THE EFFECT OF NURSES' USE OF A FOCUSED PROTOCOL TO DECREASE DISTRACTIONS DURING MEDICATION ADMINISTRATION

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DEDICATION

To nurses concerned with patient safety

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ABSTRACT

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Medication administration errors (MAE) are often the result of system problems that lead to patient injury, increased hospital costs and nurses being blamed for the incident. Contributing factors include distractions, lack of focus, poor communication, and failure to follow standard operating procedures during medication administration.

A quasi-experimental study was conducted to measure the effect of two targeted interventions based on airline industry safety measures for decreasing nurses' distractions during medication administration. The study was conducted at a mid-sized acute care "for profit" hospital in a large southeastern metropolitan city in Texas. A convenience sample of 24 medication administration cycles was observed during high volume medication administration times. Observed nurses were LVNs and RNs who routinely administer medications. The study involved three groups with nurses in the control group using customary medication administration procedures. Nurses in the first intervention group used the focused protocol. The third group used the Medsafe© protocol intervention with the same instructions, teamwork, and checklist, but also wore a special vest to indicate to others that distractions were not acceptable during medication administration.

Two instruments were used during the study: the Demographic Data Form (DDF) and the Medication Administration Distraction Observation Sheet (MADOS). The MADOS was validated using Fehring's Diagnostic Content Validity Model.

The ANOVA (alpha = .05) revealed significance among groups, $\underline{F}$ (2, 23) = 68.229, $\underline{p}$ = .000. Post hoc pairwise comparisons using Tukey's HSD revealed significance between the control and focused protocol groups $\underline{p}$ = .000, between the focused protocol and Medsafe© groups, $\underline{p}$ = .014, and between the control and Medsafe© protocol groups, $\underline{p}$ = .000. Multiple regression revealed all 10 distraction predictors as significant for causing distractions, $\underline{R}^2$ = 1.0, $\underline{F}$ (10, 13) = 2.96E + 15, $\underline{p}$ = .000. Bivariate linear regression showed conversation ($\underline{r}^2$ = .93), personnel interrupting (r^2 = .90), and noises ($\underline{r}^2$ = .87) were highly related to total distractions experienced.

Study results infer that changes in work design using teamwork and targeted interventions can significantly reduce nurses' distractions during medication administration, ultimately reducing medication errors.

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CHAPTER 1

INTRODUCTION

Medication administration errors (MAE) occur when there is a breach of one of the seven rights of medication use: right patient, right drug, right dose, right time, right route, right reason and right documentation. MAEs often result in patient injury, increased hospital costs and casting blame for the incident. Errors occur in any industry but they are more critical in healthcare because lives are at stake. However, complex systems rather than humans are frequently the source of medication errors in health care settings. Factors contributing to system failures include distractions, lack of focus, poor communication, and failure to follow standard operating procedures during medication administration. Following the Institute of Medicine's 1999 report, there has been an increased interest on identifying and implementing MAE safety measures. Yet more needs to be done to improve medication safety.

According to the 1999 Institute of Medicine (IOM) report, preventable events resulting from medical errors cause nearly 100,000 deaths in hospitals annually, with almost two percent of these being medication related (Institute of Medicine, 2000). A recent study refutes the IOM results as being overestimated in terms of patient deaths attributed to medical errors or MAEs identifying limitations with physician review of charts for determining patient deaths due to preventable errors. In these retrospective reviews of charts, the authors found problems with physician's interrater reliability,

as reviewer's assessments of probability of error, and mistakes in judging the prognosis of the patient who died (Hayward & Hofer, 2001). Nevertheless, the IOM report has focused national attention on improving the healthcare system. No matter what the mortality statistics reveal, patient safety and prevention of MAEs has become a national focus.

Based on a 1999 study involving 56 hospitals, evidence indicates that most medication errors occur at the point of administration (which usually involves nurses). Distractions, performance problems, inexperience, and failure to follow procedures are leading causes of errors (United States Pharmacopeia [USP], 2000). Furthermore, MAEs remain third in the list of causes of sentinel events leading to patient death or loss of function, and most occur in general hospitals as opposed to behavioral hospitals, outpatient facilities, long term care facilities, or home care settings (Joint Commission on Accreditation of Healthcare Organizations, 2002). As much as 1.6 percent to 38 percent of all medications administered are in error, excluding about 25 percent of those that are not reported (Osborne, Blais, & Hayes, 1999). With millions of doses of medications administered in the United States annually, error rates as small as one error per thousand doses would produce error totals that exceed other industries. An equivalent in other industries would be two plane crashes at a major airport per day and 16,000 pieces of mail lost per hour (Beardsley & Woods, 1999). These staggering numbers cause great concern for organizations struggling to remain viable in today's healthcare market.

Without a clear plan for error management, mistakes cannot be effectively reduced (Helmreich & Merritt, 1998). The Agency for Healthcare Research and Quality

(AHRQ) 2001 report recommends research in various areas including resolving system problems by researching cause and effect risk factors for errors. Research that utilizes teamwork, decision support, and checklists borrowed from the aviation industry should be conducted (Agency for Healthcare Research and Quality [AHRQ], 2001a). Situations that reduce distractions and promote focus are strategies that would help prevent errors. To that end, nurses and others should provide help to peers to improve concentration on the medication administration process and avoid being rushed during medication administration periods (Wolf, 2001). Finally, patients have the right to expect that they will not be overly exposed to risks during medication administration but have the benefit of researched safety practices.

Problem of the Study

Medication errors remain widespread and problematic, with patients and nurses being the most directly affected. In reality, medication errors seldom occur because of one person, but they are the result of a series of system events or failures. While it may not be possible to prevent all errors, there is much room for improvement. Medication errors also create ethical, financial, and legal problems for today's healthcare institutions. As a result, most hospitals have systems of checks and balances to ensure patient safety during medication administration, but none are flawless. Thus, the multiple issues surrounding medication errors demand immediate and effective improvements in medication administration systems (i.e.: methods of delivery, environment, and organizational culture).

System failures include distractions, lack of focus, poor communication, and failure to establish or follow standard operating procedures and protocols during medication administration. The purpose of this study was to determine the impact of distraction reducing interventions on the medication administration system within the hospital setting. The study evaluated the effectiveness of focused protocols with checklists and the application of a special vest as interventions to decrease nurses' distractions during medication administration.

Rationale for the Study

Nurses are most frequently the ones held accountable for medication errors since they are usually involved at the administration phase. However, systems should be the focus of investigation rather than humans. Unfortunately, most hospital medication systems have evolved over time without a plan and without effective error prevention methods. These faulty systems cause human tragedy and increased costs both for patients and healthcare professionals (Cohen, 1999). In addition, the US is currently experiencing a nursing shortage and cannot afford to lose valuable nurses due to MAEs.

Healthcare as a high-risk industry is responsible to the public for maintaining a culture of safety. However, organizations differ in their perception or value of safety. Some simply do not have the resources to implement large-scale or costly safety plans (Helmreich & Merritt, 1998). Nevertheless, several national organizations recommend focusing on system failures and improving safety (Institute Of Medicine [IOM], 2000; AHRQ, 2001a; Quality Interagency Taskforce [QuIC], 2000)

The IOM recommends raising safety standards and expectations and creating safer systems. There is a need to simplify systems, use standard protocols, improve communication and teamwork and build in redundancy to defend against system errors. Also, psychological limitations should be considered for those involved in the task (IOM, 2000). The Quality Interagency Coordination Task Force (QuIC) has challenged healthcare professionals to research and identify effective safety practices that could be used by other hospitals and health care systems (QuIC, 2000). The AHRQ has also reviewed multiple studies and factors contributing to MAEs, and recommends serious research be conducted involving safety measures to decrease risks of error (AHRQ, 2001a).

Even with systems of verification in place, most medication administration processes are convoluted and error prone. System failures include both design failures and environmental failures. Design failures involve problems with process, tasks, or equipment. Environmental factors that are precursors to errors include crowded spaces, high noise levels, a sense of urgency, and distractions, to name a few (Cohen, 1999).

Safety occurs on a continuum from increased to decreased likelihood of error, with many errors resulting from human performance limits having been exceeded (Helmreich & Merritt, 1998). In addition, the capacity to maintain one's attention in the presence of excessive stimulation is almost impossible. This deficit may be explained by the tendency for the attention from a task contained by one brain hemisphere to be depleted by a concurrent cortical stimulation within the environment (Driscoll, 1994).

Interruptions as distractions while preparing medication are a primary environmental factor contributing to medication errors (American Nurses Association, 1998). Two separate research studies have identified distractions as third in a list of top causes of MAEs (Gladstone, 1995; Walters, 1992). Most recently, one study moved distractions to number one on the list of causes of error, stating that most MAEs are the result of distractions, overwork, inexperience, communication gaps, lack of focus, and failure to follow protocols during medication administration (USP, 2000).

Another contributing factor to the difficulty in identification of root causes of medication errors is high traffic congestion on many nursing units which adds to distractions and confusion about roles and identities. In the past nurses were more identifiable due to the presence of nurse's caps. There were often only one or two medication nurses thus reducing the problems with distractions from other personnel. They simply left the medication nurses alone to perform their job. Today, many hospitals utilize the modified case method in which each nurse has responsibility for assigned cases with assistance from nurses' aides. In the modified case method, many nurses deliver medications to several patients. Consequently it is often challenging to identify whether nurses are administering medications or performing other duties. It is also difficult to determine which employees are nurses, because of similar uniforms and small print on nametags.

Other problems also contribute to distractions. For example, active failures (personal mistakes, slips, and lapses of memory) affect the system for a short time. Latent conditions (distractions, overwork, fatigue, and inexperience) allow failures to continue.

When these latent conditions combine with active failures, MAEs occur. A slip occurs when the intended observable action is replaced by another action. A lapse is when a memory cannot be recalled. A mistake occurs when an incorrect planned action fails to achieve the intended goal, because the action choice was incorrect (Reason, 2000).

Functioning in the "automatic mode" is one example of a system process which requires less thinking and is common for experienced nurses. However, MAEs often occur as distractions cause the automatic thought process to be lost or interrupted, and an incorrect choice made. This action is like to going to another room to get something and forgetting the purpose (Cohen, 1999).

A key to prevention of MAEs may lie within other industries that focus on safety measures and decreases in errors. For example, safety in aviation can be evaluated as a model for safety in medication administration. Pilots are not allowed to engage in conversation unrelated to the flight checklist (sterile cockpit situation) as long as the plane is below 10,000 feet (Cohen, 1999). Accordingly, a similar tactic includes requiring nurses to focus on the medication administration task without engaging in conversation not related to medications as long as the nurse is involved in administering medications.

No known studies exist that have implemented and evaluated an intervention to reduce distractions during medication administration. Therefore, to assist in reducing system problems for safer administration of medications, this study proposed the application of a visible outward sign and other focused protocols as interventions to decrease nurses' distractions while administering medications.

Conceptual Framework

Flawed medication administration systems are the primary cause of medication administration errors (MAE) with distractions, lack of focus, poor communication and failure to follow protocols as major contributing factors (USP, 2000). Furthermore, MAEs often occur as a consequence of shortcuts taken because of pressures to increase productivity and efficiency. Consequently, nurses are often unfairly blamed or reprimanded for medication errors, which results in a variety of responses. Ultimately, the results of MAEs are reflected in the erosion of organizational effectiveness and decreased public trust. This interplay of internal and external environmental factors illustrates an organization's open system.

Harrison and Shirom's (1999) organizational assessment framework was utilized for the theoretical perspective for this study. The theory includes a practical approach to open systems in evaluating problems with inputs, throughputs and outputs. Examples of inputs are the characteristics and contributions of the nurses, pharmacists and physicians involved in medication administration. The output is the service provided to the patient. Throughputs are the system processes, organizational behavior and patterns of interaction within the organization.

The system is in a constant state of flux in an attempt to adapt to the environment in the process of accomplishing organizational goals. System constraints hinder the process. Once the points of constraint are determined, the intervention focus is on forces that cause problems or those that may be more receptive to change (Harrison & Shirom, 1999). Many groups encounter problems or constraints in the process of task completion

(Goldratt, 1997). Group process and problem solving incorporate certain social contexts including collective beliefs and expectations. People in a group often choose to assist others only after seeking approval from peers, especially when it pertains to safety in the workplace. Education provides reasons and principles for changing behavior when faced with future similar situations (Geller, 2001).

The model: Medication Administration for Safety in Hospitals (MASH) depicts the structure, process, and effectiveness dimensions within the multilevel prescriptive model of the organization, group, and individual (Figure 1). The MASH model represents an open system with fluctuating interactions between system levels, indicated by the broken lines. Solid lines describe the linear interaction of levels within and between each other. Broken lines further represent openness to interference from other levels within the system. These lines also represent the systems vulnerability to outside constraints such as costs, regulatory agencies, the hospital's medical error history, current occupancy rates and staffing patterns, public trust, and medical errors in the news. Bolded broken lines enclose the section of the study's focus at the group level.

The model describes the inputs that feed into the system to promote accurate delivery of medications to patients, the throughputs or processes involved in medication administration, barriers or constraints to the process, and the outputs that explain the goals of the system and methods for evaluation. Feedback mechanisms include communication and reports from within and outside the system. The ultimate output is the safe delivery of medications to every patient in the system according to the seven rights of medication administration.

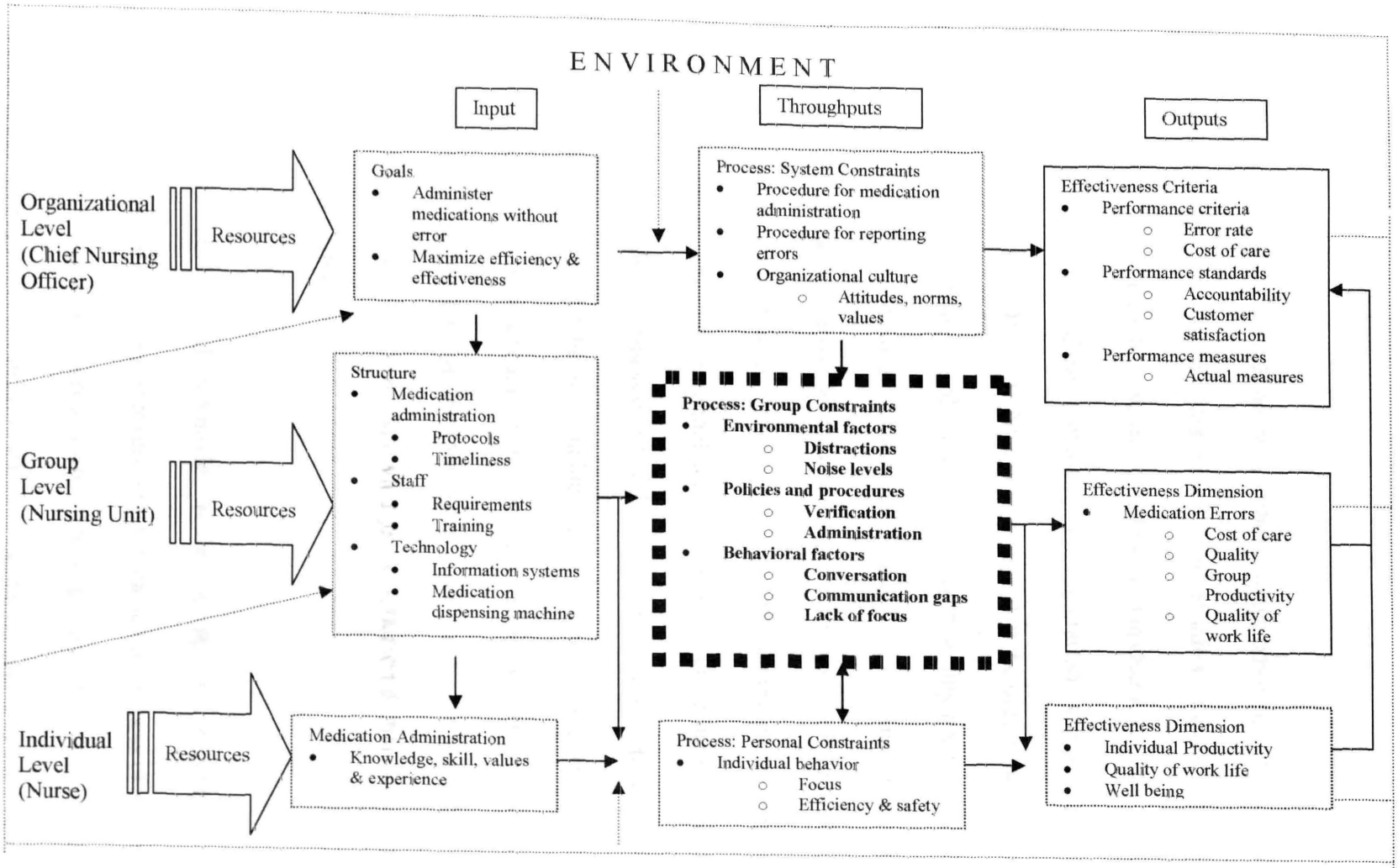

Figure 1. Medication Administration for Safety in Hospitals (MASH): An Organizational Framework Adapted from Harrison & Shirom (1999).

Inputs

The inputs into the MASH model are those organizational, group, and individual factors which contribute to the final desired outcome of safe medication administration. Resources are the inputs into the system, including human characteristics, attitudes, knowledge, attention span, and past medication administration experiences and errors.

The Chief Nursing Officer (CNO) is represented at the organizational level as person who establishes strategic goals at the start of the planning process. For this model, the goals are to administer medications without error and to maximize efficiency and effectiveness. A downward arrow directs toward the necessary elements within the medication administration structure at the group level. Within the group domain, represented by the nursing unit personnel and resources, structure includes medication administration protocols, timeliness of administering medications to patients, and staffing requirements and training. Technology includes information systems available for charting medications, computer data sets for tracking medication errors, and the medication-dispensing machine. At the individual level, much of medication administration depends on the nurse's knowledge, skill, personal attributes, values and experience or background.

Throughputs

The throughputs in the MASH model are those constraints found at the organizational, group, and individual levels which impede the process of successful medication administration. At the organizational level these include customary procedures, and protocols for medication administration, reporting of medication errors

and organizational culture including attitudes, norms and values. At the group level, constraints are limitations inherent within the environment, policies and procedures, and behavior. Environmental factors include distractions and noise levels. Policies and procedures, whether implied or written, govern medication verification and administration. Behavioral factors include extraneous conversation while administering medications and lack of focus. Therefore, as constraints limit the success of the group, the effectiveness dimension suffers. The process domain includes the person's ability to focus in the face of distractions and other constraints, while administering medications efficiently and safely.

Outputs

The outputs in the MASH system are the dimensions of effectiveness which can be measured and evaluated to determine if safe medication administration is occurring. The outcome measures provide information for feedback to improving the system. These outputs are described as performance criteria, performance standards, and actual performance measures. Performance criteria consist of minimal acceptable medication error rates and cost of care. Performance standards include organizational accountability, and customer satisfaction. Performance measures involve the actual medication error rate, and reports of customer satisfaction surveys. Within the effectiveness dimension, diminished outcomes frequently involve medication errors that lead to: increased cost of care, decreased quality of care, and reduced group productivity. Effectiveness at the individual level includes individual productivity, quality of work life, and a sense of well being.

The purpose of this study was to test a component of the throughput section at the group or unit level which was the most intervenable (bolded section - Figure 1). This process portion involved group constraints in medication administration. In the case of MAEs, the constraints were environmental (distractions), procedure constraints (failure to establish and follow standard operating procedures and protocols), and behavioral constraints (lack of focus, communication problems, conversation).

Assumptions

Framework assumptions for this research study included:

1. The system performs because of a planned course and constraints lead to performance problems (Theory of Constraints Center [TOC], 2000).
2. Environmental constraints (distractions, lack of focus, conversation) affect workgroups making them less productive, less cohesive, and less committed to the task (Harrison & Shirom, 1999).
3. Ineffectiveness at one level affects all other levels and directly affects outcomes (such as hospital medication errors and reporting) within the effectiveness dimension (Harrison & Shirom, 1999).
4. Manipulation of more accessible constraints within the system is more likely to result in a successful change in outputs (Harrison & Shirom, 1999).
5. Once the constraint is removed, the system moves to a higher level of performance, thus reducing system problems (TOC, 2000).

Research Hypothesis

The study tested one research hypothesis. The research hypothesis stated: Two targeted interventions, a "focused" protocol and a "Medsafe"© protocol both with educational interventions, will reduce nurses' distractions during medication administration cycles when compared to a control group of similar nurses who do not use either intervention.

The hypothesis was tested by observing 3 groups of medication cycles ($\underline{N} = 24$) while nurses administered medications on a hospital medical-surgical nursing unit. The dependent variable was the number of distractions experienced by nurses throughout 8 cycles of medication administration for each group. The independent variable was group assignment for either the control group, the Protocol group or the Medsafe© group designed to decrease distractions during medication administration. The number of distractions was expected to decrease for both intervention groups with significantly more decrease in distractions for the Medsafe© group.

Research Question

One research question was also identified for the study. The research question was: Which distracters contribute more significantly to the distraction variance nurses experience and are more predictive of nurses being distracted during medication administration cycles?

Definitions

The following definitions are offered to add clarity and guidance to the study:

1. Education session – An education session is a period of time used to teach learners actions they could not perform before the session occurred. Demonstration that learning occurred is observed when the learner exhibits new behavior learned during the education session (Driscoll, 1994). The education sessions in this study were the in-services provided to nurses and staff working on the unit just prior to each observation, and consisted of familiarizing them with the study protocols.
2. External visible symbol – A symbol was defined as a sign, an emblem, a letter, a figure, or other mark designating an operation, object, or function (Webster, 1997). For the purposes of the study, a red vest was operationally used to indicate to others that distractions were unacceptable during medication administration. The red vest had white lettering with the words "Medsafe Nurse, Do Not Disturb" on the back and front.
3. Distraction – A distraction was defined as any action that draws away, diverts, or disturbs the mind or attention from achieving the medication administration goal (Webster, 1997). For the purposes of this study, potential distraction sources were: physician, other personnel, phone call, other patient, visitor, missing medication, wrong dose medication, emergency situation, conversation, and external noises as indicated on a the MADOS (Appendix

A), and measured by the observer using slash marks for each distraction that occurred.

4. Medication administration– Medication administration is the process of getting a medicinal substance into the body so it can move into the bloodstream and travel to a specific site where it is needed as a remedy for a disease or condition (Berkow, 2001). Medication administration also includes the nurse providing the medication after thoroughly assessing the patient, being knowledgeable about the drugs, and following administration safety protocols (National Coordinating Council for Medication Error Reporting and Prevention, 1999).
5. Medication administration cycle - For this study, a medication cycle started when the nurse began the administration of all assigned patient's medications at a scheduled time. The medication cycle ended when the nurse completed charting the medications given.

Limitations

Generalizability of the study findings is limited to male and female English speaking nurses who administer medications in mid-sized acute care hospital settings. The study results are limited to facilities utilizing the modified case-method nursing model, and therefore cannot be generalized to other nursing models. Limitations also included that only one nurse was observed at a time and therefore cannot be generalized to many nurses administering medications at the same time. Medication administration cycles utilized in the study included high volume weekday scheduled medication times.

Therefore, generalizability is limited to these time frames. Another limitation was the selection of a nursing unit without a medication room. Some nursing units have medication rooms, which may affect the number of distractions possible.

Summary

Medication administration errors (MAE) cause patient injury, increased costs and human blame. Factors contributing to MAEs include distractions, lack of focus, poor communication, and failure to establish or follow standard operating procedures during medication administration. Following the Institute of Medicine 1999 report, there has been a national interest in MAE safety measures. Yet, few interventions have been effective. The federal government's Agency for Health Research and Quality supports system research using teamwork, decision support, and checklists similar to that used in aviation. Therefore, the purpose of this study was to determine the impact of two targeted interventions on the medication administration system within the hospital setting by decreasing nurses' distractions during medication administration. The study used a three group quasi-experimental design with one control and two intervention groups. The study evaluated the effectiveness of focused protocols based on airline industry safety measures with checklists and the application of a special vest as interventions to decrease nurses' distractions during medication administration.

The Medication Administration for Safety in Hospitals (MASH) model depicts an organizational prescriptive model based on Harrison and Shirom's (1999) organizational assessment framework. The theory includes a common sense approach to open systems in evaluating problems with inputs, throughputs and outputs. Once organizational goals are

established, constraints deter their accomplishment. In the case of MAEs, the constraints were environmental (distractions), procedure constraints (failure to establish and follow standard operating procedures and protocols), and behavior constraints (lack of focus, communication problems, conversation). The group process section of the MASH framework guided the research protocol for this study by identifying and resolving constraints.

The study has far reaching implications for the way hospital work systems are redesigned and whether or not changes are needed in existing policies, protocols and procedures. Nurse managers and hospital administrators will benefit from the knowledge gained from the study. The knowledge that standard operating procedures using focused protocols, teamwork, and the use of an outward visible sign may decrease distractions during medication administration has the potential to improve medication administration systems and ultimately decrease medication errors.

CHAPTER 2

REVIEW OF LITERATURE

This review focuses on literature pertaining to medication administration practices of nurses and the causes and prevention of medication administration errors (MAE). The approach includes medication error literature relating to the study's conceptual framework components. Some practices of other healthcare providers that affect the process are included.

To date, research studies involving the reduction of distractions as a mechanism for decreasing medication errors have not been completed. There is a scarcity of research addressing human factors and work redesign to reduce errors. Most available research studies address causes and possible resolutions to medication errors, but few have provided practical interventions.

The literature review for this study pertains to the structure and process of the medication administration system, in relation to an intervention to decrease distractions during medication administration. The review begins with the history and evolution of medication errors, definitions of medication errors, and the taxonomy and typology of medication errors. Consequences of medication errors, causes of medication errors, safety and error prevention are also discussed.

History and Evolution of Medication Errors

Before 1974 medication errors were rarely discussed openly, and rarely tracked or categorized for quality improvement. Fortunately, most errors do not result in serious harm to patients, but those that do, make the headlines. In 1975 a few insightful healthcare providers began a nationwide system to collect and share medication error information. In 1994 this group formed the Institute for Safe Medication Practices (ISMP) to prevent medication errors through education about adverse drug events. Since then the ISMP has teamed with the United States Pharmacopeia (USP) to review adverse drug events reported to the Federal Food and Drug Administration (Cohen, 1999).

The 1999 Institute of Medicine (IOM) report sounded a sentinel warning that preventable medication errors had reached epidemic proportions in the United States (US). Their report of approximately 98,000 hospital deaths occurring in US hospitals annually as a result of medical and medication errors, has lead to increased efforts at resolving system problems. Preventable medication related errors increase hospital costs by about $4,700 per admission, thus contributing an additional two billion dollars to health care costs (Institute of Medicine [IOM], 2000). As a result, the IOM provided the impetus for patient safety awareness in healthcare organizations.

Subsequently, societal pressures provided the momentum for the establishment of the Quality Interagency Coordination Task Force (QuIC) to evaluate and monitor the problem of medical errors. The IOM allocated funds for the establishment of the Quality Forum at the Agency for Healthcare Research and Quality (AHRQ) (QuIC, 2000).

The AHRQ promotes patient safety through funding for research-based initiatives having the potential to reduce errors (Agency for Healthcare Research and Quality [AHRQ], 2001a). Recently the AHRQ has offered funding for innovative research involving work redesign to improve patient safety and to develop approaches that reduce errors as in other industries (AHRQ, 2001b). In addition, public familiarity with medication risks has increased on several fronts due to media focus on shocking cases.

Cases in The News

A 1996 Colorado incident involved 3 healthcare providers who were indicted for negligent homicide as a result of a medication error. These nurses and the hospital pharmacist misread the physician's order and gave a ten-fold dose of penicillin G intravenously to a newborn infant. Language barriers caused insufficient history to be obtained from parents. Hospital staff lacked experience treating infant syphilis, and the drug order was written illegibly. The pharmacist, nurse, and nurse practitioner were unfamiliar with the drug's correct dosage and route of administration (Pearson, 1998; Smetzer, 1998). Another Colorado death involved a nurse accidentally injecting potassium chloride (KCL) into an IV instead of regular saline. The incident led to increased awareness that KCL should not be kept in stock on nursing units (Hudson, 1996). These errors resulted from a multitude of system failures.

In 1996 the death of two-month old infant, who was a patient at Hermann Hospital in Houston, Texas, made national news when he received a 10-fold dose of digoxin due to a calculation error. The physician's order was calculated by both the consulting doctor and the resident before being sent to the pharmacy. Questioning the

order, the pharmacist tried to contact the doctor for clarification. However, while awaiting the call, the pharmacist placed the order on a nearby shelf where it was filled by the technician and sent to the nursing unit. The nurse recalculated the dose and verified it with the resident. The intended dose was digoxin .09 mg, but the decimal point was misplaced on the label and the resident did not notice. The nurse still had doubts about the dose and consulted a doctor who said to go ahead and give the drug. The dose that was given was .9 mg, leading to the overdose and subsequent death of the child (Belkin, 1997; Napthine, 1999).

Systems problems were also to blame for chemotherapy overdoses leading to the 1994 deaths of two cancer patients in Massachusetts. The state board of nursing disciplined 18 nurses for their role in the incidents (Beardsley & Woods, 1999). In another chemotherapy case, the death of a 10-month-old infant was attributed to a pharmacist not seeing the decimal point for 20.4 mg of cisplatin (Platonol) and dispensing 204 mg. The nurse did not even recognize the overdose when administering the drug. However, if the amount had been rounded to the nearest whole number, the error would not have occurred (Cohen, M. R., 1998).

In September of 2000, public attention was again focused on free-flow infusion pumps and the associated deaths. One patient died of a heart attack resulting from a magnesium sulfate infusion overdose. Another patient was an infant who died four days after delivery due to a pitocin overdose given during labor. Finally, a 65-year old woman died after an abdominal aortic aneurysm repair when she received a large dose of sodium nitroprusside (Berens, 2000a). Subsequently the "public eye" watched nurses intently

after the Chicago Tribune expose' in September of 2000 in which nurses made multiple MAEs with few repercussions. Additionally, there was no punishment for nurses who consistently engaged in other misconduct or were drug impaired (Berens, 2000b). These cases help further illustrate the need for focusing on medication error prevention.

Definitions of Medication Errors

Nurses are frequently unsure what constitutes a medication error. In a study asking 64 nurses about their perceptions of the causes of medication errors, 63% ($\underline{n} = 40$) were not sure of what defines a medication error (Gladstone, 1995). A medication error is often identified as any deviation in medication administration from the physician or licensed practitioner's written order, but may or may not cause injury to the patient (Institute for Safe Medication Practices [ISMP], 2000a). Not surprisingly, criteria for what represents a medication error differ along with perspectives.

An 18-week ethnomethodological study revealed that nurses create their own criteria to determine whether an MAE actually occurred. The results found that nurses used situational logic to redefine MAEs by the following: it is not an error if (a) "it wasn't my fault", (b) "everyone else does it too," (c) "you can make adjustments," (d) "another situation is more pressing," (e) "it's a documentation error," or (f) "it's to prevent something worse." The authors concluded that changes should be made in terms of whether medications are time-critical or not time-critical. For drugs that are not time-critical, scheduling rules should be adapted to the realities of nursing practice (Baker, 1997). Nevertheless, institutions usually write their own policy regarding what classifies as a medication error. Some hospitals define medication errors as those incidents when

medications are (a) omitted, (b) given at the wrong time, (c) given to the wrong patient, (d) the wrong dose, (e) the wrong medication, (f) the result of a transcription error, (g) given to a patient with a known allergy, (h) repeated without an order, (i) given by the wrong route, and (j) discontinued without an order (Roseman & Booker, 1995).

Perhaps the simplest and most reliable definition is: any preventable medication-related event occurring as a result of actions by a healthcare professional that may cause or lead to patient harm while the patient is in the care of the healthcare provider (National Coordinating Council for Medication Error Reporting and Prevention [NCCMERP], 2000).

Taxonomy of Medication Errors

In 1998, the NCCMERP developed a standard taxonomy of medication errors to assist in systems analysis of errors and to provide a standard language that could be used between various institutions. The categories are based on patient outcome criteria as follows:

Category A – No error (NCCMERP, 1998)

Category B – An error occurred but did not reach the patient.

Category C – An error occurred and reached the patient but did not cause harm.

Category D – An error caused a need for increased monitoring, but no harm occurred.

Category E – An error caused a need for intervention and only temporary harm.

Category F – An error caused increased hospitalization and temporary harm.

Category G – An error caused permanent patient harm.

Category H – An error caused a near-death event.

Category I – An error resulted in a patient death.

Typology of Medication Errors

The NCCMERP has also provided a standard list of the types of MAEs that should be considered. These include: dose omission, improper dose, wrong strength or concentration, wrong drug, wrong dosage form, wrong technique, wrong route, wrong rate, wrong duration, wrong time, wrong patient, monitoring error, deteriorated drug error, and other (NCCMERP, 1998).

Medication Administration Structure and Process

Ultimately, medication errors are linked to the organization's structure, process, and measures of effectiveness. Some of these elements have overlapping and intermingling components. For example, the environment and behavior are as much a part of the structure as they are the processes within the organization. Technology is as much a part of system components within processes as it is of structure.

Within the prescriptive framework for this study, the medication administration structure encompassed the organizational goals, medication administration protocols, and technology. The organizational goal for the conceptual framework was the administration of medications without error, while maximizing efficiency and effectiveness. Included are standard protocols, error rates, and reactions to errors.

Standard Protocols

The five rights of medication administration have now evolved into the seven rights: right drug, right patient, right dose, right time, right route, right reason, and right documentation. These standard elements of medication administration include knowledge

of the medication's use, usual dosage and route, actions, side effects, drug and food interactions, and contraindications (Pape, 2001).

The standard procedure for medication administration taught to nursing students begins with obtaining the medication administration record (MAR) and verifying the order for accuracy. Once the medication is obtained, the container label is first compared to the MAR. The label is then re-checked while preparing the medication, and verified one last time when replacing the drug container. After checking the patient's identification bracelet and asking the patient to state his/her name, the medication is then administered. Simultaneously the drug's purpose and pertinent side effects are explained to the patient. The dosage, time, and nurse's signature are documented. Finally, after 30 minutes, the patient is evaluated for any effects of the medication (Kozier, Erb, Berman, & Burke, 2000). When nurses are in a hurry or are distracted, they sometimes deviate from previously learned procedures for medication administration, resulting in increases in medication errors.

Error Rates

Methods for calculating medication error rates differ among institutions. The rates are usually determined by dividing the total number of errors by the total of all ordered medications plus unordered doses. Some institutions prefer to separate different errors by category. For example differentiating error rates of wrong time doses or error rates by patient day proves useful for comparing different studies (Tissot, Cornette, Capellier & Schmitt, 1999). Some institutions divide the number of errors by the number of medications administered (Marino, Reinhardt, Eichelberger & Steingard, 2000).

In a study involving 57 out of 92 returned surveys from nurses, the majority of respondents (44%, n = 25) thought that only 25 % of all medications administered are reported (Osborne, Blais, & Hayes, 1999). Wakefield, Wakefield, Uden-Holman, Blegen and Vaughn (1999a) studied 1,428 staff nurses' perceptions of MAE rates and found that the majority of nurses believed that only 60 % of all MAEs are reported.

Pelletier (1999) studied the medication error rates of 244 long-term care facilities in Connecticut. The results showed that only 2% (n = 5) failed to meet the Health Care and Finance Administration (HCFA) standard of maintaining medication errors below the 5% level. Of these five facilities, the medication error rate ranged from 8 to 13% out of 25 observed medication administrations during May 1, 1998 through April 30, 1999.

In a study involving a retrospective chart review of 30,195 charts from 51 New York hospitals, adverse medication events comprised 19% (n = 215) of the identified 1,133 adverse events, which were more common among elderly patients (Leape, et al., 1991). As a result, various forms of technology such as patient identification armband bar coding, automated medication dispensing machines, and computerized physicians order entry, have been recommended to facilitate medication delivery and error prevention.

Technology

Recently there has been a national impetus by the Leapfrog group, a supporter of large corporations, to implement computerized systems to decrease MAEs (ISMP, 2000b). However, computerized systems cannot resolve all medication errors, because results are inconsistent since these systems only eliminate some sources of error.

Bar Coding

Bar coding is a process of identifying objects with the use of machine-readable labeling. Medication bar code systems typically involve the use of optical markings placed on medication packages and patient armbands. A hand-held device is linked to a computerized medication dispensing system. The caregiver scans the patient's armband and the medication. If a match is found, the nurse can record the medication given. If no match is found, an alert will be displayed and the medication cannot be charted without overriding the system.

There is evidence that medication and patient identification band bar coding has shown a decrease in MAEs. One hospital in Colorado reduced error rates from 0.17% to 0.5% from 1991 to 1995 using the barcode-enabled point of care system. Primarily errors that were reduced included wrong time errors (43%), and omitted dose errors (52%). However, wrong patient errors (5%) did not decrease because nurses were able to bypass scanning the armband by choosing the patient from a computerized list (Puckett, 1995).

The NCCMERP recommends adopting some form of standard machine-readable labeling mechanism for administering medications (NCCMERP, 2001). However, equipment cost is a significant initial factor for many organizations. The Veterans Administration Hospital in Washington D. C. spent $365,000 on such a computerized system (Gebhart, 2000). Computerized medication dispensing systems have also been installed in various hospital settings for process improvement.

Medication Dispensing Systems

Another system for medication administration is the medication dispensing system in which medications are stored in computerized machines. Nurses typically access medications by entering a user identification number and a password. Nurses select patient names, which are listed on a touch screen, then a list of ordered medications appears. Nurses then select the medications desired for the patient and a drawer opens containing unit dose packages. The nurse selects the correct medication and dose and takes the medication to the patient. The system automatically tracks charges, times of selection, and transmits information to the pharmacy.

Schwarz and Brodowy (1995) reported on a study conducted in a 560-bed California teaching hospital in which an automated medication-dispensing system was implemented on a surgical nursing unit and in a cardiac ICU. The machine reduced MAEs on the surgical unit from 0.75% to 0.58%, but reported errors increased in the ICU from 0.5% to 0.9%. During the same time period, 6 of 7 conventional nursing units not using the medication system reported a 30% increase in MAEs. However, part of the increase in reporting may have been due to implementation of a new error-reporting sheet. Borel and Rascati (1995) conducted a similar study in which 873 nurses were observed giving medications before installing the automated medication-dispensing system. After instituting the system, 929 nurse observations were made. The error rate was 16.9% ($\underline{n}$ = 148) before the system and 10.4% ($\underline{n}$ = 97) after implementation of the system. They also observed the same nurses giving multiple medications at one time. For example, some nurses gave oral hypoglycemic medications (due with breakfast) with

10:00 a.m. medications. As long as nurses had to line up at the dispensing machine, they collected all medications for their assigned patients at one time, removing some medications earlier than scheduled. This practice makes it more difficult to determine whether medications were given at the right time.

Computerized Physician Order Entry

Computerized Physician Order Entry (CPOE) is the electronic entry of provider medication orders into a computer database. These systems require the prescriber to enter the patient's diagnosis, the name of the drug, the dose, and the route. Then the CPOE provides alerts for inappropriate orders such as wrong drug, wrong dosing, drug interactions, medication contraindications, or patient allergy conflicts.

One study evaluated CPOE at Brigham and Women's Hospital of Boston during a six-month period before the CPOE was installed, and for a nine-month period after implementation of the computer system. During the study periods, approximately 6400 medication orders were written daily. The results found the CPOE system effective in intercepting potential medication error sources. Overall dosing errors decreased by 23% and known allergy errors were down by 56% when compared to errors before CPOE. Most preventable MAEs were reduced by more than 50 %. However, the computer system could not prevent 42% of MAEs due to judgment errors especially with sedating drugs used in the intensive care unit (Bates, et al., 1998).

Raschke, et al. (1998) found that a computerized alert system failed to detect consequences of some true alerts. As a result, some patients were harmed. One renal patient did not receive the needed dose of potassium and quinapril, which led to a cardiac

arrest. For another patient, acidosis developed after metformin was withheld because the computer alarm showed a conflict due to an elevated serum creatinine level. Nightingale (2000) conducted a study in a 64-bed renal services center using a rules-based CPOE system over a 10-month period. Out of 87,789 prescriptions, the system disallowed .07% (n = 58) due to contraindications and drug interactions. However 43% (n = 322) of 749 high-level prescription alerts, and 92% (n = 15,000) of the low-level ordering alerts were overridden and completed. There was also 12 hours of computer downtime due to hospital networking problems.

While research has demonstrated that CPOE is useful for improving legibility of physician's orders, there is limited use because people are slow to embrace digital applications partly due to cost (Borel & Rascati, 1995; Nightingale, 2000). Hence, technology is only a part of the solution to medication errors, because cost and human factors play a critical part. A clinician can overlook or over-ride some computer warnings in almost any system (Borel & Rascati, 1995; Nightingale, 2000; ISMP, 2000a). Another factor to consider is whether hospitals can afford to integrate existing computerized systems into newer computerized alert systems (Raschke, et al., 1998). Nevertheless, Michael Cohen of the ISMP says that initial costs are minimal considering the cost of one medication error settlement (Gebhart, 2000). In addition, a medication error experience can have other hidden costs for all those involved.

Consequences and Reactions to Errors

Organizations suffer, as do individuals when there are problems providing critical services to the public. A variety of domino effects can occur for the institution and the individual as medication errors increase.

Institutional Effects

A recent study during a 543-day period involving four hospitals, including a 383-bed tertiary hospital, a 60-bed Mental Health Center, an 84-bed Children's Psychiatric Hospital, and a 30-bed children's disability center, focused on the frequency of adverse drug events (ADE). An ADE was defined as any patient injury whether from medication use or from medication error. Many potential ADEs were identified by computer alerts. Actual ADEs, potential ADEs and those causing readmission were also identified by random chart audits. Results found a total of 74 ADEs during the study period, which was 4.2 per 100 admissions. The average cost per ADE was $2,162 with an annual cost of $1.7 million. Readmissions due to ADEs averaged $6,886 each with an average length of stay of 10.5 days. This study showed that 76% of all ADEs were preventable and represented an annual cost of $260,000 (Senst, et al., 2001).

There has been an overall loss of public trust due to increased media attention on medication errors. Reviving the lost trust in nursing and the medical profession will take a concerted effort at improving performance and communicating quality to consumers (Curran, 2000). With millions of doses of medications administered in the US annually, error rates as small as one error per thousand doses would translate into two plane crashes

per day at a major airport (Beardsley & Woods, 1999). These staggering numbers cause great concern for organizations concerned about containing losses.

During 1999 the USP gathered valuable medication error data using an anonymous voluntary reporting system. However, only 56 of 6000 US hospitals participated due to the fear of repercussions. The USP is also concerned about the lack of a federal statute that protects hospitals and nurses from punitive recourse (United States Pharmacopeia [USP], 2000). Many institutions react to medication errors by finding someone to blame or reprimand. In these situations the probability of future reporting is further reduced, thus limiting the identification of occurrence patterns (Beardsley & Woods, 1999). Such reactions are ineffective at resolving underlying system issues. In addition, MAEs affect healthcare providers on a more personal level, with guilt and self-blame as typical responses.

Personal Effects

Researchers have found that nurses express feeling extremely guilty after an error and often worry about the error's effect on the patient (Gladstone, 1995; Wakefield, et al., 1996). A study surveying 60 nurses investigated the causal attributions of medication errors using case scenarios. Contrary to attribution theory, which was used as the foundation for the study, researchers found that most nurses tended to blame themselves for errors rather than the environment (Meurier, Vincent & Parmar, 1998). Nurses often expect themselves to be perfect and cannot readily accept they made an error (Cohen, 1999). Medication errors also cause them to lose confidence in their nursing abilities (Gladstone, 1995; Wakefield, et al., 1996).

Reporting MAEs

Wakefield, et al. (1996) surveyed 1384 nurses from 24 acute care hospitals in Iowa during 1994 concerning perceptions of barriers to reporting MAEs. The results revealed that nurses fear that other nurses will consider them incompetent. The guilt and pain from reporting is likened to committing sins, in which forgiveness comes after attending educational programs. Furthermore, medication error descriptive terms "errors of commission" and "errors of omission" are linked to religion and sin, making nurses more likely to withhold information. In a similar study Wakefield, et al. (1999b) reported difference in nurses' and supervisors' perceptions of reasons MAEs are not reported. The rank order of greatest agreement for the reasons MAEs are not reported was: fear of being viewed as incompetent, disagreement about what constitutes an error, and the amount of effort required to make the report. Other healthcare providers experience similar responses.

Wolf, Serembus, Smetzer, Cohen & Cohen (2000) surveyed physicians, pharmacists, and nurses about responses and concerns about medication errors they had made in the past. A total of 3,000 surveys were mailed from a list of licensed MDs, RNs and pharmacists provided by the Pennsylvania State Boards of Medicine, Nursing and Pharmacy. Out of 631 returned surveys, only 64% ($\underline{n}$ = 402) were complete. Survey results showed that nurses were more fearful for the patients than for themselves. Also, nurses feared disciplinary action more than pharmacists or doctors. The most notable responses by the healthcare providers were ranked as feeling guilty, worried, and nervous. Their concern in order of importance was: being named on the incident report,

verbal reprimands, or legal actions. Ultimately, the magnitude of fear for patient injury was unwarranted compared to the guilt felt by the practitioner and the actual injury that resulted.

Research shows inconsistency in actions managers take in dealing with nurses who make errors, and nurses state that they tended not to report MAEs as a result. In an Iowa study of 1,384 nurses from 24 acute care hospitals during 1994 concerning perceptions of barriers to reporting MAEs, researchers found that nurses felt that they were not given positive feedback for correctly administering medications ,and feared the individual blame often placed on them for errors (Wakefield, et al., 1996). Gladstone (1995) conducted a study in Southwest England to determine causes and reporting of medication errors. The study involved 79 drug incident reports, 14 informal nurse interviews, and returned surveys from 64 nurses and 17 nurse managers. Results found that most nurses tended not to report errors to nurse managers when there might be disagreement about when to notify the physician. Nurse interviews revealed that 64% feared inconsistencies in management's reaction. Nurse managers reported variations in the way they dealt with medication errors depending on error severity (41%, $\underline{n} = 7$), drug type involved (24%, $\underline{n} = 4$), or the potential for patient injury (41%, $\underline{n} = 7$).

Arndt (1994) conducted a qualitative study of 8 nurses in Germany, 8 nurses in Scotland, and 12 nurses in England, revealing the effect of drug errors on self-esteem. The results found that nurse managers frequently blamed errors on lack of nursing knowledge. Nurses felt let down by nurse managers and were less likely to report errors because they believed the errors would not be dealt with fairly. Some nurses would not

report errors unless a patient was likely to be harmed, because the disciplinary ordeal reduced their self-esteem. Other times, nurses reported errors in order to obtain emotional support from nursing colleagues.

Healthcare organizations and/or state boards of nursing frequently punish nurses for medication errors. The extent of punishment varies from state to state resulting in often devastating effects to the persons involved.

Disciplinary Actions

More than 5,000 nurses are disciplined in the US annually for various types of misconduct (LaDuke, 2000). A retrospective study of 176 disciplined nurses during 1991 and 1992 in the State of Texas found that 34% (n = 58) violations of the Nurse Practice Act were due to failure to administer medications responsibly. Moreover, 16% (n = 9) of these incidents were due to failure to document correctly, destroying notations, or making false entries (Green, Fizpatrick, Crismon & Waddill, 1994). Results of a recent research study revealed that out of 177 nurses disciplined in New York State in 1998, 27% (n = 48) were due to medication errors. Nurses reported loss of jobs, home, friends, self-esteem, and trust in others (LaDuke, 2000). In spite of everything, it is inherent in the human condition that mistakes will occur with many errors being unforeseeable. Failure to provide adequate mechanisms to reduce medication errors supports a culture of blame and punishment and prevents the identification of the cause.

Causes of Medication Errors

Medication administration involves a complex set of steps in achieving the desired goal of getting the medication to the patient in a timely manner. A multitude of

contributing factors often lead to medication errors as nurses encounter constraints within the system, work design problems, human and environmental factors.

System Constraints

System constraints include both design failures and environmental failures (AHA, 1999; Cohen, 1999; Pape, 2001). Design failures involve problems with process, tasks, or equipment. Internal and external environmental factors contributing to errors include crowded spaces, high noise levels, hurriedness, and distractions, to name a few (Cohen, 1999). Certainly medication administration involves a complex system with various environmental elements continually interacting with one another.

Proximal Causes

Proximal causes of MAEs relate to those that occur at the point of origin or immediately before the incident, thus offering a focus for corrective measures. For example, proximal causes of MAEs involve several stages in the medication administration process with several potential points for mistakes. These include medication errors that occur at the ordering stage, dispensing phase, or the administration phase. In a study involving 11 medical-surgical units in two hospitals during a six-month period, researchers found multiple proximal causes of medication errors. In order of most frequent occurrence these were: wrong dose errors, lack of drug knowledge, lack of patient information, rule violations, slips, memory lapses, inadequate monitoring, misuse of infusion pumps, faulty dose checking, transcription errors, failure to identify the correct drug, medication stocking problems, and using the wrong technique (Leape, et al., 1995).

Hackel and Banister (1996) asked 146 nurses in a 382-bed hospital about their perceptions of the causes of MAEs. Most nurses identified: slow pharmacy delivery, transcription errors, not double-checking medications, overwork, stress, mislabeled medications, and look alike medications and containers.

In a study of MAEs involving pediatric patients, researchers detected MAEs using chart audits, pharmacy logs, and incident reports. After 669 patient days, a total of 784 errors were discovered out of 11,978 doses passed. Of these 766 (97%) were determined to be from latent failures occurring at various phases of the process. Most of the errors were in the prescribing phase (n = 654, 85%) and 2.3% (n = 18) occurred at the administration phase, representing an administration error rate of 0.15%. The number of medications passed was used as the denominator (Marino, et al., 2000). In another study of 312 newsletter survey responses, researchers reported only 81% of all pediatric drugs, and 84% of all pediatric parenteral solutions were dispensed in unit doses. Despite the recommended practice, less than half of the respondents indicated that the pharmacy provided all parenteral solution admixtures. Only 30% (n = 93) reported that nursing calculations were verified by two nurses, and 32% (n = 99) noted no dosing or infusing guidelines posted in the pediatric unit. Thus, much more needs to be done to prevent MAEs in the pediatric population (ISMP, 2000c).

Lack of Knowledge

The most frequently occurring factors associated with medication errors are lack of knowledge or application of knowledge, use of the wrong drug name, dosage form or abbreviation, and incorrect calculations or unit expressions (Cohen, 1999; IOM, 2000). In

one study, nurses were observed identifying patients by room numbers instead of identification bands (Borel & Rascati, 1995). In a recent occurrence, a pharmacy technician filled a prescription for "14-Persantine" 50 mg with Persantine 75 mg, because of a misunderstanding and lack of product knowledge. The technician had called another pharmacy to ask for 14 Persantine. The other technician removed 14 tablets of Persantine 75 mg from the shelf to fill the order. The error was not found until the 14 loaned pills were replaced (Dunn & Wolfe, 2000). Other proximal causes of error involve legibility in addition to misunderstandings.

Written Orders

Illegible handwriting and improper abbreviations are major sources of preventable errors. Many prescriptions contain unclear writing, which causes more than 150 million pharmacist calls to physicians annually. Illegibility of written orders adds to costs by wasting time, delaying medication, and leading to patient injury (ISMP, 2000a). The abbreviation "u" for units can look like a zero, "q.d." (every day) and "qod" (every other day) look like "qid" (four times a day). Other problems result from failing to place a zero before a decimal, or putting a zero after a decimal point following a whole number. For example the number 1.0 looks like the number 10 (Cohen, H. G., 1998). The letters "SC" or "SQ" for subcutaneous are often mistaken for the sublinqual route, "D/C" can mean discharge or discontinue, "HS" can mean hour of sleep or half-strength, and "cc" (cubic centimeter) can be mistaken for "u" as in units (Jech, 2000). Verbal orders add to these problems with even more confusion.

Verbal Orders

Verbal orders are dangerous sources of error because certain numbers sound alike. For example the spoken numbers 15 and 50, and two and ten often sound alike (Cohen, H. R., 1998). Taking orders over static sounding cell phones also poses problems when sound-alike names such as Celexa, Cerebyx, and Celebrex are misunderstood. The first drug manages depression, the second treats seizures, and the third is a nonsteroidal anti-inflammatory medication (Karch & Karch, 1999). Lambert (1997) conducted a computerized research study examining medication name similarities and verified that these look-alike, sound-alike names are serious threats to patient safety. Medication names, whose lexical similarities were greater than standard thresholds, were predicted to be between 25 – 523 times more likely to cause medication errors. Thousands of similar sounding medication names are added in the US annually, with no prior checks on nomenclature. It is no wonder confusion exists among those who must prescribe and administer these medications.

Human Factors

There are limits on human cognition including accuracy, accessibility of primary and working memory, attention, focus and concentration, and the connection that must be made for precise motor skills (Moray, 1994). Inevitably, an investigation that focuses only on system problems to the exclusion of human factors would be meaningless. The system affects individual constraints just as personal limitations affect system constraints and vice versa.

Active Errors

In reality there is much overlap between errors, neglect and acts of purposeful negligence. Those who have made medication errors usually do so unintentionally rather than maliciously.

According to Reason's (1990) Generic Error Modeling System (GEMS) there are two types of errors that affect performance: (a) slips and lapses, and (b) mistakes. Mistakes are further divided into knowledge-based and rule-based. Knowledge-based behavior relies on familiarity with the situation, but with no rules or skills to guide performance, actions are often tested by trial and error. Knowledge-based behavior represents the lowest form of cognitive control. Rule-based behavior occurs when the individual depends on rules to guide action. Rule-based actions rely on a cookbook style know-how learned from someone else or from personal experience. Experiences that come to mind first are chosen for the intended action (Reason, 1990).

Training in any skill follows the skill-rule-knowledge framework as the person progresses from novice to expert. Unfamiliar tasks are learned, practiced, and become automated performance. Typically during the course of a task, people unconsciously switch between all three levels of functioning depending on the situation (Reason, 1990).

Slips and lapses result from a deviation from the plan, whereas mistakes result from the wrong plan. Slips result primarily from failures on the skill-based level, which represents the highest form of cognitive control. Experts are more skilled at carrying out skill-based and rule-based levels of performance. Though the chances for errors at this

level are usually less, they have a greater magnitude of inaccuracy (strong-but-wrong) (Reason, 1990).

Slips and lapses precede the detection of a problem, and are associated with monitoring failures. Mistakes occur more often at the rule-based and knowledge-based level following the detection of a problem occurring as decision-making failures (Reason, 1990).

In rule-based thinking, changes in situations are anticipated because of past encounters, or as learned from instructors. Mistakes occur because of application of a bad rule or misapplication of a good rule (Reason, 1990). For example if the observer receives an ambiguous signal such as an alarm, the person may decide that the alarm pattern matches a familiar sound, and may make a wrong choice of action such as ignoring a true alarm, thinking it was false (Moray, 1994).

At the knowledge-based level, mistakes happen when the person is not equipped to handle unexpected changes (Reason, 1990). For instance the ambiguous sounding alarm may be totally foreign to the person as well as the correct action required. Thus the person may try to silence a true alarm and take other inappropriate actions.

At the skill-based level, the character and timing of the change may be known, but an alternate choice is not planned (Reason, 1990). For example the charge nurse may have allowed too many personnel to go to lunch. When the ambiguous alarm sounds while busy with another task, the nurse fails to act.

Figure 2 summarizes distinctions between skill-based, rule-based, and knowledge-based errors and their potential failure mode. Errors at any of the three levels will vary

depending on attentional limitations (distractions and preoccupations) and the type of task (Reason, 1990). These factors should be considered in work redesign to reduce distractions, which affect the working memory.

Figure 2. Distinctions Between Skill-based, Rule-based and Knowledge-based Errors.

Dimension	Skill-Based Errors		Rule-Based Errors		Knowledge-Based Errors
Type of Activity	Routine actions		Problem-solving actions		
Focus of Attention	On other things than the task.		Directed at problem-related issues.		
Control Mode	Mainly at automatic processors (action plan) (stored rules)				
Predictability of Error Type.	Largely predictable "strong but wrong" errors.				Limited conscious processes.
Ratio of Error to Opportunity for Error.	Constitute a small proportion of total number of chances for error.				Variable
Situational Influence	Low to moderate; internal factors & prior experience likely to influence.				External factors dominate.
Ease of Detection	Detection usually rapid and effective.		Difficult and often only achieved through external intervention.		
Relationship to Change	Knowledge of change not accessed at proper time.		When and how anticipated change will occur unknown.		Changes not prepared for or anticipated.
Failure Modes & Error Potentials	<u>Inattention</u> Slips, Omissions after interruptions or distractions. Easily distracted. Perceptual confusions. Interference errors.	<u>Overattention</u> Omissions Repetitions Reversals	<u>Misapplication of good rules</u> <u>Mistakes</u> First exceptions. Countersigns & Nonsigns. Information overload.	<u>Bad rules applied</u> <u>Mistakes</u> Encoding deficiency. Action deficiency. Wrong rules. Bad rules.	<u>Mistakes Caused By</u> Workspace limitations. Out of sight out of mind. Confirmation bias. Overconfidence. Biased reviewing. Halo effects Causality problems. Complexity problems.

(Adapted from Reason, 1990, p. 62 & 69).

Indeed active failures (slips, mistakes, memory lapses, and procedural violations) affect the working memory, which differs from primary memory (Moray, 1994; Reason, 1990). Primary memory is identified with long-term memory, chunking of information (clustering), and filing of items, and the recall of large amounts of information. For example primary memory comes into play when studying for an exam. Working memory, on the other hand, is recognized for its short-term memory properties, attention, consciousness, and the storage of small amounts of information (Reason, 1990).

Slips present evidence of a distraction or preoccupation limiting the attention and intended action. Excessive input (information overload) and distractions compete for attention and fill the working memory where information is temporarily stored, thus affecting the ability to concentrate (Reason, 1990).

Slips occur when a planned action fails, and when actions are governed by automatic and familiar patterns. For instance driving home from work is an action governed by automatic influences. If an alternate trip to a shoe store is deliberately planned, the person must disengage the internal "auto-pilot" to accomplish the goal. A slip would occur if the person inadvertently arrived home instead (Reason, 1990).

Latent Errors

Latent conditions (distractions, communication problems, time pressure, noise) are linked to conditions within the external work situation. When latent conditions combine with active failures, repeated mistakes happen (Reason, 1990; Reason, 2000). Medication administration is an example of a complex system involving several phases and steps. When complex systems are faulty the potential to accommodate multiple error

sources accumulate over time and finally result in a major accident. Noise levels, interruptions, difficult to read equipment displays, illegibility of dosage labels, and similar shapes, colors and sizes of bottles, are all system failures in the hospital work environment (Moray, 1994).

Interruptions of activity also cause omitted actions when the intended action is lost due to the delay between the formulation of the action thought and the time of its completion. A lapse will result unless the intended action is sporadically revived with attentional checks. Once the distraction or interruption focuses the person's attention elsewhere, switching attention back to the intended task takes time. Redirection becomes even more difficult when the distraction was unrelated to the current action (Reason, 1990). To illustrate, imagine a nurse administering scheduled medications and getting distracted by the need to administer a pain medication to another patient. Once the alternate task is accomplished, the diverted attention will not take much time to redirect back to the scheduled medication. However, if the switch in activity required the nurse to take the elevator to another floor to transport a patient, more time would be needed to direct the attention back to the previous medication administration task, not only because the activity was unrelated to the previous task, but the diversion would have lasted longer.

Human Factor Study

Postcompletion errors are similar to slips and represent situations where people have the correct knowledge of a routine task, perform the task correctly most of the time, but manage to make an error anyway. Postcompletion and other aspects of human errors

were observed in a four-week replication study involving the effects of punitive actions, retraining, or praise on human error rates. Cognitive functions were also taxed using time pressure and either sound or light. This human factors study involved 60 undergraduate students of a large university using a computer program in which participants acted as cadets in a fictional space navy. They had to complete 10 trials of four tasks to qualify for "Bridge Officer Command School." The complexity of each task varied, with one task being the critical task of interest. This critical task had two versions: a postcompletion and control version. In the postcompletion version, the last step in the task occurred after the main goal of the task had been satisfied. In the control version, satisfying the main goal of the task was contingent on executing this last step. There were six groups of participants. Five groups had the postcompletion version and the last group had the control version. While the participants executed the various tasks, they had to complete a secondary task concurrently with the primary tasks. This secondary task required them to recall and type the last three letters they heard each time they heard an auditory tone. Time and task performance accuracy were measured for both primary and secondary tasks. In the five groups with the postcompletion version of the critical task, participants received one of the following: a reprimand for poor performance, retraining for poor performance, or praise for good performance, no feedback at all, or redesign of the critical task to the control version. The redesign involved simplifying the task steps, which reduced tactical errors from 17% on Day 1 to 9% on Day 3. The results found that punishment, retraining, or praise had little effect on error rates. However, praise elicited a predictable favorable behavioral response (Serig, 2001).

Ultimately, the study found that redesigning the task to create a "forcing function" (something prevents the continued procedure until the problem is corrected) at the point where the error is most likely to happen resulted in fewer errors and improved task time completion. Thus the limitations of cognitive functioning require altering the external environment to accommodate these limitations during task performance using a systems approach (Serig, 2001). These study findings have major implications for work redesign. Performing skill-based tasks along with distractions, increased memory load, and/or time pressures causes more errors.

Distractions

A distraction is defined as any action that draws away, diverts, or disturbs the mind or attention from achieving the medication administration goal. Thus, distractions can take many forms including preoccupations with other things, noise, other peoples' increased activity, interruptions, etc.

A recent study conducted by the USP (2000) during a 12-month period involved 56 hospitals in the US using a self-reporting medication error database. Participating facilities included general community hospitals (59%, n = 33), specialty or psychiatric hospitals (23%, n = 13), teaching or university hospitals (16%, n = 9) and 1 other facility (category not provided). The results of 9,570 reported causes of medication errors indicated that most errors were the result of lack of focus (29%, n = 2,740), failure to follow procedures and protocols (12.4%, n = 1,196), lack of knowledge (18%, n = 732), distractions (8.3%, n = 796), inaccurate documentation (6%, n = 586), communication

gaps (6%, n = 573), overwork (3%, n = 263), and inexperience (2.5%, n = 237). Overall 45% of reported medication errors were due to multiple factors.

One study involving 334 nurses in a large Midwestern tertiary care hospital asked about nurses perceptions of causes of errors. Nurses were surveyed during an in-service on medication administration. Usable survey (N = 238) results indicated that the main reported causes of errors were frequent interruptions (42%) and forgetfulness and oversight (35%). Less than a third of the nurses believed their causes were due to personal disorganization or system problems (Walters, 1992).

Gladstone (1995) sent 102 surveys to 64 nurses and 17 nurse managers in Southwest England. The questionnaires asked nurses to rank 10 separate statements about the causes of medication errors. Eighty-one nurses returned surveys and ranked causes of errors in order of importance as: (a) failing to follow procedures such as checking the patient's armband, (b) illegible orders, and (c) distractions as third. Therefore, work processes and facilities need to be redesigned to reduce these environmental problems.

Working Conditions

In a study of 39 nursing units in 11 hospitals, risks for medication errors were associated with working conditions and staffing levels. Nursing units with higher RN proportions tended to have fewer MAEs (Blegen & Vaughn, 1998). A study involving a 140-bed hospital in Anchorage, Alaska found that increased risks for MAEs were due to darkness and the winter months, increased patient days, increased number of shifts worked by temporary staff, and nurses working overtime (Roseman & Booker, 1995). Additionally, the American Nurses Association recently cited mandatory overtime as a

dangerous practice with the potential to increase errors (Foley, 2000). However, employment restrictions in healthcare institutions may be dependent on the organizational culture.

Organizational Culture

Culture is a set of norms, attitudes, and values inherent within the organization defined by the importance placed on the work done. The organizational structure involves relations between individuals, groups, and positions. Organizational culture shapes the work, the change process, the power held by others, and the impact of external trends (Harrison & Shirom, 1999). The assumptions, values, and beliefs of employees merge with managerial systems producing the norms and standards of the organizational culture. The hospitals culture regarding how MAEs are handled also affects whether or not nurses report errors. Conversely, if medication errors are not reported system issues may not be uncovered which affects the organizational culture (Wakefield, et al., 1996; Wakefield, et al., 1999b; Wakefield, Wakefield, & Uden-Holman, 2000).

In one study of 292 nurses in six hospitals, four organizational culture types were studied in relation to likelihood of support for reporting MAEs. The four types were: group (affiliation, trust, flexible, people-oriented, with supportive leadership) developmental (task focus, flexible, with inventive risk-taking leaders) hierarchical (bureaucratic, controlling, with cautious leaders) and rational type (achievement focus, productivity, efficiency, with directive goal-oriented leaders). Authors used Quinn and Kimberly's 20-item self-reporting organizational culture inventory. Results were correlated with a 58-item Continuous Quality Improvement (CQI) inventory, which was

also completed by study participants. The study results showed that more MAE reporting is associated with the group-oriented culture (Wakefield, Wakefield, & Uden-Holman, 2000).

Certainly management places constraints on organizational culture in many ways. Managers create the qualities of organizational culture when ranking objectives in terms of safety, profit, service, and standards. Such shaping may be deliberate or accidental, depending on financial constraints and value systems, and whether or not the managerial culture supports learning from past errors. Administration also exercises control over the type of equipment purchased, establishes staffing levels, patterns of shift work, bonuses for good work or sanctions for bad work (Moray, 1994).

If managers are not perceived as concerned about safety, employees will follow with the same attitude. Further, if employees do not trust management, they will reject any new safety initiatives. Effective changes begin with management that supports a safety culture by "walking the walk" of safety not just by "talking the talk." When new employees come aboard, someone who exemplifies the safety culture should mentor them (Helmreich & Merritt, 1998). Ultimately organizational culture either supports or detracts from organizational effectiveness. Teamwork may also be an important contributor to assisting nurses to avoid distractions during medication administration.

Teamwork

Team structures often lose cohesiveness as constraints from social dynamics cause them to dissolve into an informal group. Subsequently, when the formal authority structure is lacking, the team functions ineffectively. Even if someone in the team

remains functional, social pressures by other team members eventually cause behavior conformity (Moray, 1994).

The airplane cockpit demonstrates one example of the importance of teamwork, with clear lines of authority and effective communication. Pilots follow standard operating procedures and checklists directing appropriate actions. Nevertheless, variations can occur in flight or on the ground requiring coordinated efforts between team members, the captain, and the airplane's computer. Airline research indicates that errors have occurred most often because of failures in teamwork and coordination. Complex work such as that involved in the healthcare also requires teamwork. Thus following the example of the aviation industry by training teams to work harmoniously can improve safety (Helmreich & Merritt, 1998). Leaders must demonstrate support for safety and expect employees to model an attitude of safety in work relations.

Safety and Error Prevention

Countermeasures to errors are derived from the notion that although we cannot change the human condition, we can redesign the work system to help humans avoid errors. When the system fails to prevent an error, the focus should not be on who makes a mistake, but how and why the defenses failed (Reason, 2000). System redesign is a critical component of future health care safety in creating a culture where prevention is everyone's responsibility (Leape et al., 1998).

Root-Cause Analysis

Root cause analysis was developed over the last five years by the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) as a method to

investigate medication errors and learn from experience, especially following sentinel events. The term sentinel is used because it sounds a warning that something needs to be done to prevent future similar incidents. The new criteria for determining whether a medication error is considered sentinel include: patient death, paralysis, or coma associated with a medication. Any "near miss" medication error is now considered non-reportable (Joint Commission on the Accreditation of Healthcare Organizations [JCAHO], 2001a). An estimated 10 to 20 such events occur in every US hospital annually. These events are considered sentinel because they sound a warning that immediate attention is required (Kobs, 1998). Unfortunately, MAEs are third in the list of causes of sentinel events leading to patient death or loss of function (JCAHO, 2002).

Sentinel events are now voluntarily reported to JCAHO and followed up with root cause analysis within 45 days. However, healthcare institutions are encouraged to report sentinel events so that other institutions may benefit from the information learned. Since the JCAHO began tracking MAEs in 1995, there have been 89 sentinel cases reported. As a result, monthly reports are published describing the nature of reported sentinel events and methods for prevention of errors. For example, the death of a seven-year old boy during an elective tympano masotoidectomy resulted from a mix-up in the operating room (OR). The situation involving lidocaine with epinephrine 1:100,000 happened when it was accidentally replaced with topical adrenalin 1:1000 causing the boy's death shortly after it was injected. The root-cause analysis initiated a change in the OR process of transferring medications to the sterile field (JCAHO, 2001a).

Failure Mode Effects Analysis

Failure Mode Effects Analysis (FMEA) is a technique often applied by other industries to prevent human error prospectively rather than retrospectively. FMEA includes an ongoing identification of the entire system including subsystems, processes, interactions, functions, and error prone procedures. The next step is determining what possibly could go wrong and establishing error traps. For example separating look alike drugs from each other or identifying a hazardous procedure and making a change (Cohen & Senders, 1994; Cohen, 1999).

Protocols and Visible Signage

Medication errors can be prevented if hospitals establish streamlined procedures and routines for administering medications and nurses avoided busyness and being interrupted or distracted (Walters, 1992; Wolf, 2001). Another example of a safety process is conducting a chart check (Marino, et al., 2000) using redundancies when verifying medications by reading the label three times, or having two nurses confirm the correct medication (Wolf, 2001).

Using visible hazard warnings, following written protocols and procedures, and encouraging accurate documentation promote medication administration safety (Wolf, 2001). The world of symbols, values, social entities, and cultures is something very real as systems theory bridges the gap between science and the humanities, technology and history, natural and social sciences. Humans have increasingly become symbol-making, symbol-using, symbol-dominated creatures. First, symbols represent something of value to humans. Second, symbols are transmitted by tradition and by learning processes.

Thirdly, the connection between the symbol and the value represented is either imposed from outside or from within (von Bertallanfy, 1967).

Professions typically have symbols differentiating themselves from others. For example, the white smock worn by physicians or the airline pilot with multiple golden stripes and wings. The symbols identify both professions as having a certain level of expertise that sets them apart from other persons (Helmreich & Merritt, 1998).

In a study of 203 parents and their children, Barrett (1994) found that children rated both male and females dressed in a white lab coat as most competent, compared with four other types of dress. The study took place in a Birmingham Children's Hospital using a survey in which participants reviewed five color photographs each of male and female doctors dressed in a variety of attire. Half the set of parents and children rated the male photos (99) and the other half rated the female photos (104). Subjects were asked to assign both positive and negative attributes to the photos (most competent/ friendly/ concerned/ gentle/ preferred; least competent/ friendly/ concerned/ gentle/ preferred). Children thought the man (44%, $\underline{n} = 44$) and the woman (46%, $\underline{n} = 48$) in the white coat were most competent.

In a similar study involving 168 patients from three teaching clinics of the department of Family Medicine in Israel, subjects were asked to select a photo that represents their preferred choice for doctors or nurses. Participants, who were both native and foreign born, were shown 12 photos of the same male physician and 6 photos of the same female physician wearing a variety of clothing. They were asked to choose their preferred photo. The results showed once again that the traditional formal attire with

white lab coat was preferred for both doctors and nurses. The study revealed that 52% (n = 87) liked the male in the white coat and 71% (n = 119) preferred the female it the white coat (Menahem & Shvartzman, 1998).

In a qualitative study examining the components of nurses' professional attire, the majority of 14 participants, including 12 healthcare professionals, 1 nursing student, and one lay person, the majority of respondents believed that a clean white uniform (especially a white lab coat) and a large print identification badge promoted easy identification and projected an image of competency and professionalism. Participants also felt that the ability to identify the nurse from other caregivers was critical. They noted that identifying an employee's status is often difficult because institutions attire all many types of employees the same (Lehna, et al., 1999).

Signs can serve as warning of impending danger or error messages before the fact (Reason, 1990). Thus, signs and symbols can serve various purposes in the medication administration process. For example, symbols can identify the nurse by attire so that others recognize a preconceived level of knowledge and expertise. Signs are useful reminders of the priority of safety and act as activators to direct behavior (Geller, 2001).

One problem often encountered with signage is the phenomenon known as habituation. This process causes people to learn not to respond to an event that occurs repeatedly. If this were not the case, we would not be able to tolerate road noise, machinery clatter, or other fairly innocuous distractions. However, the importance of the consequences for not following the sign reduces the potential for habituation and increases the potential for continued compliance. People must believe that the safety goal

is worthwhile, or that the consequence for not achieving it is unacceptable (Geller, 2001). Decreasing the potential for medication errors provides a worthwhile safety incentive to reduce distractions during medication administration.

Summary

The literature review for this study revealed that medication errors are a persistent multifaceted problem. The increased costs of medication errors, cases in the news, societal pressures, and government agency support have provided the impetus for current patient safety research. As a result, a considerable amount of medication error literature has erupted.

Although much research into medication error system issues has been done, with the multi-disciplinary nature of errors recognized widely, the majority of studies do not address effective interventions. Primarily, studies have focused on institutional and personal effects of medication errors, barriers to reporting, responses and consequences of reporting, and causes of medication errors. A few studies have focused on system causes and one study involved human factors, but no research studies have included distraction-reducing techniques. Some studies have focused on technological resolutions, but these reveal important limitations for consistent usage.

Having outlined the existing state of the science regarding medication errors has lead to the discovery of structures and processes needed to reduce system constraints. System constraints include breakdowns in both work design and environmental design. Design failures involve problems with process, tasks, or equipment. The literature clearly identifies a lack of intervention research on system issues to prevent distractions, improve

focus, and develop teamwork. The purpose of the proposed study is to address this lack by examining the effect of two targeted interventions on the medication administration practices of nurses.

CHAPTER 3

PROCEDURE FOR COLLECTION AND TREATMENT OF DATA

A quasi-experimental three-group design was used to test the effects of two interventions to reduce distractions of nurses administering medications. Hallmarks of the quasi-experimental design include manipulation of the independent variable to observe its effect on the dependent variable, controlling for confounding variables, and use of a convenience sample. Further comparisons between intervention groups and the control allow additional interpretation of the results (Knapp, 1998; Polit & Hungler, 1995).

Consistent with the design, this study utilized a convenience sample of medication administration cycles while observing nurses employed in a mid-sized acute care hospital medical-surgical nursing unit To control for confounding variables one nursing unit with a patient census of approximately 30 and with no medication room was utilized for each set of 8 observations. The medication-dispensing machine was freestanding located near one end of the circular nurses station. The independent variable was group identity of first the control and then the two interventions to prevent distractions during medication administration. The dependent variable was the number of distractions throughout 8 cycles of medication administration for each group. A medication cycle started when the nurse began the administration of all assigned patient medications at a scheduled time and included the chart check procedure. The medication cycle ended when the nurse completed charting medications given.

Setting

The study took place in a 520-bed acute care "for-profit" hospital located in a large metropolitan city in southeast Texas over a six-day period in early December. One medical-surgical nursing unit with a patient census ranging from 19 to 27 during the study period was utilized for each set of 8 observations. Nurses administered approximately 10-30 medications for their assigned patients during each medication cycle. Nurses were observed for no longer than two hours for any one medication cycle.

Population and Sample

The population included hospital high volume medication administration cycles. A convenience sample ($\underline{N} = 24$) of medication cycles was selected for one control and two intervention groups during high volume medication administration times. Observed subjects were English speaking male and female nurses who routinely administered medications and agreed to participate. Subjects were excluded if they were not routinely assigned to the nursing unit, were precepting a student or new employee, or had participated in the pilot study. Due to differences in nursing units within the facility (some having medication rooms, some with partial medication rooms, and only two without a medication room), one nursing unit was selected to control for extraneous variables.

Following a pilot conducted for this study, an effect size of 1.32 for a power of .80 and alpha of .05 (one-tailed) was established. According to Lipsy (1999) a sample size of 5 is considered adequate to determine significant mean differences between

groups. However, since few studies exist for comparison, a sample of 8 medication administration cycles for each group was observed.

Protection of Human Subjects

After obtaining approval from Texas Woman's University Institutional Review Board and permission from the study hospital, study dates and times were established. Medication administration cycles were the unit of interest in this study. Participation was voluntary with all observed subjects provided informed consent (Appendix B). Potential risks were discussed with each study participant, and they were told that they could withdraw from the study at any time.

Potential risks included: feeling anxious at being observed while administering medications, feeling embarrassed if a medication error was made, fearing that errors could result in disciplinary action, and loss of confidentiality. Confidentiality of data was established with code numbers used for identification of all information (Appendix C) and study materials were kept in a locked file cabinet. Study participants were assured that they would not be identified in written reports.

Instruments

Two instruments were employed for data collection. They were the Medication Administration Distraction Observation Sheet (MADOS) (Appendix A) and the Demographic Data Form (Appendix C).

Demographic Data Form

The Demographic Data Form (DDF) was used to collect information from participants prior to the observation process. The information included: age, gender, ethnicity, level of nursing education, years of nursing experience, and self reported level of nursing expertise (Appendix C)

The Medication Administration Distraction Observation Sheet (MADOS)

The MADOS is a 10-item instrument designed to count distractions during medication administration. A distraction was defined as any action that draws away, diverts, or disturbs the mind or attention from achieving the medication administration goal. Potential distraction sources included: physician, other personnel, phone call, other patient, visitor, missing medication, wrong dose medication, emergency situation, conversation, and external noise. Data collection for observing distractions during medication administration was completed by the nurse researcher for both the control and the intervention periods for each observed nurse. The Medication Administration Distraction Observation Sheet (MADOS) included number of distractions by category (Appendix A). The observer made slash marks under the corresponding cause of the distraction each time a distraction occurred. The scheduled medication time and total time interval for each observation period were also entered on the MADOS form.

MADOS Validity and Reliability

Prior to its use, the MADOS was designed after performing a literature review of the domain content of distractions. The MADOS instrument was then developed into a survey for content validation using Fehring's (1987) diagnostic content validation (DCV)

model. The final MADOS was based on expert opinions of nurses (N = 26), who validated the instrument using a rating scale (Fehring, 1987). Those items that received high scores indicated that the nurses considered the items important sources of distraction during medication administration. Items receiving a DCV over 0.3 were considered valid for inclusion in the instrument. Items that received very low scores were excluded.

During the pilot study a student nurse was trained as research assistant for validating the MADOS instrument on the first day. Interrater reliability was calculated by comparing the investigator and trained observer's counted distractions. Reliability was determined by calculating the total number of distractions marked by category and dividing the number of agreements by the number of agreements plus disagreements (Knapp, 1998). A cut off level of 0.80 was selected as the minimum acceptable reliability estimate. Thus, Interrater reliability was established at .90 indicating a high Interrater reliability quotient. The MADOS instrument was also validated in the pilot study by nurses' comments to an open-ended question on the demographic sheet regarding causes of distractions.

Pilot Study

A quasi-experimental pilot study was conducted to determine feasibility of the study protocols. The pilot study took place on a medical-surgical nursing unit in the same mid-sized acute care "for-profit" hospital located in a large metropolitan city in southeast Texas over a three-day period. A convenience sample of 6 high volume medication administration cycles was selected. Nurses who agreed to be observed and met study inclusion criteria were selected for participation. One medical-surgical nursing unit with a

patient census of approximately 30 was selected within the facility. Data were collected for medication observation during the 9: 00 a.m. and 1:00 p.m. medication administration times. Various nurses served as both control and intervention groups on different days. Lower observation scores represented more favorable results.

The one-way ANOVA ($\alpha = .05$) revealed significant differences among the groups, $F(2, 5) = 9.992$, $p = .048$. Post hoc pairwise comparisons using Tukey's HSD found a significant difference between the control and the Medsafe© group, $p = .045$.

Pilot study participants were asked to evaluate the research protocol, including critique of the observers influence, the length of observation time for each medication cycle, and use of checklists and the Medsafe© vest. Their feedback was used in modifying study protocol for the major research project. Feedback from the nurses included concern that the researcher emphasize the importance of acting normal during the control group. Nurses said they tended not to distract because of the title of the study on the informed consent. They also stated they felt they were being judged on their technique. Nurses said that the one-yard distance the observer stood was adequate and that observation time of two hours was not too long. Even though nurses felt awkward wearing the red vest with lettering, they suggested its continued use for the major study and that the same words "Do Not Disturb" be placed on the vest front. Based on this feedback, the control group for the major study was specifically asked to act as normal as possible so the reality of the medication administration process may be uncovered. The same vest with lettering was used. However, the words "do not disturb" were included on the vest front. Additional vests were obtained to facilitate the larger sample size and

frequency of use. Because of difficulty conducting in-service education sessions on the nursing unit prior to the interventions, the researcher asked the nurse manager for assistance with gaining the attention of the staff. Information given to potential study participants prior to the study emphasized that it was not the researcher's intent to make judgments about technique or to look for errors.

Form changes included items in the informed consent, the MADOS, and the checklists. The informed consent did not include the word "distractions." Instead participants were informed that the purpose of the study was to observe the medication administration process. Given that it was difficult to determine the status of the personnel doing the distracting during the pilot study, the categories "other nurses" and "other personnel" were combined to become "other personnel." Since it was also difficult to determine whether a chart check problem occurred without asking the nurse, this item was eliminated from the MADOS. Having to ask the nurse presents another source of distraction. In response to nurses' suggestions, the item on the protocol checklist indicating to "verify the empty unit dose packet while charting" was eliminated in favor of a suggestion to "correctly document medication administration."

Data Collection

After obtaining approval from Texas Woman's University Institutional Review Board and permission from the study hospital, nurse managers were contacted to arrange study dates and times. A convenience sample of high volume medication cycles was selected for observation. Observed nurses were selected from those who agreed to participate and met study inclusion criteria. Participation was voluntary with all subjects

provided informed consent. Participants were told that the medication administration process would be observed. Potential risks were discussed with each study participant and they were told that they could withdraw from the study at any time without repercussions. Potential risks included feeling anxious at being observed while administering medications, feeling embarrassed if a medication error was made, fearing that errors could result in disciplinary action, and loss of confidentiality.

Confidentiality of data was established with code numbers used for identifying all data and study materials kept in a locked file cabinet. Study participants were assured that they would not be identified in written reports. After signing informed consent participants were asked to complete the DDF. Nurses who participated in the pilot study were not eligible for inclusion in the major study.

Data were collected from the sample ($\underline{N} = 24$) of medication administration cycles observed during high volume medication administration times. Observed participants were included if they were English-speaking, male and female LVNs or RNs regularly employed on the nursing unit and were not precepting a nursing student or new employee. The researcher attempted to control for observer influence by standing at least one linear yard behind and/or to the side for the observed nurse and nurses were not observed any longer than two clock hours. In addition, the researcher was familiar to staff in the setting as a clinical instructor with nursing students during previous semesters.

A medical-surgical nursing unit was used weekdays for observing and counting distractions during medication cycles. Nurses obtained medications from an automatic medication-dispensing machine situated near one end of the circular nurses' station. The

study took place over a six-day period of time with distraction observation continuing for each group until the sample of 8 medication cycles for each group was reached. Nurses were observed during scheduled medication administration for the 9:00 a.m., 1:00 p.m., 5:00 p.m. and 9:00 p.m. times for each study group.

For the control group, distractions were observed while nurses used customary medication administration procedures ($\underline{n} = 8$). Observed participants and other employees were asked to maintain the usual conditions during medication administration and to act as normal as possible. For the first intervention group ($\underline{n} = 8$), nurses' distractions were counted while they use the focused protocol including a checklist (Appendix D). Just prior to data collection, staff members participated in a brief education session regarding the study protocol. Employees were asked not to interrupt or distract the nurse being observed during medication administration unless the distraction related to the medications being administered. Instead they were asked to intercept phone calls and other distractions for the nurse as much as possible. The observed nurse was also asked to avoid conversation unrelated to medications.

Subsequently, for the second intervention group ($\underline{n} = 8$) the focus was on counting distractions while nurses used the Medsafe© protocol with checklist (Appendix E) and study nurses wearing a special vest. As before, just prior to data collection, staff members were in-serviced regarding the study protocol and asked not to interrupt or distract the nurse being observed during medication administration unless the distraction related to medications being administered. Instead they were asked to intercept phone calls and other distractions for the nurse while the nurse wore the vest. The observed nurse was

asked to wear the red vest and avoid conversation unrelated to medications during medication administration. The red vest had white lettering with the words "Medsafe Nurse, Do Not Disturb" on the back and front.

Treatment of Data

Descriptive indicators were used in analyzing demographic data, including frequencies, percentages, and measures of central tendency and variance. The total number of distractions for each category was entered as interval level data into SPSS 10.0 (Statistical Package for the Social Sciences). Demographic information was also entered into the computer program for analysis.

Data from the MADOS instrument was analyzed using a one-way ANOVA (α = 05) to compare mean scores between the groups for total distractions. Descriptive statistics was used in evaluating distraction scores by category. In addition, multiple and bivariate linear regression analysis was performed to explain the extent to which each distraction category predicted distractions nurses were likely to experience during most medication administration cycles.

A three independent groups design ($\underline{N}$ = 24), was used to analyze mean distraction score differences between the groups of (a) nurses using standard and customary procedures ($\underline{n}$ = 8), (b) nurses using a focused protocol based on airline industry safety measures with checklist ($\underline{n}$ = 8), and (c) those using a focused protocol based on airline industry safety measures with checklist plus a special Medsafe© vest ($\underline{n}$ = 8). Lower scores represented more favorable results. The groups were homogeneous because of

equal sample size. Post hoc pairwise comparisons using Tukey's HSD were used to evaluate the effect of type of intervention on number of distractions.

Summary

The purpose of this study was the objective measurement of the number of distractions occurring during medication administration cycles on an average nursing unit. The findings were analyzed to determine if they increased, stayed the same, or decreased after two planned interventions. After observing the control group, the first intervention was implemented. The aim of the focused protocol was to inform and remind the medication nurse to focus on the task at hand, to not engage in conversation and to decrease distractions. Staff members were asked to not distract or interrupt the nurse, but to facilitate medication administration by fielding phone calls or other distractions. The second intervention included the same reminders but also an outward visible sign in the form of a red vest with lettering to indicate to others that the nurse administering medications should not be disturbed. Other team members again facilitated the Medsafe© protocol by deterring distractions for the nurse as much as possible. The results were further compared to determine if significant differences were present between interventions, and which distracters predicted more of the total number of distractions.

CHAPTER 4

ANALYSIS OF DATA

The purpose of this study was to evaluate the effectiveness of two targeted interventions designed to decrease hospital employed nurses' distractions during medication administration. A distraction was defined as any action that draws away, diverts, or disturbs the mind or attention from achieving the medication administration goal. The procedures included the use of focused protocols, checklists and the application of a special vest. The study was guided by the model: Medication Administration for Safety in Hospitals (MASH), which depicts the structure, process, and effectiveness dimensions within the multilevel prescriptive model of the organization, group, and individual. The MASH model depicted three open system components: inputs, throughputs, and outputs. Since the throughput section was considered the most intervenable component, it was selected for testing the interventions on system associations. This process portion involved group constraints in medication administration. In the case of medication administration errors (MAEs), the constraints were environmental (distractions and noise), procedure constraints (failure to establish and follow standard operating procedures and protocols), and behavior constraints (lack of focus, communication problems, and conversation).

Data were collected using a demographic data form (DDF) to identify characteristics of participating nurses, and the Medication Administration Distraction Observation Sheet (MADOS) was used to measure observed distractions during medication administration. Descriptive statistics were used in summarizing participant

demographic data in order to describe the sample. The MADOS summed scores for total number of nurses' distractions were analyzed using a one-way analyses of variance (ANOVA). Post hoc pairwise comparisons using Tukey's HSD evaluated the effect of the type of intervention on the number of distractions. Multiple and bivariate linear regression and descriptive statistics were used to further elucidate distraction categories in an attempt to predict the most common sources of future distractions.

Description of the Participants

Medication administration cycles were the unit of interest in this study. Data were collected from a convenience sample ($\underline{N} = 24$) of medication administration cycles observed during high volume medication administration times. A medication cycle started when the nurse began the administration of all assigned patient medications at a scheduled time and ended when the nurse completed charting medications given.

A total of 17 individual nurses were observed to obtain a total of 24 medication cycles with some nurses observed more than once. Staff nurses consenting to participate in the observation cycles included English-speaking, male and female LVNs and RNs regularly employed on the nursing unit who were not precepting other nurses or students. Initially, the nurses were told that the observations were of a general nature. However, problems were encountered as nurses elected not to participate unless they knew more about what was being observed. Therefore, they were told that the environment was being observed during medication administration times. Several nurses later reported that they suspected that interruptions were being counted. Reasons given for not volunteering

for study participation were feeling hurried and being uncomfortable at being observed administering medications.

Four or five nurses staffed the nursing unit during the day and evening shift, depending on patient census. There was consistently one charge nurse, who was assigned fewer patients. There was also a unit secretary and two nurses' aides for each shift. Occasionally, there were new employees being precepted by nurses or nurses' aides. The nursing unit noise level remained relatively high throughout most of the study, but it was even greater during the Medsafe© protocol days as the patient census rose.

Due to a limited number of nurses regularly employed on the nursing unit willing to participate, some nurses participated more than once. Five nurses accounted for 12 medication cycles and 12 nurses accounted for the other 12 cycles for a total of 24 medication cycles. One nurse participant was also in charge of the nursing unit, but the potential for increased distractions was offset by having fewer assigned patients and by the presence of the nurse manager who assisted with phone calls and questions so the nurse could administer her assigned patient's medications. This occurred twice during the study period.

Just prior to data collection, staff members were educated regarding the study protocol. Prior to the control group ($n = 8$) observation period, staff members were asked to act as normal as possible so the reality of the medication process could be observed. For the second observation session ($n = 8$), employees were asked not to interrupt or distract the "special nurse" being observed during medication administration unless the distraction related to medications being administered. For the third observation session (n

= 8), staff members were asked not to interrupt or distract the nurse wearing the vest during medication administration unless the distraction related to medications being administered. In-services were not implemented as planned. Because of the design of the work environment and the standard one-on-one report, the nurse manager stated that it was not possible to gather all employees together. Instead, the researcher instructed each individual employee. Patient census for the control group was 19 on the first day and 23 on the second day. Despite the observer's attempts to avoid influencing participants during the control group study period, it seemed that some nurses were still influenced. They tried to stay unusually focused on the medication process. This observation was based on the observer's previous experience being on the unit with the nurses as an employee and as an instructor with students. Nevertheless, other persons and employees continued to interrupt as usual, and phone calls continued to be answered and made by the nurses.

Patient census rose to 25 during the focused protocol intervention period, and to 27 during the Medsafe© protocol intervention. Although study participants agreed to follow the study protocol, some nurses were seen deviating from practice by not taking the medication administration record (MAR) with them, and by removing pills from unit dose packaging prior to going to the patient's room.

During the study period, there was a change in methods for selecting medications from the medication-dispensing machine. This change occurred just prior to implementation of the Medsafe © protocol. The change entailed nurses having to hand count all medications in the drawer and enter the amount on the computer touch screen,

instead of simply agreeing with the amount shown. This change added to the time it took for nurses to obtain medications from the machine and could have added to the number of distractions experienced during the Medsafe© protocol. However, it appears that this change did not make much difference.

One thing that did seem to add to the time involved with obtaining medications was that nurses often had to look in various places for missing medications. Nurses would first check the medication-dispensing machine, then check the patient's medication cart drawer or check the refrigerator. Finally nurses would check the pharmacy in-box for the drug. If the medication still could not be found, the nurse would call the pharmacy or search in other patients' medication drawers in case the drug was inadvertently placed in the wrong drawer. Some nurses were even seen borrowing from other medication cart drawers in order to be able to dispense the medication on time. Many nurses obtained medications earlier than the scheduled administration time since they had to line up at the machine to obtain the medications. These practices occurred consistently, regardless of which protocol was used in the study. Following all data collection, the nurse manager was given a thank you note along with $300 toward the purchase of educational equipment for the nursing unit. Staff members were given small parting gifts.

Among the nurses observed, 70.6% (n = 12) were Anglo, 23.5% (n = 4) identified themselves as Hispanic, and 5.9% (n = 1) were African American. There were 94.1% (n = 16) females and 5.9% (n = 1) males. One participant who volunteered twice did not report age. Reported ages ranged from 26 to 51 years with a mean of 39.2 years (SD =

7.9). The educational level of the nurse participants included: an equal number of LVNs and ADNs, each accounting for 41.7% (n = 7), followed by BSN graduates at 11.8% (n = 2), and 5.9% (n = 1) Diploma graduate. Participants' years of nursing experience ranged from 1 to 26 years with a mean of 8.8 (SD = 8.2). The majority of participants' level of expertise was self-reported as proficient (52.9%, n = 9). The remaining participants reported being competent nurses (35.3%, n = 6) or advanced beginners (11.8%, n = 2). Measurement of distractions during medication administration was accomplished by counting the number of distractions using the MADOS instrument by type of distraction that the nurse encountered during a medication administration cycles (Appendix A). A slash mark was made on the sheet each time a distraction occurred.

Findings of the Study

The study tested one research hypothesis and one research question. The research hypothesis stated: Two targeted interventions, a "focused" protocol and a "Medsafe©" protocol both with educational interventions, will reduce nurses' distractions during medication administration cycles when compared to a control group of similar nurses who do not use either intervention. The research question was: Which distracters contribute more significantly to the distraction variance nurses experience and are more predictive of nurses being distracted during medication administration cycles?

Statistical data were analyzed using SPSS 10.0 (Statistical Package for the Social Sciences) with alpha set at .05. The research hypothesis was addressed by observing eight medication administration cycles for each of the two treatment groups and one control. The control group experienced 484 (mean = 60.50 ± 12.91) distractions during

medication administration. When the focused protocol was used to guide medication administration there were a total of 180 distractions (mean = 22.5 ± 8.47) per observation. When the Medsafe© protocol with vest was used, total distractions dropped to 64 instances (mean = 8 ± 4.50). Table 1 presents means and standard deviations for the dependent variable of distractions during medication administration on the independent variable of group assignment for either the control group, the focused protocol group or the Medsafe© group.

Table 1

Means and Standard Deviations for Number of Distractions Nurses Experienced During Scheduled Medication Administration for the Control, Focused Protocol or Medsafe© Protocol Group Interventions (N = 24).

	Distractions Experienced During Medication Administration		
Group	Mean	Standard Deviation	Total of all distractions
Control (n = 8)	60.50	12.91	484
Protocol (n = 8)	22.50	8.47	180
Medsafe© (n = 8)	8.00	4.50	64

Mean differences in effectiveness of the two interventions to reduce distractions during medication administration were analyzed using a one-way ANOVA. The ANOVA revealed statistically significant mean differences among the groups, F (2, 23) = 68.229, p = .000. The independent variable was group assignment for the control, the focused protocol group or the Medsafe© group. The dependent variable was the change in

number of distractions experienced by nurses during medication administration depending on whether they were a part of the control group or one of the intervention groups. The model was able to predict that 86% of the time there would be a decrease in distractions depending on the intervention used (Table 2).

Table 2

One-way Analysis of Variance (ANOVA) for Differences Among Groups on Number of Distractions Nurses Experienced During Medication Administration (N = 24).

Source	Sum of Squares	df	Mean Square	F	p
Between groups	11761.333	2	5880.667	68.229	.000
Within groups	1810.000	21	86.190		
Total	35654.000	24			

Dependent Variable: Total number of distractions
*p < .05
R squared = .867 (Adjusted R squared = .854)

Post hoc pairwise comparisons using Tukey's HSD were used in evaluating the effect of the type of intervention on number of mean distractions. The ANOVA relies on the assumption that the variance spread is the same in all conditions. Since equal sample sizes existed in this study, no test for homogeneity of variance was performed. There was a significant mean difference in total distractions between the focused protocol group and the control group (p = .000). There was also a significant difference between observed distractions for the focused protocol group and the Medsafe© group (p = .014) and between the control and the Medsafe© protocol group (p = .000) (Table 3). These

findings indicate that significantly fewer distractions occurred in the Medsafe© vest wearing group than in the protocol or control groups.

Table 3

Tukey HSD Post Hoc Pairwise Comparisons for Mean Differences Between Groups on Number of Distractions Nurses Experienced During Medication Administration (N = 24).

Group	Group	Mean Difference	Std. Error	p
Control (n = 8)	Protocol	*38.00	4.64	.000
Protocol (n = 8)	Medsafe©	*14.50	4.64	.014
Medsafe© (n = 8)	Control	*52.50	4.64	.000

Based on observed means. Dependent variable: Total distractions
* The mean difference is significant at the .05 level.

Distraction categories were further analyzed using descriptive methods and multiple and bivariate linear regression. Just as the mean values decreased, the total of all distractions decreased incrementally with each intervention as follows: 484 for the control group, 180 for the focused protocol group and 64 for the Medsafe© group.

Descriptive analysis shows that for all three groups, most of the distractions occurred due to interruptions by personnel and by distractions caused by conversation. These distractions included conversation caused by others in the environment or those that were caused by the nurse speaking to someone about something other than medications. The two types of distractions were mutually exclusive in that if conversation were a part of the interruption by personnel, it was not counted as a conversation

distraction unless it was directed toward someone else or unless loud conversation in the area distracted the nurse.

The control group experienced the most interruptions by personnel (n = 154, 58%) followed by the focused protocol group (n = 84, 32%) and the Medsafe© group with the least interruptions by other employees (n = 29, 11%). External conversation or nurse initiated conversation accounted for nearly the same amount of interruptions (n = 155, 72%) for the control group, less for the focused protocol group (n = 50, 23%) and even fewer for the Medsafe© group (n = 10, 5%). The fewest number of distractions were caused by a wrong dose of medication being present or an emergency situation in all three groups (Table 4).

Multiple and bivariate linear regression analysis were conducted to answer the research question. The research question stated: Which distracters contribute more significantly to the distraction variance nurses experience and are more predictive of nurses being distracted during medication administration cycles?

The potential distraction source was the independent variable and the total number of distractions was the dependent variable. Potential distraction sources included: physician, other personnel, phone call, other patient, visitor, missing medication, wrong dose medication, emergency situation, conversation, and external noise. Results of the simultaneous multiple regression analysis revealed that all ten distraction predictors were significantly related to the total number of distractions nurses experienced, $R^2 = 1.0$, $F(10, 13) = 2.96E + 15$, $p = .000$. Subsequently bivariate linear regression was used to

estimate the unique effect of each variable, while holding other effects constant on the total number of distractions nurses experienced.

Table 4

Means, Standard Deviations, And Frequencies of All 10 Categories of Distractions Nurses Experienced During Medication Administration for the Control, Focused Protocol, or Medsafe© Groups (N = 24).

Group		MD	Other person	Phone call	Other pt	Visitor	Missing Med	Wrong dose med	Emerg. situation	External talking or nurse talked	Loud noise
Control											
	Mean	1.75	19.25	8.38	2.88	1.75	2.38	.38	.63	19.38	3.75
	SD	1.04	3.28	3.62	.99	1.49	1.06	.74	.74	5.24	1.39
	% of Total	82%	58%	74%	61%	64%	56%	60%	83%	72%	88%
	Total	14	154	67	23	14	19	3	5	155	30
Protocol											
	Mean	.25	10.50	1.50	1.50	.63	1.13	.13	.13	6.25	.50
	SD	.71	4.24	1.60	.93	.74	1.73	.35	.35	4.50	.53
	% of Total	12%	32%	13%	32%	23%	27%	20%	17%	23%	12%
	Total	2	84	12	12	5	9	1	1	50	4
Medsafe©											
	Mean	.13	3.63	1.38	.38	.38	.75	.13	.00	1.25	.00
	SD	.35	2.13	.74	.74	.74	.89	.35	.00	1.39	.00
	% of Total	6%	11%	12%	8%	14%	18%	20%	.0%	5%	.0%
	Total	1	29	11	3	3	6	1	0	10	0
All											
	Mean	.71	11.13	3.75	1.58	.92	1.42	.21	.25	8.96	1.42
	SD	1.04	7.27	4.01	1.35	1.18	1.41	.51	.53	8.72	1.89
	Total	17	267	90	38	22	34	5	6	215	34

Independent variables are listed in order of importance from greatest likelihood to increase distractions to least likely to contribute to total nurses' distractions during medication administration. The wrong dose medication variable was non-significant in

the bivariate regression analysis indicating a low relationship to total distractions. Conversation accounted for the majority (93%) of the variance in total distractions, interruptions by personnel accounted for 90%, and loud noises accounted for 87% of the variance (Table 5). Variables that involved people in the environment seemed to form a pattern of more increases in distractions compared to those factors related to medications.

Table 5

Bivariate Linear Regression Using Separate Predictors While Controlling for All Other Distractions Sources Nurses Experience During Medication Administration.

Distracter	R	R^2	Slope	Standard Error	Sig.
Conversation	.996	.934	.966	.153	.000
Other personnel	.951	.904	.951	.220	.000
Loud noise	.933	.871	.933	.985	.000
Phone call	.850	.722	.850	.680	.000
Physician	.810	.656	.810	2.92	.000
Different patient	.709	.503	.709	2.71	.000
Visitor	.638	.408	.638	3.39	.001
Emergency	.603	.363	.603	7.78	.002
Medication missing	.508	.258	.508	3.16	.011
Wrong dose medication present	.381	.145	.381	9.41	.066

Predictors: Conversation, other personnel, loud noise, phone call, physician, different patient, visitor, emergency, missing medication, wrong dose medication present.
Dependent variable: Total distractions

The slope measures the rate of change for the independent variable and is expressed as a positive number indicating that the change in one independent variable is associated with upward changes in the dependent variable. A high slope indicates that changes in the specific independent variable were associated with more significant change in the dependent variable. The closer the rate is to 1, the higher the predicted

relationship to the potential to cause distractions. A score of .80 or higher indicates a strong relationship between the distraction source and the potential for total number of distractions experienced during medication administration. Those with the highest scores included: conversation, other personnel, noise, phone calls and physicians.

There was a positive linear relationship between number of total distractions and conversation related distracters. External conversation that distracted the nurse or conversation initiated by the nurse, were both predictive to cause increased total number of distractions during medication administration. There was also a positive linear relationship associated with the total number of distractions experienced and personnel interruptions. Increases in interruptions by personnel correspond to an upward change in total distractions. In fact, the total number of distractions increased as the number of people related factors increased. Medication related factors were less likely to produce a source of distraction for the nurses.

In addition, there was a positive linear slope related to high noise levels as predictive of distractions, though not as dramatic as in the previous analogies. All but the last factor (wrong dose medication present) was significant while controlling for all other variables in the analysis. Yet not all significant factors represented a linear relationship indicating that they were less likely to create a change in the specific independent variable as associated with a change in the dependent variable.

There was a non-linear relationship in total number of distractions experienced from missing medications as distraction sources. Thus, pharmacy related causes of

distractions are much less likely to contribute to the total number of distractions than people related distractions.

Summary of the Findings

A sample of 24 medication administration cycles was observed during high volume medication administration times. Nurses who consented to participate in the observation cycles included male and female LVNs or RNs employed on a medical-surgical nursing unit, who met inclusion criteria. These nurses ranged in age from 26 to 51 and were mostly Caucasian females. The interventions revealed a significant reduction in distractions experienced during medication administration for both the focused protocol group ($p = .014$) and the Medsafe© protocol group ($p = .000$) as compared to the control group. Multiple and bivariate linear regression analysis revealed that three of the highest sources of distractions contributing more significantly to nurses' distractions during medication administration were conversation, other personnel interrupting, and external noise. In conclusion, nurses' distractions during medication administration can be reduced significantly using targeted interventions involving reduced conversation, increased teamwork, increased focus, and the application of a visible symbol.

CHAPTER 5

SUMMARY OF THE STUDY

According to the 1999 Institute of Medicine (IOM) report, preventable events resulting from medical errors cause nearly 100,000 deaths in hospitals annually, with almost 2% of these being medication-related (Institute of Medicine, 2000). This finding translates to 2000 medication related deaths annually. Regardless of the reported number, medication error reduction is critical to patient safety.

Medication administration errors (MAE) occur when there is a breach of one of the seven rights of medication use: right patient, right drug, right dose, right time, right route, right reason and right documentation. MAEs often result in patient injury, increased hospital costs and nurses being blamed for the incident. Complex systems rather than humans are frequently the source of MAEs in health care settings. Factors contributing to system failures include distractions, lack of focus, poor communication, and failure to follow standard operating procedures during medication administration.

This study was designed to determine the impact of distraction-reducing interventions on the medication administration system within the hospital setting. To that end, the study evaluated the effectiveness of focused protocols with checklists and the application of a special vest as interventions to decrease nurses' distractions during medication administration.

Harrison and Shirom's (1999) organizational assessment framework was utilized for the Medication Administration for Safety in Hospitals (MASH) open systems model for this study. Inputs feed into the system to promote accurate delivery of medications to patients. Throughputs are those constraints and barriers found at the organizational, group, and individual levels which impede the process of getting medications to patients. Outputs contribute to patient safety and include mechanisms that determine if safe medication administration is occurring, while feedback mechanisms include communication and reports from within and outside the organization. The ultimate output is the safe delivery of medications to every patient in the system according to the seven rights of medication administration.

The purpose of this study was to test a component of the throughput section at the group or unit level that was the most intervenable to reducing system problems. This process portion included group constraints involved in medication administration. In the case of MAEs, the constraints are environmental (distractions and noise), procedure constraints (failure to establish and follow standard operating procedures and protocols), and behavior constraints (lack of focus, communication problems, and conversation).

Summary

A quasi-experimental three-group design was used to test the effects of two interventions to reduce distractions of nurses administering medications. After obtaining approval from Texas Woman's University Institutional Review Board and permission from the study hospital, study dates and times were confirmed. The setting included an orthopedic-neurological medical-surgical nursing unit with an average patient census of

30 in a 520-bed acute care hospital. Medication administration cycles were the measured elements in this study. A convenience sample of 24 medication cycles was selected for observation during high volume medication administration times. A medication cycle started when the nurse began the administration of all assigned patient medications and ended when the nurse completed charting medications given. Observed nurses were selected from those who volunteered to participate and met study inclusion criteria. Four nurses participated twice and one nurse participated four times to make the total of 24 medication cycles during the six-day study period. Therefore the total discrete number of nurse participants was 17 with six nurses being observed more than once. The nurses were approached and provided with an explanation of the study purpose and protocols. Verbal and written consent were obtained just prior to each observation period. Confidentiality of data was established with code numbers, study materials were kept in a locked file cabinet, and participants were assured that they would not be identified in written reports.

The Demographic Data Form was used to collect information about age, gender, ethnicity, level of nursing education, years of nursing experience, and self reported level of nursing expertise. The Medication Administration Distraction Observation Sheet (MADOS) was used to count nurses' distractions during medication administration.

The MADOS is a 10-item instrument designed to count distractions during medication administration. A distraction was defined as any action that draws away, diverts, or disturbs the mind or attention from the medication administration process. Potential distraction sources included: physician, other personnel, phone call, other

patient, visitor, missing medication, wrong dose medication, emergency situation, conversation, and external noise. The nurse researcher collected data by observing distractions during medication administration for both the control and the intervention groups. Slash marks were made under the corresponding cause of the distraction each time a distraction occurred. The scheduled medication time and total time interval for each observation period were also entered on the MADOS form. Higher scores correspond to increased frequency of nurses' distractions during medication administration.

Distraction observation continued for each group until the sample of 8 medication cycles for each group was reached. Nurses were observed during scheduled medication administration for the 9:00 a.m., 1:00 p.m., 5:00 p.m. and 9:00 p.m. times for each study group. For the control group ($\underline{n} = 8$), distractions were observed while nurses used customary medication administration procedures. Observed participants and other employees were asked to maintain normal conditions and behavior. Even though the planned in-services were replaced with individual instruction, participants seemed receptive to the study protocols. Observer influence may have affected the study to some extent. However the influence did not seem to change the ultimate outcome of the study and was consistent throughout each of the three protocols.

For the next set of 8 medication administration cycles, the focused protocol intervention was implemented, and nurses' distractions were counted. Staff members were asked not to interrupt or distract the "special nurse" being observed unless the distraction related to medications being administered. Instead they were asked to

intercept phone calls and other distractions for the observed nurse. The observed nurse was also asked to refrain from conversation unrelated to medications during medication administration.

Subsequently, the Medsafe© protocol intervention was implemented ($\underline{n} = 8$) and distractions were counted while nurses used the checklist and wore a special vest. As before, just prior to data collection, staff members were asked not to interrupt the nurse being observed while the nurse wore the vest, but to intercept phone calls or other distractions as much as possible. The observed nurse was asked to wear the red vest and avoid conversation unrelated to medications during medication administration. The red vest had white lettering with the words "Medsafe Nurse, Do Not Disturb" on the back and front.

One research hypothesis and one research question were proposed for the study. The research hypothesis stated: Two targeted interventions: a "focused" protocol and a "Medsafe"© protocol both with educational interventions will reduce nurses' distractions during medication administration cycles when compared to a control group of similar nurses who do not use either intervention. The research question was: Which distracters contribute more significantly to the distraction variance nurses experience and are more predictive of nurses being distracted during medication administration cycles?

The research hypothesis was examined using a one-way analysis of variance (ANOVA) and descriptive indices. The research question was analyzed using multiple bivariate regression to explain the extent to which each distraction category predicted distractions nurses are likely to experience during most medication administration cycles.

Discussion of the Findings

A desired situation in a nursing unit would be to have as few distractions as possible. Therefore, lower distraction scores were the most desirable. Significant mean distraction differences were found among the three groups: nurses using standard procedures, nurses using the focused protocol, and those using the Medsafe© protocol. For all three groups, nurses' distraction scores decreased incrementally from control to focused protocol and then to Medsafe© protocol groups indicating that the interventions were effective in reducing nurses' distractions.

These results indicate that distractions during medication administration can be significantly reduced by educating staff members of the importance of not distracting nurses during medication administration. Distractions can be further reduced by nurses' avoidance of conversation, and by use of a visible symbol to indicate to others that distractions are unwanted for a time.

There is a scarcity of research addressing human factors and work redesign to reduce errors. Primarily, studies have focused on institutional and personal effects of medication errors, barriers to reporting, responses and consequences of reporting, and causes of medication errors. A few studies have focused on system causes (Hackel & Banister,1996; Leape, et al., 1995; Walters,1992; USP, 2000) and one study involved human factors (Serig, 2001), but no research studies have included distraction-reducing techniques.

For example, in one study researchers found that multiple causes of medication errors were: wrong dose errors, lack of drug knowledge, rule violations, slips, memory

lapses, inadequate monitoring, misuse of infusion pumps, faulty dose checking and failure to identify the correct drug, medication stocking problems, and using the wrong technique. System failures included lack of easy access to drug information, look-alike packaging, sound-alike drug names, transcription errors, lack of patient information, poor communication, and excess workloads (Leape, et al., 1995).

A study conducted by the USP (2000) found both personal and system causes of medication errors were: lack of focus, failure to follow procedures and protocols, lack of knowledge, distractions, inaccurate documentation, communication gaps, overwork, and inexperience. Walters (1992) found that the main reported causes of errors were frequent interruptions, forgetfulness, and oversight. Some of the errors identified by Hackel and Banister (1996) were caused by: transcription errors, not double-checking medications, overwork, stress, mislabeled medications, and look alike medications and containers. These error categories caused nurses to become frustrated because of the increased amount of time taken for system correction. Having to take alternate actions to correct problems served as a distraction source.

Illegible handwriting and improper abbreviations are major sources of errors as unclear orders require a multitude of pharmacy calls to physicians (ISMP, 2000a). Taking verbal orders is also a dangerous source of error because certain numbers sound alike. For example the spoken numbers 15 and 50, and two and ten often sound alike (Cohen, H. R., 1998). The literature clearly identifies a need for intervention research on system issues to prevent distractions, improve focus, and develop teamwork. Recently the AHRQ

has emphasized the need for innovative research involving human factors and work redesign to improve patient safety (AHRQ, 2001b).

This study supports the literature and theoretical framework that system problems can and should be changed to decrease distractions during medication administration. No other similar studies exist for comparison of distraction reducing techniques. A human factors study found that restrictions on cognitive functioning require altering the external environment to accommodate task performance using a systems approach (Serig, 2001). Thus, likely resolutions to errors involve the realization that although we cannot change the human condition, we can redesign the work system to help humans avoid errors (Reason, 2000). Since this study found that the majority of distractions occurred from (a) conversation, (b) interruptions by other personnel, and (c) high noise levels, emphasis should be placed on these aspects as important distracters to reduce during medication administration.

The majority of the observed nurses were Caucasian 706% ($\underline{n}$ = 12), and were female 94.1% ($\underline{n}$ = 16). There was an equal number of LVNs and ADNs, each accounting for 41.7% ($\underline{n}$ = 7), followed by BSN graduates at 11.8% ($\underline{n}$ = 2), and 5.9% ($\underline{n}$ = 1) Diploma graduate. Ages ranged from 26 to 51 years with 1 to 26 years of nursing experience. This distribution is fairly representative of most hospital systems in the U.S. today. Although no similar studies exist for direct population comparison, other studies addressing medication errors have reported similar participant allocations. For example, in a study addressing medication errors, Osborne, Blais and Hayes (1999) described the majority of nurse survey respondents as Anglo (50%) and female (93%), between the

ages of 31 to 50 with 11 to 20 years of experience. However, the majority held an ADN in nursing. Wakefield, et al., (1999a) who studied MAE reporting rates, also identified the majority of nurse participants as having an ADN degree. Green, Fizpatrick, Crismon and Waddill, (1994) report the majority of disciplined Texas nurses as comparative to the general population. The majority were ADN graduates from the age of 27 to 72 years with most being white (79%) and females (84%). Thus the population for this study primarily differs from other studies in the level of education of study participants equal numbers of ADNs as LVNs.

Recently several governmental agencies including the Agency for Healthcare Research and Quality (AHRQ) have emphasized the need for innovative research involving the work environment to improve patient safety. The AHRQ also suggests using similar approaches that reduce errors in other industries (AHRQ, 2001b). These were important considerations in designing this study since airline safety measures were used to reduce work-related distractions. Some of the nurses indicated that the protocol checklist was not the method actually used for delivery of patient medications, even though it is ideally the best way to administer medications and does reflect the technique nurses were taught. Only one nurse kept the checklist in hand during medication administration. Most others read the checklist items, laid it with their chart papers and agreed to follow the list. It was unknown just how many times the nurses referred to the checklist (Appendix D & E). Items on the checklist included verifying orders, not engaging in conversation, looking at items being read, using the seven "rights," taking the Medication Administration Record (MAR) to the patient's bedside, taking meds in unit

dose packets to the bedside, verifying the armband, asking the patient to state his/her name, and correctly documenting medications given. However, most nurses did not take the MAR to the bedside and some opened unit dose packets and dropped the medications into a pill cup at the nurses' station. It is unknown what method the nurses used to verify patient identity since they were not visible in many patient's rooms. Nevertheless, the nurses stated that the checklists aided them by offering reminders of the proper method of administering medications and made them think more about what they were doing.

In the past, a multitude of contributing factors have been shown to lead to medication errors as nurses encounter system constraints including work design problems, and human and environmental factors. The environment and behavior are as much a part of the organizational structure as they are the processes within the organization. Puckett (1995) found evidence that patient identification band bar coding has shown a decrease in MAEs. Primarily errors that were reduced included wrong time errors (43%), and omitted dose errors (52%). However, wrong patient errors (5%) did not decrease because nurses were able to bypass scanning the armband by choosing the patient from a computerized list (Puckett, 1995). Borel and Rascati (1995) observed nurses administering medications all together instead of giving them at the assigned times because they had to line up at the dispensing machine. To improve efficiency the nurses collected all medications for their assigned patients at one time. These findings lead one to believe that computerized systems are not the ultimate solution to the MAE problem because humans tend to override technological devices whenever possible. This same

practice of obtaining medications ahead of time was observed on a few occasions in this study.

Excessive input such as distractions compete for attention and affect the ability to concentrate and maintain accuracy. Latent conditions (distractions, communication problems, time pressure, and noise) are linked to working conditions. When latent conditions combine with active or personal failures, mistakes can happen. Slips and memory lapses occur when a planned action fails, and when actions are governed by automatic and familiar patterns. Medication administration is an example of a complex system involving several steps, which are often done automatically. Once the distraction or interruption focuses the person's attention elsewhere, switching attention back to the intended task takes time. Plus, redirection becomes even more difficult when the distraction was unrelated to the current action (Reason, 1990). When nurses are in a hurry or are distracted, they sometimes deviate from previously learned procedures for medication administration, resulting in increases in errors. Thus the focused protocol used in the study included checklists of focal reminders along with an optimal method of administering medications. Some of the nurses commented that they had never realized how many times they are interrupted or distracted during medication administration. Some nurses even admitted to causing many of their own distractions. Several nurses commented that they had given all of their patient's medications much faster without interruptions and wanted to keep the vest on for that reason.

The culture within the organization establishes the norms, attitudes, and values placed on the work done. This culture includes relations between individuals, groups, and

positions, and the power held by others including peers and managers (Harrison & Shirom, 1999). Teamwork is essential to a well functioning nursing unit. However, teamwork often suffers as constraints from social dynamics cause teams to dissolve into informal groups (Moray, 1994). The airplane cockpit demonstrates one example of the importance of teamwork, with pilots following standard operating procedures and checklists. Airline research indicates that when errors occur, they are due to failures in teamwork. Thus, following the example of the aviation industry, training teams to work harmoniously can improve safety (Helmreich & Merritt, 1998).

The research design for this study included safety checklists that outlined an optimal medication administration process and the avoidance of conversation. The efforts of other staff members to prevent distractions supported the nurse's ability to focus during medication administration. Most staff members applied this teamwork approach well during the study intervention periods. However, the evening shift personnel seemed to work better as a team compared to the day shift. A few staff members said it was not feasible to not distract all nurses giving medications because they are all giving medications at once. They further suggested that if there were more nurses and support staff, interruptions could be decreased. Nevertheless, they admitted that many of the interruptions, social "chit chat," and noise could be reduced. Many nurses indicated that phone calls consistently cause them to stop what they are doing in order to do something else. Later they find that many of the calls could have waited or been redirected to someone else.

Signs often serve to warn of impending danger, and symbols can identify the nurse by attire. Signs are useful reminders of the priority of safety acting as activators to direct behavior (Geller, 2001). Thus the Medsafe© vest, as a symbol, was effective as a visible reminder that distractions were unwanted for a time. Few nurses complained about wearing the vest for the purposes of research. However, other symbols such as special armbands may be just as effective in reducing distractions during medication administration. The novelty of the vest may have also played a role in its success. Without further study it is unclear whether personnel would become accustomed to the vest as a symbol and begin to interrupt the medication nurse as much with the vest as currently is done.

However, the importance of the consequences for not following the sign reduces the potential for habituation and increases the potential for continued compliance. People must believe that the safety goal is worthwhile, or that the consequence for not achieving it is unacceptable (Geller, 2001). Decreasing the potential for medication errors provides a worthwhile safety incentive to follow signs and symbols reminding personnel to reduce distractions during medication administration.

The major sources of nurses' distractions during medication administration were due to conversation, other personnel interrupting, and external noise. The study findings support the feasibility and necessity of using distraction reducing techniques to improve medication safety. Changes in work design for nurses need to be addressed immediately to increase focus during critical tasks such as medication administration. Improving teamwork should be considered as an effective distraction decreasing technique.

Protocols used should be specific to these most frequently occurring sources of nurses' distractions in order to improve focus and enhance medication administration safety. Environmental factors such as high noise levels should be reduced as much as possible. For the study hospital in particular, perhaps a medication room with walls would facilitate nurses' ability to concentrate on the task without external influence. In addition, a rule could be implemented that when nurses stand at the medication dispensing machine, they should be left alone.

Conclusions

Within the limitations of the study and based on the results, the following conclusions apply:

1. Avoiding unnecessary conversation while administering medications can reduce nurses' distractions.
2. Educational interventions and teamwork are effective measures to decrease nurses' distractions during medication administration.
3. Visible symbols are effective at reducing nurses' distractions and interruptions during medication administration.
4. Using checklists that serve as reminders to improve focus could reduce both personal and group constraints for safer medication administration.
5. Sources of distractions contributing more significantly to nurses' distractions during medication administration were conversation, other personnel interrupting, and external noise.

Implications

1. Many of the constraints inherent in medication administration can be reduced by changes in work design, including providing an uninterrupted noise free environment.
2. Educational interventions and teamwork should be used to decrease nurses' distractions during medication administration
3. Medication administration methods should be modified to include standard protocol checklists as safety reminders during medication administration.
4. A visible symbol is needed that identifies nurses, indicates to others that nurses are administering medications, and that distractions are unwanted.

Recommendations for Further Study

Based on the study findings and conclusions, the following recommendations were developed:

1. The research should be replicated in multiple settings, with varied days, time frames, and used with other nursing models.
2. More research is needed to further investigate the use of various types of visible symbols to identify nurses during medication administration.
3. More research is needed that includes varied educational interventions designed to improve healthcare personnel's awareness of the importance of focus during medication administration, reducing distractions, following standard procedures, improving teamwork, and establishing a culture of safety.

4. If visible symbols are implemented to reduce distractions during medication administration, follow up checks will be needed to reduce the possibility of habituation causing others to ignore the symbol.

Summary

This quasi-experimental study measured the effect of two targeted interventions based on airline industry safety measures for decreasing nurses' distractions during medication administration. Significant reductions in distractions were found with both the focused protocol and the Medsafe© protocol with vest. The largest mean difference was between the control and the Medsafe© group demonstrating that a visible symbol worn during medication administration as a sign that distractions are unwanted can make a difference for nurses in preventing interruptions. These results infer that changes in work design using teamwork and targeted interventions can significantly reduce nurses' distractions during medication administration, ultimately reducing medication errors.

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APPENDIX A

Medication Administration Distraction Observation Sheet (MADOS)

Appendix A

Medication Administration Distraction Observation Sheet (MADOS) with definitions of distraction categories while administering medications

Control Group ☐ Experimental Group 1 ☐ Experimental Group 2 ☐

Department _____

Date of obs. _____

Observation # _____

Scheduled Med time_____	Number of DISTRACTIONS									
Start time_____ Stop time_____ Elapsed time_____	Physician	Other personnel	Phone call	Other Patient	Visitor	Missing medication	Wrong dose medication	Emergency situation	Conversation	External Noises

A distraction includes any action that draws away, diverts, or disturbs the mind or attention from achieving the medication administration goal. Categories are further defined below.

Physician	Physician or other Medical provider (NP or PA) distracts or interrupts the nurse administering medications.
Other personnel	Other personnel distract or interrupt the nurse administering medications.
Phone call	The nurse administering medications is interrupted by a phone call or places a phone call.
Other Patient	A different patient interrupts the nurse or the nurse must stop administering routine meds to attend to a different patient.
Visitor	A visitor or person other than an employee distracts the nurse administering medications
Missing medication	The nurse administering medications encounters one or more missing medications from the patient's drawer or the Med Dispensing machine, which causes the nurse to take some action to retrieve the missing medication.
Wrong dose medication	The nurse administering medications encounters one or more wrong dose medications in the patient's drawer or the Med Dispensing machine, which causes the nurse to take some action to retrieve the missing medication.
Emergency situation	Any emergency situation such as a code or a patient's change in health that necessitates the nurse's immediate action.
External Conversation	Loud conversation going on in the area, or any conversation not related to medication administration that the nurse engages in.
External noise	Loud noises audible to the nurse administering medications that appear to distract the nurse.

APPENDIX B

Written Consent Form

Appendix B

INFORMED CONSENT

I agree to take part in a study conducted by the researcher, who is a doctoral candidate at Texas Woman's University. This study is designed to investigate the medication administration process. I was told that the principle investigator Theresa (Tess) Pape will be observing me while I prepare and administer scheduled medications to my patients.

I understand that there is some possible risk to me. I may feel some anxiety at being observed while administering medications, or may feel embarrassed if I make a medication error during the observation time, and may fear that errors will be traced back to me for disciplinary action. There is also a risk of possible loss of confidentiality.

To avoid obtrusiveness, the researcher will attempt to control for influences of her presence on me by standing at least one linear yard behind and/or to the side. The researcher/observer has informed me that she will be far enough away that it would be difficult to directly detect medication errors, and that the purpose of the observation is to observe the medication administration process, not errors.

I have been assured that my identity will be protected, that all information obtained will be held with the strictest of confidence and code numbers will be used for identification of information, and no one but the researcher will have access to the information. I have been assured that my name will not be used in data collection, reporting, or publication. All data will be reported in group format only. No one will be able to identify me anywhere in the report. I understand that all data will be kept in a locked file during the time of the study

If I have any questions about the research or about my rights as a subject, I should ask the researcher. I may contact the researcher at 281-756-3622. If I have questions later, or if I wish to report a problem, I may call the researcher or the Office of Research and Grants Administration at 940-898-3375.

I understand that there are no direct benefits to me from participating in this study. I understand that I am free to participate or not participate. The choice is mine. If I choose to join the study, I may withdraw from the study at any time without penalty. I was given a chance to ask any questions I had about the study. I understand that the total time I will be observed for any one medication cycle is 2 hours or less.

_____ _____

Subjects Signature Date

APPENDIX C

Demographic Data Form

Appendix C

Demographic Data Form

Participant #_____ Date_____ Dept _____

To assist in data analysis and interpretation, I would appreciate if you would provide me with the following information. All information will be held strictly confidential.

1. What is your age? _____

2. What is your gender?

   (1) Female (2) Male

3. What is your ethnicity?_____

4. What is your highest level of nursing education?

   (1) LVN/LPN (2) Diploma (3) ADN (4) BSN (5) Masters degree in nursing

5. How many years of nursing experience do you have?_____

6. What level of nursing expertise do you feel that you have?

   (1) novice (2) advanced beginner (3) competent (4) proficient (5) expert

APPENDIX D

Checklist for Focused Protocol

Appendix D

Medication Administration Checklist for Focused Protocol

1. Verify all assigned patients MAR forms with MD orders.

2. DO NOT engage in conversation
   not pertaining to medication delivery.

3. DO NOT allow interruptions or distractions
   while administering medications.
   a. Hold your hand up and verbalize
      the need for no interruptions or distractions.
   b. Other staff members "field" phone calls
      and interruptions for nurse.

4. Prioritize tasks.

5. Obtain med and verify with MAR.

6. Look at items being read.

7. Use 7 rights
   a. Right drug, right patient, right dose, right time,
      right route, right reason, right documentation

8. Administer meds to only one patient at a time.
   a. Right patient

9. Take MAR and unit dose packets to bedside.
   a. Verify patients armband name
      and MD name with exact spelling on MAR

   b. Ask patient to state name

10. Read med name aloud to patient while opening unit dose packet.

11. Correctly document medications given.

12. Continue with second patient, etc.

APPENDIX E

Checklist for Medsafe Protocol

Appendix E

Medication Administration Checklist for Medsafe Focused Protocol with Vest

1. Verify all assigned patients MAR forms with MD orders.
2. Place Medsafe vest on self.
3. DO NOT engage in conversation not pertaining to medication delivery.
4. DO NOT allow interruptions or distractions while administering medications.
    a. State "Medsafe protocol is being followed at present."
    b. Other staff members "field" phone calls and interruptions for Medsafe nurse.
5. Prioritize tasks.
6. Obtain med and verify with MAR.
7. Look at items being read.
8. Use 7 rights.
    a. Right drug, right patient, right dose, right time, right route, right reason, right documentation
9. Administer meds to only one patient at a time.
    a. Right patient
10. Take MAR and unit dose packets to bedside.
    a. Verify patients armband name and MD name with exact spelling on MAR
    b. Ask patient to state name
11. Read med name aloud to patient while opening unit dose packet.
12. Correctly document medications given.
13. Continue with second patient, etc.

APPENDIX F

Agency Approvals

TEXAS WOMAN'S UNIVERSITY
DENTON DALLAS HOUSTON

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IRB APPROVAL FORM

Name of Investigator(s) Theresa (Tess) M. Pape

[redacted]

Name of Research Advisor(s): Lynn Wieck , RN, Ph.D. Anne Young, RN, Ed.D.. and Rebecca Krepper, RN, MBA, Ph.D.

Address: 3875 Clover

Alvin, TX 77511

Type of Review: Full X Expedited

Dear:

Your study entitled: The Effect of Nurses' Use of a Focused Protocol To Decrease Distractions During Medication Administration

(The applicant must complete the top portion of this form)

has been reviewed by the **Institutional Review Board** - Houston Center and it appears to meet our requirements in regard to protection of the individual's rights.

Please be reminded that both the University and the Department of Health and Human Services regulations typically require that signatures indicating informed consent be obtained from all human subjects in your study. These are to be filed with the **Institutional Review Board** Chairman. Any exception to this requirement is noted below. Furthermore, according to HHS regulations, **another review by the IRB is required if your project changes or if it extends beyond one year from this date of approval.**

Any special provisions pertaining to your study are noted below:

_____The filing of signatures of subjects with the Institutional Review Board is not required.

_____Other: see attached sheet.

_____No special provisions apply.

Sincerely,

William P. Hooten

~~Gayle Hersch, Ph.D., OTR~~
Chairperson, **IRB** - Houston Center

11-20-01
Date

TEXAS WOMAN'S UNIVERSITY
COLLEGE OF NURSING

AGENCY PERMISSION FOR CONDUCTING STUDY

THE [redacted] Medical Center

GRANTS TO **Theresa (Tess) M. Pape, MSN, RN, CNOR** a student enrolled in a program of nursing leading to a Doctoral Degree at Texas Woman's University the privilege of its facilities in order to study the following problem:

The Effect of Nurses' Use of a Focused Protocol To Decrease Distractions During Medication Administration - A dissertation study

The conditions mutually agreed upon are as follows:

1. The agency (may) (may not) be identified in the final report.
2. The names of consultative or administrative personnel in the agency (may) (may not) be identified in the final report.
3. The agency (wants) (does not want) a conference with the student when the report is completed.
4. The agency is (willing) (unwilling) to allow the completed report to be circulated through interlibrary loan.
5. Other: _____

Date: 7/26/01

[redacted]
Signature of Agency Personnel

Theresa M. Pape
Signature of Student

K. Lynn Kreck
Signature of Faculty Advisor

Fill out and sign three copies to be distributed as follows: Original – Student: First copy – Agency, Second Copy – TWU College of Nursing.