6.80	1.79	1.69	.166	4
	Nursing	92	5.44	1.00			
	Diagnostic imaging	2	7.00	2.83	0.78	.578	1
	Nursing	92	5.44	1.00			
	Physician	2	4.50	3.00	-0.44	.736	1
	Nursing	92	5.44	1.00			
	Physician	2	4.50	3.00	-1.01	.495	1
	Pharmacy	5	6.80	1.79			
	Diagnostic imaging	2	7.00	2.83	0.09	.941	1
	Pharmacy	5	6.80	1.79			
	Pharmacy	5	6.80	1.79	1.00	.500	1
	Diagnostic imaging	2	7.00	2.83			

Table 12

ANOVA by NM Intuition Score by Discipline

Source	*df*	*Sum of squares*	*Mean squares*	*F*	*p*
Between groups	4	34.16	8.54	2.67	.038
Within groups	82	262.19	3.20		
Total	86	296.34			

Table 13

t Test by NM Intuition Score by Discipline

Type of error	*Sample*	*Sample size*	*M*	*SD*	*t value*	*p value*	*df*
NM	Pharmacy	8	7.50	1.69	2.77	.024	8
	Nursing	75	5.74	1.81			
	Diagnostic imaging	2	6.00	0.001	1.21	.230	74
	Nursing	75	5.74	1.81			
	Pharmacy	8	7.50	1.69	23.51	.040	7
	Diagnostic imaging	2	6.00	0.001			

Additional analysis looked at stratifying by gender within the discipline. There was no difference for nursing, $t(-0.38)$, $p = .712$, $df = 15$. However, there was a statistically significant difference within pharmacy by gender, $t(3.94)$, $p = .006$, $df = 7$ (see Figure 4). In addition, there was a statistically significant difference between females when comparing nurses to pharmacists, $t(-8.77)$, $p = .00$, $df = 8$. There was no statistically significant difference between males when comparing nurses to pharmacists, $t(-0.04)$, $p = .969$, $df = 16$. The other disciplines had only females and fewer than 3 participants in each discipline, so a comparison was not possible. The difference in mean intuition scores by discipline posed the following questions: Would teams of health care members have a better sense of intuition that would prevent a medical error from reaching a hospitalized patient? Would the collective intuition of various health care team members who are part of an operating room team have a better sense in order to prevent a medical error than as individuals? Would developing team versus individual intuition provide a stronger base to prevent medical errors? These results are discussed in more detail in chapter 5.

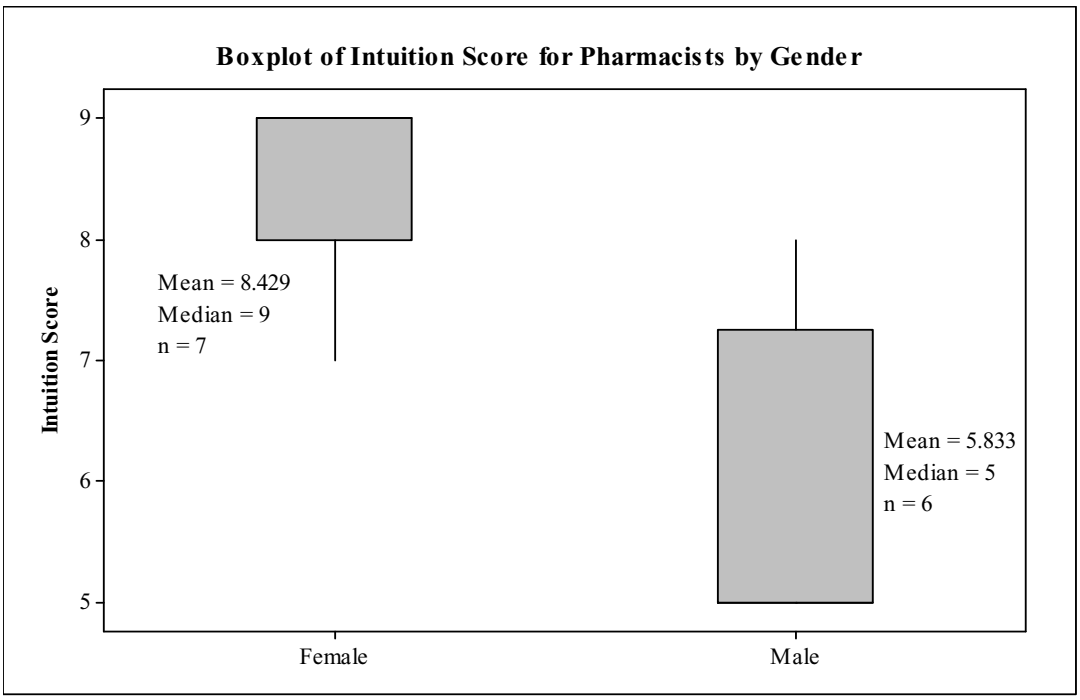

Figure 4. Boxplot of intuition scores for pharmacists by gender.

Research Question 2: Do health care team member's document constructs of intuition when identifying NMs as compared to AEs on UORs?

Hypothesis 3

Issue 3: Is there a difference between the numbers of documented constructs of intuition for AEs versus NMs?

H_{03}*:* There is no difference in the number of documented constructs of intuition for AEs versus NMs.

Issue 3 was answered by comparing the mean number of documented constructs of intuition for voluntarily reported AEs and NMs. Based on the results of a two-sample *t* test using a significance level of .05, the null hypothesis was rejected, $t(\ 2.20)$, $p = .028$,

df = 1444. Therefore, there was a difference between the mean intuition scores of the two groups.

Research Question 3: Are there differences about health care team members at the integrated West Coast health care system who rate higher on the AIM Inventory in preventing medical errors from reaching hospitalized patients?

Hypothesis 4

Issue 4: Is there a difference in the low, medium, and high intuitive scores by age of health care team members who submitted UORs regarding medication-related errors?

H_{04}*:* Not all the population means are equal in the low, medium, and high intuitive scores when comparing the age of health care team members who submitted UORs regarding medication errors.

Issue 4 was answered by conducting a one-way ANOVA to determine whether significant differences existed when comparing the differences among and within population means, in this case, comparing the intuition scores by age of health care team members who submitted UORs regarding medication errors. Based on the results of the ANOVA using a significance level of .05, the researcher failed to reject the null hypothesis. The level of intuition score did not differ by age between the groups, F (5, 19.30) = 3.86 $p < .05$, and within the groups, F (195, 624.32) = 3.20, $p < .05$ (see Table 14).

Table 14

ANOVA by Intuition Score and Age

Source	*df*	*Sum of squares*	*Mean squares*	*F*	*p*
Between groups	5	19.30	3.86	1.21	.308
Within groups	195	624.32	3.20		
Total	200	643.62			

Hypothesis 5

Issue 5: Is there a difference in the low, medium, and high intuitive scores by gender of health care team members who submitted UORs regarding medication errors?

H_{05}*:* There is no difference in the low, medium, and high intuitive scores by gender of health care team members who submitted UORs regarding medication errors.

Issue 5 was answered by comparing the intuition scores of health care team members who submitted UORs regarding medication errors (see Table 15). Based on the results of chi-square using a significance level of .05, the researcher failed to reject the null hypothesis. The level of intuition score (low, medium, and high) did not differ by gender, χ^2 (2, N = 190) = 0.860, p > .05. There is no difference among the mean intuition scores (low, medium, and high) by gender.

Table 15

Chi-Square of Gender and Intuition Score

Gender	Low intuitive score (0-4)	Medium intuitive score (5-8)	High intuitive score (9-12)	Total
Female	47	112	11	170
	45.39	113.04	11.57	
	0.056	0.009	0.028	
Male	4	15	2	21
	5.61	13.96	1.43	
	0.460	0.076	0.227	
Total	51	127	13	191

Chi-Sq = 0.8609
df = 2
p value = .650 (1 cell with expected counts < 5)

Qualitative Analysis

Three different segments of the study were analyzed for narrative content: (a) comments from voluntarily submitted medication-related UORs, (b) narrative comments from the AIM Inventory, and (c) interviews with the participants describing times when medical errors were prevented from reaching hospitalized patients. The narrative comments were analyzed by the researcher using SPSS Text Analysis for Surveys 2.1™ (2006). Text analysis, a form of qualitative analysis, is the extraction of useful information from text (such as open-ended responses) so that the key ideas contained within this text can be grouped into an appropriate number of categories (SPSS).

Once the text was coded and reviewed for face validity (i.e., did the groupings and number of responses seem appropriate versus disproportional), the next step was to use the visualization tool (Category Web) option in the software. This tool allowed the researcher to analyze the categorization results further. The primary function was to

review the category definitions to "uncover categories that were too similar, i.e. share more than 75% of the responses" (SPSS, 2006, p. 101). If the subcategories overlapped greater than 75%, then the categories and definitions needed to be reevaluated by collapsing the overlapping subcategories or refining the existing definitions. This process was used with each of the three data sets.

Separately, the narrative comments from the NM UORs, the AIM Inventory, and the interviews did not have overlapping subcategories. However, there were overlapping subcategories in the AE UOR narratives. The subcategories were all above the threshold of 75%, ranging from 80.3% to 97.8%, which suggested that there was not as much distinction by the health care team members in documenting an AE when a medical error reached a patient. With the regrouping of the subcategories, the four most frequently coded categories overall were hunches, something is wrong, pattern recognition, and gut feeling. This supported Benner's (1984) novice-to-expert model and Gladwell's (2005) thin slicing or pattern recognition.

Examples

The examples documented for the category of Hunches involved clinical situations where medications that should have been administered were not and the hunch or guess of the causative factors proved correct. "I checked the outstanding overdue medication list and found two meds overdue…the previous nurse was unaware these meds had been ordered…I checked the order sheet and then called Pharmacy" (UOR narrative 401). A second example was "I could not tell you what was wrong, I had a

hunch that my patient was going to code and he did later that night" (UOR narrative, 212).

The second highest category, Something Is Wrong, had multiple examples: "a quiet voice in my mind; a red flag 'something is not right" with an accompanying increase in (my) alertness and attention" (AIM Participant 12). A second example was the following:

> The patient did not "look right," but vital signs were stable; (I) told the surgery team they needed to evaluate and look into this further. After persistent discussion, they agreed to see the patient, who quickly decompensated and was rushed to surgery. If I had waited until the vital signs changed, the patient would have been in real trouble. (AIM Participant 97)

Examples of pattern recognition were described as past experiences or, in more detail: "intuitive abilities are based on lots of experience; ability to define patterns, shared observations of details, and quickly analyze the data" (AIM Participant 37). Another participant noted that intuition was "extrapolating from past experience to current problems" (AIM Participant 82). A third example described intuition as, "To be clear, I rarely reply on intuition alone. Intuition is nothing mystical, it is high efficiency processing that relies on all of the salient features, pattern recognition and, embedded repeated experiences, as in Patricia Benner's novice-to-expert" (AIM Participant 99).

Examples of comments coded for the category of gut feeling included, "One time with a patient, all the numbers were good but my observations and 'gut feeling' said otherwise. I called the physician and the patient ended up in ICU" (AIM Participant 21).

A different participant described intuition as, "I can look and my 'gut' does the decision making" (AIM Participant 134).

Of interest, an 11th category emerged containing 36 comments related to prayer and meditation. This was not a construct noted in Agor's (1984) work or in current literature related to intuition. The health care facilities selected for inclusion in this study did have a religious affiliation. This in part may have explained the prayer-related comments. Further study would be needed to understand the significance of prayer and the relationship to intuition including comparing religious and secular health care facilities.

Interviews

Eight health care team members were interviewed about a time when they prevented a medical error from reaching a patient. The interviews were transcribed, coded, and analyzed against Welling's (2005) five phases of intuitive knowledge. Two of the 8 interviews substantiated the phases. In hindsight, the limited interviews were not sufficient to gain adequate information during the interview process.

The researcher's bias was that this would be a straightforward process for the participants. Instead, what was observed was that participants' hesitation and seeming uncertainty how to articulate an example of stopping a medical error from reaching a patient. The interview process was altered to ask the participants not only to describe or define a medical error but also to define intuition. One nurse described intuition as knowledge:

> Then a lot of it is just the knowledge – if you have (a patient with) a GI bleed, you know that they can bleed at any minute. So that you are always on alert for that, you are always on alert for signs and symptoms of that or with a renal patient, their K (potassium) may go up. You are always on alert for things like that, and it becomes a part of your practice. It is part of what I do. (Interview 1)

Another participant talked about the art and science of medicine and described intuition as "a gut sense…not necessarily grounded in science. There is a nagging sense that something just doesn't fit, and it's the intuition that makes you question the science" (Interview 8).

The transcriptions of the interviews were analyzed using SPSS Text Analysis for Surveys 2.1™ (2006). The content was coded against Welling's (2005) five phases of intuition, a process consisting of sequenced phases with increasing amounts of information: detection, dichotomic awareness, related object, metaphorical solution, and explicit verbal understanding. Each phase involves different types of knowledge. Of the content review, only 2 of the 8 health care team members' content depicted all five phases.

First, a cardiovascular nurse described an incorrect surgical consent that was detected and surgery postponed until the correct consent was obtained. This nurse, with 33 years of experience, described three of Welling's (2005) five phases, that is, detection, dichotomic awareness, and related object, in her ability to ascertain and ask questions quickly when something was not right.

> I believe it has served me well through the years just to have the ability to know that I am empowered to ask more questions, to pursue avenues that I might be uncomfortable with, and certainly, I think that serves the nurse well when you have limited time with a patient, especially in the interview process. The sedate

> patient is only in the pre-op holding area 30 minutes, and (the nurse) has to drill down to the problem rapidly because everybody is depending upon everything to align and be accurate; otherwise, it stops the surgery. (Interview 1)

The nurse further articulated the solution and explicit verbal understanding:

> I think it is, ah, professional body of knowledge that you graduate [with]. You [have] a license that says, "Yes I have this amount of knowledge to operate…" on top of that; I believe that it (intuition) is a gift that you cannot teach somebody. Your past; your experience with your family; your culture of growing up; what is OK; the permission inside to say, "I am not comfortable, and I need to check this out." I think the healing arts need to give permission to its providers so that we take the time in our system of business, and certainly, there is more and more to do to and accomplish and to compile with. A person could feel overwhelmed and that to do the right thing to prevail, to take the time out to take the necessary precautions to follow up on the intuitive "I don't feel comfortable here" or this doesn't align or what was this about to feel free to communicate that and then to act on it. And thirdly, to not feel like there is some reprisal or price to pay. (Interview 1)

The nurse articulated the five phases in this example.

A second example came from a perinatologist with 29 years of experience who talked about a time regarding pattern recognition of a baby with a tentative diagnosis of necrotizing enterocolitis:

> I think you have to experiences (to have intuition). It is one of the challenges of health care is that you have to have enough experience to become proficient, and book learning is not enough. So, you have to be able to combine your experience, and that's what makes health care risky for our patients. It is hard to just reproduce all the possible experiences that you are going to see over your career. There are still things that I have never seen, and so the question always is so what would help me in those situations recognize that this is different than anything I have ever seen and that is where you talk with your colleagues. (Interview 4)

Summary

The overall purpose of this exploratory study was to examine the role of intuition in preventing medical errors from reaching hospitalized patients. Tacit knowledge or

intuition is one aspect of knowledge management (Davenport & Prusak, 2000; Nonaka & Takeuchi, 1995). The ability to articulate tacit knowledge, often otherwise unattainable to other team members, into explicit concepts that could potentially prevent a medical error is fundamental to changing the culture of safety within the health care system. The analysis of error reporting, measurement of intuition scores, and interviews with health care team members provided insight into the role of intuition and knowledge of medical error prevention. Voluntarily reported medication-related UORs were analyzed for intuitive content. Narrative documentation was coded, quantified, and compared for constructs of intuition. Seven hundred and ten health care team members who signed the analyzed UORs were sent an AIM Inventory designed to establish their intuitiveness scores. There was a 28% (201) response rate. Five hypotheses were analyzed using *t* test, chi-square, and ANOVA. Interviews were conducted with 8 members of the health care team who talked about times when they had prevented medical errors from reaching hospitalized patients. Their remarks were transcribed, coded, and compared to Welling's (2005) stages of intuition.

There were no statically significant differences when comparing mean intuition scores by type of error; gender; or levels of intuition score (low, medium, or high) by age or gender of participants. There was a difference when comparing the mean number of documented constructs of intuition for AEs and NMs. When the results were stratified by type of error and discipline, there was a difference for NM, pharmacy and nursing, and pharmacy and diagnostic imaging. High-intuitive health care team members' responses

from the AIM Inventory were examined for predictors of intuition and phases of intuition trended in the audio- and videotaped interviews against age, years of experience, discipline, and gender. No differences were found.

Interviews were conducted with health care team members asking them to describe times when they prevented medical errors from reaching hospitalized patients. The purpose was to identify triggers or ideas that may have contributed to stopping the medical errors. The transcribed interviews were coded against Welling's (2005) five phases of intuitive knowledge: detection, dichotomic awareness, related objects, metaphorical solution, and explicit verbal understanding. Two of the 8 participants met Welling's five phases of intuition.

The qualitative analysis of documented comments from the UORs, the narrative from the AIM Inventory, and the interviews showed that intuition is something that the practitioners in this study used and perhaps even underused in daily practice. The most common descriptor noted was a "gut feeling," or pattern recognition, which supported Gladwell's (2005) thin slicing and Benner's (1984) model of novice to expert. The health care team members who participated in the interviews did not readily have stories to describe times when they had prevented medical errors from reaching hospitalized patients. However, when they were asked to talk about intuition in daily practice, they noted that other practitioners used intuition. An observation by the researcher was that the participants found it easier to identify intuition in a colleague than in personal use.

Further research would be needed in this area to more fully understand how intuition is used by health care team members.

The findings from the quantitative and qualitative analysis were integrated to identify the role of intuition in preventing medical errors from reaching hospitalized patients. This exploratory work took an initial examination of the content documented by health care workers on UORs describing both AEs and NMs, comparing mean intuition scores, and analyzing the interviews of health care team members describing NMs.

Chapter 5 is a summary and interpretation of the findings, and offers recommendations for action and future research. Five hypotheses were tested in an effort to understand the differences among the health care team members in preventing medical errors from reaching hospitalized patients. No differences were found when comparing mean intuition scores by type of error and level of intuition score (low, medium, high) by age or gender of the participants. However, there were differences when comparing the number of documented constructs of intuition by type of error and stratifying error type (NM) by discipline, that is, pharmacy to nursing and diagnostic imaging. Of the 8 health care team members who were interviewed and described times when they had prevented medical errors from reaching hospitalized patients, 2 articulated Welling's (2005) five stages of intuition.

CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The researcher, using an exploratory quantitative and qualitative approach, examined the role of intuition in preventing medical errors from reaching hospitalized patients. The purpose of the study was to understand the role of intuition in preventing medical errors from reaching hospitalized patients. Researchers have studied sentinel events and AEs through retrospective review (Bogner, 1994; DeMott, 1995; Fortune & Peters, 1995; Helmreich, 1999).

This study was conceived and developed to add insight into how medical errors are prevented because of the ramifications for society as a whole. As an example, the resources allocated on identifying, analyzing, and correcting medical errors could be spent on providing safer health care to more individuals. If health care team members can identify and prevent medical errors, there may be less need for outside regulatory agencies to mandate measurement, thus providing one area where health care costs might be lowered. Rising health care costs affect the individuals who are the most in need, namely, the vulnerable and the uninsured.

No differences were found when comparing mean intuition scores by type of error; gender; or levels of intuition score (low, medium, or high) by age or gender of the participants. There was a difference, however, when comparing the mean number of documented constructs of intuition for AEs and NMs. When the results were stratified by type of error and discipline, there was a difference for NM, pharmacy and nursing, and pharmacy and diagnostic imaging. High-intuitive health care team members' responses

from the AIM Inventory (Agor, 1984) were examined for predictors of intuition and phases of intuition trended in the audio- and videotaped interviews against age, years of experience, discipline, and gender. No differences were found.

Interpretation of the Findings

Five hypotheses were tested, and data were analyzed from the AIM Inventory (Agor, 1984) in an effort to understand the differences among the health care team members in preventing medical errors from reaching hospitalized patients. The hypotheses included comparisons of (a) intuitive scores grouped by health care team members who reported AEs and NMs; (b) intuitive scores grouped by gender of the participants; (c) number of documented constructs of intuition for AEs and NMs; (d) low, medium, and high intuitive scores by age of participant; and (e) low, medium, and high intuitive scores by gender. A comparison of the participants' ages explored the possibility that the older, more experienced health care team members would be more intuitive. An examination of gender led to the perception that the females in the study were more intuitive than the males. None of the factors that were studied demonstrated any difference between health care team members who voluntarily submitted UORs for either AEs or NMs. The idea that something would emerge as a predictor, such as gender, discipline, or years of experience, seemed plausible when reviewing the work of Benner (1984), Gladwell (2005), Klein (2001), and Welling (2005).

Issue 1: Comparison of Intuitive Scores

The intuitive scores of health care team members who voluntarily reported AEs versus NMs were compared as one mechanism to describe the difference between the two groups. A statistically significant difference between the two groups would have provided one objective point of reference. In chapter 4, the NM group's mean score was 5.843, as compared to the AE group's mean score of 5.50, reflecting a modest difference. Had the NM mean score been higher, it would have coincided with Gladwell's (2005) explanation of thin slicing, or the unconscious mind finding "patterns in situations and behaviors based on very narrow slices of experience" (p. 23). Epstein (1999) described this as knowledge through experience, that is, a "collection of information, intuition, and interpretations that guide professional practice" (p. 834). One possible explanation of a higher mean intuitive score for reported NMs would have been that the health care team member was able to prevent the error by synthesizing didactic knowledge with real-world experience.

A higher AE mean score could have been explained by Klein (2001) as the elusive nature of pattern recognition. He concluded that because patterns can be vague or indistinct, health care team members may have difficulty recognizing them. Only hindsight enables the health care team member to recognize a pattern after the medical error has reached the patient. Because there was not a statistically significant difference between the two groups, one summation would have been that pattern recognition may not play a role in preventing medical errors.

Issue 2: Comparison of Intuitive Scores by Gender

The second comparison included examining the mean intuition scores by gender of health care team members who submitted UORs. The results from chapter 4 showed a modest difference between the mean score of females (5.64) and males (5.804). The debate in the literature has suggested that analytical thought is masculine and intuition is feminine (Dreyfus & Dreyfus; Faugier, 2005). In nursing, a traditionally female-predominant profession, intuition is an implicit, fundamental part of the process (Benner, 1984; Benner et al., 1992; Tanner, 2006). In other words, it is an accepted part of the nursing process. Cappon (1993) asserted that males have less tolerance for the notion of intuition rather than females having a higher intuitive ability.

Based on the results of this small sample size, it appeared that there was no statistically significant difference between genders. Additional analysis looked at comparing gender by low, medium, and high intuition scores. The one exception was the difference found in the subset of pharmacy participants. From the results in chapter 4, the mean score for female pharmacists (8.429) was statistically higher ($p = .006$) than for male pharmacists (5.833). The researcher queried two experienced pharmacy managers who did not participate in the study to see whether an explanation was self-apparent. Both were surprised by the findings mainly because the perceived primary function in pharmacy has to do with facts and data and less with interpretation or feeling. Further research would be needed in this area.

Issue 3: Comparison of Number of Constructs of Intuition

The third area of comparison was the difference between the numbers of documented constructs of intuition for AEs versus NMs. Originally, one thought had been that an early predictor in understanding an NM would be how the health care team member documented the event. The thought was that there would be a higher number of constructions of intuition documented about an NM. The idea seemed plausible that a health care team member would describe an NM in terms of hunches, namely, that something was wrong, or pattern recognition. The results in chapter 4 depicted a statistically significant difference ($p = .028$) in the number of documented constructs of intuition. It was noted that 2 of the 10 constructs of intuition, namely, hunches and something is wrong, both had the highest number of coded responses from the review of the UOR narrative responses. At some basic level of analysis, this would seem innately true because the health care team member was documenting an actual or a potential medical error.

Issue 4: Differences Among Low, Medium, and High Intuition Scores by Age

The next issue examined if a difference existed between health care team members with low, medium, and high intuition scores by age. The literature suggested that health care team members with more experience would have more ability in recognizing a potential problem or a medical error (Benner, 1984; Mezirow & Associates, 2000; Schön, 1983). One proxy for more experience is examining the age of the health care team member. For example, a 22-year-old would not have the same

experiences as a 56-year-old health care practitioner, both in life and work experiences. Bastick (1982) noted that the "process of intuition is not a linear step-by-step process, but a global nonlinear process using information from global perception" (p. 172).

The ANOVA compared the differences among and within population means intuition scores by age of the health care team members who submitted UORs regarding medication errors. No differences between the groups were found. This was somewhat surprising. Klein (2001) summarized intuition as how an individual transforms experience into action, stating that "it is a set of hunches, impulses, insights, gut feelings, anticipation and judgments stemming from previous events in the person's life" (p. 293). This would lead to a conjecture that as an individual gains more experience over time, or as the individual becomes older, intuition would evolve. Bastick (1982) supported this idea in comparing low-intuitive types to high-intuitive types when he observed that low-intuitive types lacked the confidence to make decisions and demanded more information before making a decision.

Issue 5: Differences Among Low, Medium, and High Intuition Scores by Gender

The final issue examined if there was a difference in the low, medium, and high intuitive scores by gender of the health care team members. Based on the results of chi-square, no difference was noted among the mean intuition scores (low, medium, and high) by gender. This was consistent with the results in comparing intuition scores by gender.

Interviews

The most noticeable trait among the 8 health care team members who were interviewed was their hesitancy to acknowledge the role of intuition in their practices. This was repeated in several of the interviews and summarized the most clearly in the final interview:

> I think we can train people on the science (of health care), [but] it is really hard to understand the art or the intuition side, and because we do not understand it very well, we have a very hard time training people on it. And, in fact, we don't – we barely even talk about it anymore. (Interview 8)

Conclusions

The first conclusion is that intuition does play a role in health care team members' daily activities. The acknowledgement and use of intuition varies between disciplines. In this study, health care team members who voluntarily submitted AE UORs documented more constructs of intuition than health care team members who submitted NM UORs. Experienced health care team members who were asked to talk about intuition in daily practice found it easier to describe how other practitioners used intuition rather than talk about personal use. A number of supplementary questions arose: Do the health care team members sense that something is wrong, but do not act on or have knowledge about the medical error in time? Are they not empowered to stop or prevent a medical error? Only 2 of the 8 health care team members who were interviewed articulated all five of Welling's (2005) phases of intuition, yet each person articulated the use of intuition. Is that because the health care system does not recognize, understand, or utilize intuition to the fullest potential?

The second conclusion is that the concept of intuition in daily practice needs to have more emphasis in the curriculum for all employees. If experienced health care team members had difficulty articulating the use of personal intuition, perhaps insufficient time has been allotted in school- and work-related curricula to concentrate on the concept. This externalization of moving from tacit to explicit knowledge needs to be developed and incorporated into academic curriculum (Nonaka & Takeuchi, 1995). The notion of assimilating intuition into work-related curriculum could be accomplished in a variety of ways.

Schön's (1983) perspective of incorporating intuition would see health care team members being dependent upon skill-based performance, tacit recognition, and personal judgments, even in the face of evidence-based research. For nursing, Benner (1984) described this as the time of joining theoretical knowledge with life experiences, thus changing the individual's perspective. Mezirow and Associates (2000) theorized that individuals create structure or make meaning from experiences based on the centrality of experience, critical reflection, and rational discourse in order to avoid chaos. What three ideas have in common is the empowerment of the individual practitioner to take control of a situation to determine a different outcome.

The third conclusion is that team versus individual intuition may better serve to prevent medical errors from reaching hospitalized patients. The scope of this research was to examine the role of intuition in preventing medical errors. Although not clearly articulated, the assumption was to study individual intuition versus team intuition. The

results demonstrated a difference between pharmacy and nursing, in particular female pharmacists. Instead of focusing on the individual's use of intuition, studying and developing team intuition may better serve health care in general. This is evidenced in the team-based learning model used at Baylor College of Medicine that encompasses individual versus group accountability, the necessity for group interaction, and the motivation to engage in give-and-take discussion (Michaelsen, Fink, & Knight, 1997). This is an example of how teams become empowered to change the face of health care. The sequel to this initial research would be to use the same hospital setting to study where team intuition exists as part of the existing culture.

Recommendations for Action

Based on this research, curriculum for students, residents, and new employees should have time allotted to teaching not only the science but also the art of health care in the form of intuition, and what that means for health care team members as individuals and as part of a team. This could be accomplished through curriculum and mentoring on critical-thinking skills, team building, and critical conversations between and among team members. Storytelling is an example of how to disseminate such learnings. Denning (2001) commented, "Storytelling enables the individuals in an organization to see themselves and the organization in a different light, and accordingly take decisions and change their behavior in accordance with this new perceptions, insights, and identities (pp. xiv-xv). This would need to be supported by senior administrative and physician leaders as a change in the culture for the organization. However, it is not merely getting

the right information or knowledge to individuals, there is the additional step of engaging the individuals to learn and make use of the knowledge (J. Thomas et al., 2001).

One model for leading this transformational change would be to use principles from Bridges (2003) or Kotter (1996). Enabling a sense of urgency to use intuition in the daily practice of health care team members can be accomplished by presenting a burning platform for change; in this case, it is the prevention of medical errors from reaching hospitalized patients. The guiding coalition would be the senior administrative and physician leaders, who would create, communicate, and empower health care team members to use intuition in the same way as they currently use evidence-based medicine. This type of change would require senior leaders to seek out and reward individuals or teams for incorporating the use of intuition into daily practice. The credibility to change current processes, from didactic learning only to incorporating experiences into daily practice, leads to institutionalizing intuition as an acceptable and expected form of practice. Examples of this are seen in national patient safety activities, such as situational awareness, crucial conversations, TeamSTEPPS™, or handovers (Joint Commission, 2007d; U.S. Department of Defense, 2008). In this case, it would be moving from the explicit to tacit knowledge or internalization. “When experiences through socialization, externalization, and combination are internalized into individuals’ tacit knowledge bases in the form of shared mental models or technical know-how, they become valuable assets” (Nonaka & Takeuchi, 1995, p. 69).

Recommendations for Further Study

Further research is needed to understand in more detail what happens when health care team members prevent medical errors from reaching hospitalized patients. Five potential topics for future study arose from this research. The first would be to understand the significance of prayer as a construct of intuition and its relationship to intuition. Of interest would be to compare religious versus secular health care facilities. Another area of study would be to understand how health care team members use intuition on a daily basis. This would require interviews, direct observations, and the mapping of individuals' critical-thinking processes.

The third would be to study the differences between and among disciplines, for example, pharmacy, nursing, or diagnostic imaging, regarding the use of intuition. The fourth idea would be to see how storytelling impacts health care team members' utilization of intuition in their daily practice. Storytelling or sharing knowledge as an informal and economical knowledge management system can be utilized across disciplines, departments, and units as part of an organizational strategy (Denning, 2001; Snowden, 2000). Finally, although the study sample was small, further research by patient safety advocates in health care should continue to examine documented comments in UORs and differences between pharmacy and other disciplines regarding the use of intuition.

Social Change Implications

Health care is a dynamic organism that is constantly growing and evolving. Technological innovations occur daily, new medications are approved and added to hospital formularies, advances in evidenced-based medicine are widespread in the literature, and new equipment is available. All of these enhancements contribute to societal expectations that most disease states are fixable. However, advances can come with a price, which often is the sacrifice of time and knowledge, which leads to an unsafe health care environment. Between 44, 000 and 98,000 people die each year as the result of medical errors (Kohn et al., 2000). The cost associated with these errors surpasses $29 billion annually (Al-Assaf, Bumpus, Carter, & Dixon, 2003). The normalized deviance of this high cost of medical errors has led to regulatory requirements with attached financial incentives.

The Centers for Medicare and Medicaid Services (CMS) and the Joint Commission have formalized the societal demands on health care to improve patient safety. Effective October 1, 2008, the CMS no longer paid for preventable errors and never events that occur during a hospitalization, such as patient falls, hospital-acquired pressure ulcers or infections, or retained foreign bodies after a surgical procedure. This lack of reimbursement will affect health care. Senior leaders are actively seeking ways not only to quantify the number of never events but also to prevent medical errors. This is Christensen's (1997) idea of a disruptive innovation that causes a shift in the customary health care models to sufficiently cause social change.

On way to prevent medical errors is to place a greater emphasis on the role of an NM. One strategy may be to model the health care industry's culture after other high-risk industries such as aviation (Al-Assaf et al., 2003). This means not only creating a mechanism for reporting medical errors but also establishing a culture that seeks to balance the need to learn from mistakes while holding individuals accountable for actions outside of established norms and standards (Behal, 2004; Bogner, 1994; Morath & Turnbull, 2005; Rosenthal & Sutcliffe, 2002). This includes empowering the health care team members to participate more openly in acknowledging and managing medical errors.

Empowerment is a dynamic process that is part of building self-confidence for the individual or the team. Schön (1983) described this as when the individual begins to trust the internal mechanism of incorporating skills, tacit recognition, and personal judgment. To trust personal judgment in the face of evidence-based research takes an empowered individual. Some find it easier to dismiss the use of intuition, to not trust that internal instinctual knowledge, especially when faced with group think or traditional practices. Empowering the individual or the team to trust and use intuition is part of shedding the feelings of powerlessness or resignation. Changing the structure of how health care team members learn to incorporate skills, namely, tacit recognition, intuition, and personal judgment, is part of helping to eliminate the feelings of powerlessness or resignation as to why medical errors occur. The potential benefits to society include financial savings by

preventing costly errors and rework, and safer health care systems that reduce or eliminate medical errors, all of which contribute to better care for patients.

Reflection on the Researcher's Experience

Although not as much new knowledge was forthcoming from the actual proposal, there was much learning regarding the research process. Several factors come to mind about the design of the study. For example, a pilot of the design would have been beneficial in tightening the scope and focusing the work. Having a small sample size to test the AIM Inventory (Agor, 1984) results would have aided in setting up the database and running the statistical analysis. Piloting the data collection process would have improved the actual tools sent to the participants. There was insufficient room on the inventory for the comments by participants. A pilot would have revealed this shortcoming, and adjustments could have been made prior to the actual data collection.

Piloting the interviews would have smoothed the transition of the researcher in reordering the interview questions. This may have solicited more in-depth comments from the health care team members. Having a larger sample size to interview would have been helpful. Klein's (2001) methodology of direct observation and interviews would have gained additional insights and knowledge into the role of intuition in preventing medical errors. The learnings for the researcher would have been that a basic interview for such a complex subject matter is an insufficient methodology.

Piloting the interviews also would have provided the researcher with information to ask different research questions. Using the interviews as a pilot would have suggested

that asking more direct questions about the participants' personal beliefs regarding intuition and setting the questions up using Welling's (2005) five phases could have provided more in-depth information from the participants. Recommendations to improve on this study include having a larger sample size; piloting the entire research design; focusing more on direct observations, along with interviews, to glean more knowledge about the process of intuition; expanding the scope to investigate individual versus team intuition; and creating a subset of health care team members to interview, namely, those individuals who received low intuitive scores versus high intuitive scores.

Summary

Preventing medical errors from reaching hospitalized patients is a fundamental aspect of providing safe patient care. Human and systems errors occur at a greater rate each year. Finding ways to prevent medical errors from occurring is important to health care team members as well as society as a whole. This study began an exploration into the role of intuition in preventing medical errors.

No differences were found when comparing mean intuition scores by type of error and level of intuition score (low, medium, high) by age or gender of the participants. There were differences when comparing the number of documented constructs of intuition by type of error and when stratifying error type (NM) by discipline, that is, pharmacy to nursing and diagnostic imaging. Eight health care team members were interviewed to describe times when they prevented medical errors from reaching

hospitalized patients. Two of the 8 participants articulated Welling's (2005) five stages of intuition.

Further research is needed to understand how health care team members use intuition daily. Studies might include interviews, direct observations, as well as the mapping of the individuals' critical-thinking processes. Additional study is needed to understand the differences between and among disciplines in the use of intuition to prevent medical errors. Future studies may investigate the similarities and differences in team intuition versus individual intuition in preventing medical errors from reaching patients. This research is important for patient safety advocates, risk managers, administrators, and physician leaders within health care. The information and support for further research should be disseminated through professional journals, conferences, or national organizations.

Encouraging health care team members to use intuition changes the culture of safety within an organization by explicitly stating the expectation of senior leaders and mangers for the individual to internalize policy, procedures, and evidence-based practice with critical thinking and experience. The empowerment of the individual to incorporate didactic learning and experience with the reflective judgment of intuition will lead to significant change regarding patient safety. One small aspect of learning to trust and use intuition can lead to positive change and outcomes in health care.

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APPENDIX A: LEVELS OF BEHAVIORS INVOLVED IN ERRORS

Skill-based performance (Reason, 1990)	
Inattention: Double-capture slips Omissions following interruptions Reduced intentionality Perceptual confusions Interference errors	Over attention: Omissions Repetitions Reversals
Rule-based performance	
Misapplication of good rules: First exceptions Countersigns and non-signs Informational overload Rule strength General Rules Redundancy Rigidity	Application of bad rules: Encoding deficiencies Action deficiencies: Wrong rules Inelegant rules Inadvisable rules
Knowledge-based performance	
Selectivity Out of sight, out of mind Overconfidence Illusory correlation Problems with causality Problems with complexity Problems with delayed feed-back Insufficient consideration of processes in time Difficulties with exponential developments Thinking in causal series not causal nets Thematic vagabonding Encysting Workspace limitations Confirmation bias Biased reviewing Halo effects	

APPENDIX B: ERROR CLASSIFICATION

	Rasmussen (1982) Nuclear power	Reason (1990, 1997) High technology	Comparison
Characteristics of Human Error		Questions whether or not a person is engaged in problem solving at the time an error occurred.	
Skill-based behavior	Most basic level of human performance, used to complete familiar and routine tasks that can be carried out smoothly in an automated fashion without a great deal of thought. Individual is looking for pattern recognition.	Slips and lapses occur when automatic behavior is interrupted, or are due to a lack of attention by an individual, or to execution failure.	Reason differentiated from Rasmussen's work by categorizing this as slip or lapse: (a) using the terms interchangeably and (b) attributing a lesser degree of severity than a mistake.
Rule-based behavior	More complex or less familiar tasks carried out according to a set of stored rules; requires knowledge of existing rules or norms.	Rule based with memory slips in procedural recall; requires existing knowledge.	Definitions are comparable.
Knowledge-based behavior	Adopted when a completely novel situation is presented for which no stored rules exist, oral or written, requires a plan of action to be formulated; changes frequently; dependent on situational knowledge.	Knowledge based is when a unique situation is presented; no known rules exist; dependent on situational knowledge generally oral tradition such as tacit knowledge.	Reason viewed all mistakes as knowledge based.

APPENDIX C: UOR FORM

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INFORMATION WITHIN THIS DOCUMENT IS PRIVILEDGED AND CONFIDENTIAL UNDER ORS 41.675
RELATING TO QUALITY ASSURANCE OF MEDICAL STAFF PHYSICIANS

PROVIDENCE UNUSUAL OCCURRENCE REPORT

Date of Event (MM/DD/YY) ___ / ___ / ___

Time (24-Hour) ___ : ___

Reported Location

○ Medford ○ Milwaukie ○ Newberg ○ Portland ○ Seaside ○ St.Vincent

Patient Imprint (Account # and Medical Record #)

MEDICATION-TRANSFUSION-IV *(Choose one)*

○ Omission ○ Wrong Time ○ Wrong Preparation ○ *Adverse Reaction (Call x51529)
○ Wrong Drug ○ Wrong Route ○ Infiltration/ Phlebitis ○ Wasted Blood/ Blood Products
○ Wrong Dose ○ Wrong Rate ○ Contra-Indication ○ Incomplete Documentation
○ Wrong Patient ○ Wrong Solution ○ Narcotic Count Related ○ Other

Route *(Choose One)*

○ IM/SubQ ○ IV ○ PO ○ Topical ○ Epidural ○ N/A - Other

Possible Causes *(Choose all that apply)*

○ Illegibility ○ Similar Appearance ○ Poor Veins
○ Miscommunication ○ Patient Transfer ○ Transfusion
○ Transcription Error ○ Similar Med Name ○ Allergy
○ Order Overlooked ○ Incorrect Label ○ Pharmacy Dispensing
○ Incomplete Order ○ Patient Info Missing ○ Equipment Related
○ Outdated Order ○ Wrong Solution ○ Policy/Procedure Not Followed
○ Duplicated ○ Wrong Rate ○ See Narrative

Please list medication name(s) on the back of this form

FALL *(Choose one)*

○ From Commode/ Toilet ○ From Bed
○ From Walk/Stand ○ Visitor Fall
○ From Chair/Stool ○ Other
○ From Wheelchair

Conditions *(Choose one from each partition below)*

○ Observed or ○ Not Observed
○ Risk Asmt Complete or ○ No Risk Asmt
○ Fall Precautions or ○ No Fall Precaution
○ Assisted Fall or ○ Not Assisted
○ Assessed At Risk or ○ Assessed Not At Risk
○ Restraints or ○ No Restraints

Possible Causes *(Choose all that apply)*

○ Attempt to Bathroom ○ During Transfer
○ Walking Unassisted ○ Tripped/Slipped
○ Reaching for Object ○ Wet Floor
○ Altered Mental Status ○ See Narrative
○ Collapsed/Fainted

Please select a fall outcome on the back of this form

TREATMENT RELATED *(Choose one)*

○ Omitted ○ H & P Issue ○ Contamination
○ Delayed ○ Count Discrepancy ○ Unattended Delivery
○ Incorrect ○ Procedural Complication ○ Unexpected Death
○ Wrong Patient ○ Skin Issue ○ Injury
○ Wrong Site ○ Latex Sensitivity ○ Other

Related To *(Choose one if applicable)*

○ Consent ○ Anesthesia/ Surgery ○ Scheduling ○ Documentation ○ Lab ○ Nutrition ○ Respiratory Therapy

Possible Causes *(Choose all that apply)*

○ Miscommunication ○ Missing Document ○ Lack Training/ Education
○ Order Overlooked ○ Patient Placement ○ Lacking/Inadequate Policy/Procedure
○ Misinterpretation of Results ○ Bed Unavailable ○ Policy/Procedure Not Followed
○ Specimen Lost/ Misidentified ○ Surg/Invasive Proc. Verification ○ Positioning
○ Improper Preparation ○ Burn ○ See Narrative
○ Equipment

EQUIPMENT/ SUPPLIES *(Choose one)*

○ Improper Disposal ○ Malfunction
○ Incorrect ○ Other
○ Not Available

Possible Causes *(Choose all that apply)*

○ Lack Training/ Education ○ Misuse
○ Defective ○ See Narrative

Initiate SMDA Protocol for Equipment Malfunction

Equipment Identification *(if applicable)*

Bio-Med Initial
Manufacturer
Product Name
Serial #

BEHAVIORAL *(Choose one)*

○ Physical Abuse/Threat ○ Trespassing ○ AMA ○ Contraband Drugs/Weapons
○ Unable to Contact Physician ○ Suicide Attempt ○ Complaint ○ Other Contraband (Not drugs/weapons)
○ Legal Action/ Threat of Action ○ Verbal Abuse ○ Sexual Abuse ○ Other
○ Self Inflicted Injury/Threat ○ Elopement/Attempt ○ Sexual Contact Between Patients

Possible Causes *(Choose all that apply)*

○ Dissatisfaction with Personnel ○ Adequacy of Search ○ Elopement Risk Precautions
○ Dissatisfaction with Treatment ○ Entry Door Visibility/Adequacy ○ Visitor Precautions
○ Under Chemical Influence ○ Normal Hardware/ Furnishings ○ Safety Risk
○ Altered Mental Status ○ Pt Observation Frequency/Intensity ○ See Narrative
○ Care Planning Process

LOSS - ENVIRONMENT - SAFETY *(Choose one)*

○ Lost/Damaged/Stolen ○ Exposure ○ Other
○ Environmental ○ Signage Not Used

Property *(Choose one)*

○ Individual ○ Institutional

Possible Causes *(Choose all that apply)*

○ Hazardous Material ○ Odor/Fumes ○ See Narrative
○ Unsecured/ Misplaced ○ Protocol/Policy not followed

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Name of Medication(s) *(if applicable - attach list if more than 3)*

1 | 2 | 3

Reporter's Narrative of Occurrence: *If Adverse Drug Reaction, call regional hotline x 51529

How could this incident have been prevented?

For Falls, list specific interventions used or tried prior to fall.

Please list any contributing factors that may have played a role in this incident:
(Choose all that apply)

○ Distraction ○ Frequent Interruptions ○ Noise ○ Other
○ Lighting ○ Miscommunication ○ Fatigue/Scheduling Comments:

Physician Notified ○
Name of Person Reporting: _____ Witness, *(if applicable)*: _____

OUTCOME OF OCCURRENCES

Choose One Outcome
For fall types, choose from F1 - F5
For all other types choose from A - I

No Incident	A ○ Events have the capacity to cause incident.	
Error/No Harm	B ○ Error occurred but did not reach the person.	
	C ○ Error reached the person but did not cause harm	
	D ○ Resulted in need for increased person monitoring	F1 ○ Fall ~ No Injury
Error/Harm	E ○ Resulted in need for treatment or intervention	
	F ○ Resulted in initial or prolonged hospitalization	F2 ○ Fall ~ Minor Injury - resulted in application of dressing, cleaning wound, ice, limb elevation or topical medication
	★G ○ Resulted in permanent person harm	★ F3 ○ Fall ~ Moderate Injury - resulted in suturing, steri-strips, fracture, or splinting
	★H ○ Resulted in near-death event (e.g. anaphylaxis, cardiac arrest).	★ F4 ○ Fall ~ Major Injury - resulted in surgery, casting, or traction
Error/Death	★I ○ Resulted in person death	★ F5 ○ Fall ~ Death - the patient died as a result of the fall

★ Notify QM by telephone

Manager/Designee Action/Conclusion: *(must complete)*

1. *Review both sides of form for accuracy and completeness.*
2. *Please indicate the action(s) that you will take or have taken:*

○ Review event/educate at unit/dept meeting
Follow Up With Involved personnel
○
○ Discussed/routed to other department manager for FYI & /or action.
Dept

○ Reimbursement requested
○ Policy/Procedure in place but not followed
○ SMDA related
○ Referred to Clinical Engineering/Biomed
○ Investigation in progress

○ Notified QM/RM
○ No further action
○ Other (please explain)

Please return to QM within 14 days of occurrence

Manager/ Designee Name Dept. Date / /

QM/RM Comments *(if applicable)*:

Signature: Date / /

(Used with permission, M. Graham, personal communication, July 24, 2007)

APPENDIX D: AGOR'S INTUITIVE MEASUREMENT INVENTORY

Part I: Your intuitive ability

1) When working on a project, do you prefer to:
   a) Be told what the problem is, but left free to decide how to solve it?
   b) Get very clear instructions about how to go about solving the problem before you start?

2) When working on a project, do you prefer to work with colleagues who are:
   a) Realistic?
   b) Imaginative?

3) Do you admire people most who are:
   a) Creative?
   b) Careful?

4) Do the friends you choose tend to be:
   a) Serious and hard working?
   b) Exciting and often emotional?

5) When you ask a colleague for advice on a problem you have, do you:
   a) Seldom or never get upset if he/she questions our base assumptions?
   b) Often get upset if he/she questions your basic assumptions?

6) When you start your day, do you usually:
   a) Seldom make or follow a specific plan to follow?
   b) Make a plan first to follow?

7) When working with numbers, do you find that you:
   a) Seldom or never make factual errors?
   b) Often make factual errors?

8) Do you find that you:
   a) Seldom daydream during the day and really don't enjoy doing so when you do it?
   b) Frequently daydream during the day and enjoy doing it?

9) When working on problem do you:
   a) Prefer to follow the instructions or rules when they are given to you?
   b) Often enjoy circumventing the instructions or rules when they are given to you?

10) When you are trying to put something together, do you prefer to have:
    a) Step-by-step written instructions on how to assemble the item?
    b) A picture of how the item is supposed to look once assembled?

11) Do you find that the person who irritates you *the most* is the one who appears to be:
    a) Disorganized?
    b) Organized

12) When an unexpected crisis comes up that you have to deal with, do you:
    a) Feel anxious about the situation?
    b) Feel excited by the challenge of the situation?

Part II: Do you use your intuitive ability to make important decisions?

13) Do you believe that you use intuition frequently to guide your most important decisions? (Check one)
    Yes _____ No _____

14) If yes, in which circumstances or situations do you use your intuition to make your most important decisions? (Circle the letter(s) of all choices that apply.)
    a) Where there is a high degree of certainty
    b) Where there is littler previous precedent
    c) Where variables are less scientifically predictable or where "facts" are limited
    d) Where there are several plausible alternative solutions to choose from with good arguments for each
    e) Where time is limited and there is pressure to be right
    f) Other (specify) _____

15) What kind of feelings or signals do you get when you "know" that a particular decision is "right"? What do you rely on for cues? (Circle the letter(s) of all choices that apply.)
    a) Excitement
    b) Warmth
    c) Peaceful/calm
    d) High energy
    e) Sudden flash of insight
    f) Other (specify) _____

16) Give an example (or two) of a very important decision where you followed your intuition and it proved to be the "right" decision.

17) What feelings or signals do you get when you "know" you are heading in the wrong direction or should delay your decision for a while? (Circle the letter(s) of all choices that apply.)
   a) Anxious
   b) Upset stomach
   c) Mixed or conflicting signals
   d) Other (specify) _____

18) What kinds of condition have obstructed the use of your intuition in important decision-making situations? (Circle the letter(s) of all choices that apply.)
   a) When angry
   b) Under Stress
   c) Too ego involved in the decision
   d) Rushed my decision
   e) Lack of confidence
   f) Other (specify) _____

19) Did you tend to "keep it a secret" that you use intuition to make decisions, or do you feel comfortable sharing the fact with others? (Check one).
   Keep it a secret _____ Share with others _____
   Please explain _____

20) When using your intuition to make a decision, where have you found it functions best? (Circle the letter(s) of all choices that apply.)
   a) At the very beginning when I am trying to assess the future or the options available to me
   b) At the very end when I am trying to sift through and digest all of the cues and information available to me
   c) It really varies depending on the problem or issue at hand (Specify)

21) When making a major decision, do you use any particular technique or method(s) to help draw on your intuitive ability more effectively? (Check one).
   Yes _____ No _____
   If Yes, please describe _____

22) Do you use or regularly practice any particular technique or method(s) to help develop further your intuitive ability?
   Yes _____ No _____
   If Yes, please describe _____

J. Harper (Used with permission, personal communication, July 25, 2007)

APPENDIX E: DEMOGRAPHIC INFORMATION

1. Age _____

2. Gender: Female _____ Male _____

3. Discipline:

    Diagnostic Imaging _____

    Laboratory _____

    Nursing _____

    Nutritional Services _____

    Pastoral care _____

    Pharmacy _____

    Physician _____

    Rehabilitative Therapies _____

    Respiratory Therapy _____

    Other _____

4. Educational preparation (highest level achieved) _____

5. Number of years licensed _____

6. Number of years worked at XXX _____

APPENDIX F: LETTER OF PERMISSION

From: Cancio, Julie [mailto:Julie.Cancio@sagepub.com] On Behalf Of permissions
Sent: Wednesday, July 25, 2007 11:54 AM
To: Savage, Lynette
Subject: RE: Question

Dear Ms. Savage,

Thank you for your request. Please consider this written permission to use the material detailed below in your dissertation. Proper attribution to the original source should be included. This permission does not include any 3rd-party material found within our work. Please contact us for any future usage or publication of your dissertation.

Best wishes,
Julie

Julie Cancio Harper
Senior Permissions Editor
SAGE Publications, Inc.
2455 Teller Road
Thousand Oaks, CA 91320
Phone: (805) 410-7735
Fax: (805) 376-9562
Julie.Cancio@sagepub.com

APPENDIX G: COVER LETTER AIM INVENTORY

Informed Consent Statement: The role of intuition in preventing medical errors

Dear _____,

My name is Lynette Savage. I am nurse and doctoral student working in the XXX Service Area to find ways to help XXX to improve patient safety. From my observations in working with teams throughout our system, I have questioned the role of intuition in preventing medical errors from reaching hospitalized patients. Of particular interest is in medication related errors. I received permission from Glenn Rodriguez, MD, chief medical officer, to begin analyzing medication-related unusual occurrence reports (UORs) submitted from the three hospitals.

Six months of UORs related to medication errors have been analyzed for intuitive content. Your name was selected from the UORs submitted and analyzed, and so you are being asked to take part in a research study examining the role of intuition in preventing medical errors. If you agree to take part in this study, you were asked to complete a survey related to individual levels of intuition in decision making.

The survey takes about 15 minutes of your time and will not interfere with normal work activities. An enclosed envelope is provided to return the completed survey. There are no foreseeable risks to participants associated with this study. Completing the survey is voluntary. If you decide not to take part in this study, it will not affect your relationship with XXX. You will not be paid for completing and returning the survey.

Your responses will be compared to those of other health care team members to establish aspects of intuition related to the prevention of medication errors (NMs). If you complete the survey, your identity will be kept confidential. Your anonymity will be maintained to the degree possible. All data were held in confidence and remain with the investigator.

If you have questions or concerns, you may contact me, Lynette Savage, at (XXX) XXX-XXXX, or the dissertation chair, Dr. David Metcalf via email at david.metcalf@waldenu.edu. You may also contact the XXX Institutional Review Board at (XXX) XXX-XXXX if you have questions or comments regarding your rights as a research participant. You may request a copy of the results of this research. The findings were used to try to help prevent medical errors.

Sincerely,

Lynette Savage, RN, MS, CPHQ
Project Manager, Black Belt

APPENDIX H: REMINDER E-MAIL FOR SURVEY PARTICIPANTS

TO:
FROM: Lynette Savage
Date:

Regarding: Completing Survey - Intuition and Preventing Errors

Earlier this week, you received a cover letter, survey, and return envelope asking you to participate in a research study on intuition and preventing errors from reaching hospitalized patients. I am nurse working in the XXX Service Area to find ways we as an organization can improve patient safety based on my observations in working with teams throughout our system.

You are being asked to complete a survey related to individual levels of intuition in decision making as part of a study examining the role of intuition in preventing medical errors. Six months of UORs related to medication errors have been analyzed for intuitive content. Your name was selected from the UORs submitted and analyzed to complete the survey. I have attached a copy of the survey. Please print and complete this survey. You can inter-office mail your completed survey to Lynette Savage, XXXXX, MOB Suite 835. The survey will require 15 minutes of your time. You are not required to complete this survey.

Thank you so much for your willingness to participate. Finding ways to keep patients safe is a top priority. The XXX Institutional Review Board has approved this study.

APPENDIX I: INFORMED CONSENT

Informed Consent Statement: The role intuition plays in preventing medical errors

Informed Consent for a Research Study

Study Title: Intuitive Decisions as a Means of Preventing Medical Errors

Principal Investigator: Lynette Savage, MS, BSN, BS, CPHQ

Introduction and Purpose

You are being asked to take part in a research study. The purpose of this study is to explore the role of intuition in preventing medical errors from reaching hospitalized patients. If you decide to take part in this research study, you will be interviewed by Lynette Savage, R.N., a doctoral candidate at Walden University. The interviews will be unstructured, which means that there is no script of questions. If you agree to it, the interviews will be audio- videotaped, and will take about 30 minutes of your time. The interviews will not interfere with normal work activities. Also, you may choose whether the audio or videotaped segments can be used for research, presentation, publication, or research purposes only.

Your responses will be qualitatively compared to those of other health care team members to establish aspects of intuition related to NMs. Your precise responses will be edited so that your position and affiliation with the institution will not be recognizable, if you so choose. Your anonymity will be maintained to the degree possible. All data were held in confidence and remain with the investigator.

If you are interviewed, you will be asked questions regarding experiences in stopping or preventing a medical error from reaching a hospitalized patient. Please keep in mind our duty to protect patient privacy, since there may be a temptation to talk about the patient by name or some other individual identifier. This is a reminder of identifiers that cannot be associated with the information you are about to provide:

1. Patient name;
2. Street address, city, county, precinct, state, zip code, or the equivalent geocodes;
3. All elements of dates directly related to an individual, including birth date, admission date, discharge date, date of death;
4. Telephone or fax numbers;
5. Electronic mail addresses;
6. Social Security numbers;
7. Medical record number;
8. Health plan beneficiary numbers;
9. Account numbers;
10. Certificate/license numbers;

11. Vehicle identifiers, serial numbers, or license plate number; or
12. Device identifiers.

If you do identify any patient by one of the items listed above, the researcher will remove the identifier at the time of transcription before the data are analyzed. The researcher will be the only person transcribing the tapes.

Risks

There are no foreseeable risks to participants associated with this study.

Benefits

You may or may not benefit from taking part in this research. The findings from these interviews will contribute to a fuller understanding of traits or activities of health care team members in preventing medical errors and will be used to help others involved in patient safety-related activities.

General Information

Your participation is voluntary. If you choose not to take part in this study, it will not affect your relationship with XXX. If you choose to take part, you may withdraw from this study at any point without reprisal. You will not be paid for taking part in this study.

If you have questions or concerns, you may contact the researcher, Lynette Savage at (XXX) XXX-XXXX, or the dissertation chair, Dr. David Metcalf, via email at david.metcalf@waldenu.edu. If you have questions or comments regarding your rights as a research participant, you may contact the Institutional Review Board at Walden University at irb@waldenu.edu or the XXX Institutional Review Board at (XXX) XXX-XXXX. You may keep a copy of the informed consent. You may request a copy of the results of this research.

AUTHORIZATION:

Based on the information provided by the researcher,
_____ I agree that segments of the recordings made of my interview as part of this research may be used for conference presentations.
_____I do not want segments of the recordings made of my interview to be used for conference presentations.

Participant's Initials/Date: _____

_____ I agree that segments of the recordings made of my interview in this research may be used for education and training of future researchers/health care team members.

_____I do not want segments of the recordings made of my interview in this research to be used for education and training of future researchers/health care team members.

Participant's Initials/Date: _____

_____ I agree that segments of the recordings made of my interview in this research may be used for publication.
_____I do not want segments of the recordings made of my interview in this research to be used for publication.

Participant's Initials/Date: _____

Once segments have been chosen, the remainder of the recordings must be destroyed (unless approved for archiving). Segments cannot be used for any purposes beyond those detailed and consented to in this informed consent form.

I am willing to be interviewed by Lynette Savage as part of her doctoral dissertation. By signing this form, I grant permission for information I provide in the interview and transcript to be used as described above.

_____ _____
Signature Date

_____ _____
Signature of Person Obtaining Consent Date

APPENDIX J: HIPPA REGULATIONS REGARDING PATIENT IDENTIFIERS

During this interview, you will be asked questions regarding experiences in stopping or preventing a medical error from reaching a hospitalized patient. There may be a tendency to talk about the patient by name or some other individual identifier. This is a reminder of identifiers that cannot be associated with the information you are about to provide:

1. Patient name;
2. Street address, city, county, precinct, state, zip code, or the equivalent geocodes;
3. All elements of dates directly related to an individual, including birth date, admission date, discharge date, date of death;
4. Telephone or fax numbers;
5. Electronic mail addresses;
6. Social Security numbers;
7. Medical record number;
8. Health plan beneficiary numbers;
9. Account numbers;
10. Certificate/license numbers;
11. Vehicle identifiers, serial numbers, or license plate number; or
12. Device identifiers.

If you do identify the patient by one of the items listed above, the researcher will remove the identifier at the time of transcription before the data are analyzed. The researcher will be the only person transcribing the tapes.

_____ _____

Signature Date

_____ _____

Witness Signature Date

CURRICULUM VITAE

Lynette Savage, RN, MS, CPHQ

Education

2008
Walden University
Doctoral Candidate
Applied Management and Decision Support
Anticipated Graduation November 2008

1987
Certificate in Gerontology, University of Denver

1986
MS, University of Colorado, Denver, CO

1981
BSN, Central State University, Edmond, OK

1976
BS (Sociology), Phillips University Enid, OK

Experience

2004-Present
Providence Health System
Portland Service Area
Project Manager, Six Sigma, Black Belt
Responsible for working with commissioned teams to design, implement, and monitor projects related to improving patient safety.

1997-2004
Providence St. Vincent Medical Center
Director, Quality and Medical Staff Services
Responsible for managing quality activities for 3,500 employees and 1,600 physicians, patient complaints, regulatory requirements, JCAHO, quality teams, utilization review, medical staff executive leadership, risk management, and legal issues, on-site manager for regional care management, regional facilitator for system projects, and management of 37 multidisciplinary employees.

1995-1997
Manager, Quality Management
Responsible for managing quality activities for 2,200 employees and 800 physicians, patient complaints, JCAHO, risk management and legal issues, utilization review, and of 8 employees.

1993-1994
Nurse Manager, Oncology
Responsible for managing a 14-bed in-patient oncology unit and 4-bay outpatient unit, and assisting with program development.

1989-1993
Nurse Manager, Oncology, and Medicine, Porter Memorial Hospital, Denver, CO

1988-1989
Administrative Assistant to Vice President of Nursing, Porter Memorial Hospital, Denver, CO

1986-1988
Clinical Nurse Specialist – Gerontology, Porter Memorial Hospital, Denver, CO

1984-1986
Research Assistant
University of Colorado, Denver, CO

1984-1985
Critical Care Float Nurse
University Hospital, Denver, CO

1981-1984
ICU Staff Nurse
Baptist Medical Center Oklahoma City, OK

National Certification

OCN – Oncology Certified Nurse (American Society of Oncology) 1989-1991

CPHQ – Certified Professional in Health care Quality 1996-Present

Six Sigma, Black Belt – Certification 2005-Present

Awards

Vollum Fellowship for Nursing, 2007
Providence St. Vincent Medical Foundation

Presentations and references upon request