

INTERRUPTIONS AND DISTRACTIONS OF NURSES DURING MEDICATION

ADMINISTRATION ON A MEDICAL SURGICAL UNIT

by

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A professional project submitted in partial fulfillment  
of the requirements for the degree

Master

of

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## ABSTRACT

Medication error is one of the most common preventable problems in the United States medical system today (IOM, 2006). In 2006 the Institute of Medicine recommended there should be “research effort aimed at learning more about preventing medication errors” (p. 3). One way to achieve this goal is to better understand what contributes to medication errors during administration. Many medication administration errors are a direct result of “imperfections in the work system, work assignment, staff understanding and the working conditions” (Buchini & Quattrin, 2012, p. 327). Research shows identification of interruptions or distractions can reduce medication administration errors. Understanding interruptions and distractions create a body of knowledge for policy for future quality improvement. The purpose of this project was to identify interruption trends during medication administration among nursing personnel on one medical-surgical unit in a hospital in Montana. In order to better understand the process surrounding medication administration as well as timing and possible distractions or interruptions, a descriptive observational design was used. Twenty-two nurses on a medical surgical unit were observed during 74 medication passes. Distractions and interruptions during the process were recorded at eight different time periods. Findings of this study did not indicate one single variable was significantly responsible for distractions or interruptions. Rather, the data identified a model which helped explain over 73% the time it took to complete medication administration. Distractions and interruptions of; face-to-face, medication issues, other, equipment, and pagers all contributed. The only variable not contributing to the time equation was noise experienced by the nurse during the medication process. Creating policy to address the variables that interfere with medication administration could decrease interruptions and distractions. The ultimate goal was to create a standard medication administration process for enhanced efficiency, quality and patient safety.

## CHAPTER ONE

## INTRODUCTION

Background

Medications are often life-saving or used to prevent disease and manage chronic illness. On any given week, four out of every five adults will use a medication. Nearly one third will take five or more medications daily (Institute of Medicine [IOM], 2006). The number of Americans that use at least five medications or more prescriptions has increased by 70% over the last ten years (Gu, Dillon, & Burt, 2010). As the number of self or healthcare-administered medications increases, the chance of error rises. Medication error is one of the most common preventable problems in the United States (U.S.) medical system today (IOM, 2006).

Medication errors occur in all types of health care settings including hospitals, long-term care facilities, health clinics, doctor's offices, pharmacies and more. In the hospital setting, medication errors happen most frequently during the prescription and administration stages (Conrad et al., 2009). The average hospital patient can expect to experience one or more medication errors per day. As a result, at least 1.5 million preventable medication errors occur in hospital systems yearly. An estimated \$3.5 billion dollars annually are a direct result of preventable medication errors (IOM, 2006).

There are five categories and sources of healthcare provider medication errors including (a) prescription, (b) transcription/interpretation, (c) preparation, (d) distribution, and (e) administration (Buchini & Quattrin, 2012). Conrad et al. (2009) summarizes the

magnitude for these combined categorical tasks. “Medication errors have the potential to cause patient injury, staff distress, and increased hospital costs that include a longer length of stay, patient complications, and legal expenses” (p. 137). Each process of medication administration is critical and requires a nurse’s undivided attention. Those involved in medication errors include any healthcare provider with legal scope to prescribe, prepare, dispense, distribute, or administer medication. The list includes nurses, doctors, and pharmacists. However, most often, the nurse holds the responsibility for safe drug administration and provides the last check prior to the medication reaching the patient (O’Shea, 1999).

Medication administration errors may account for up to 42-59% of all medication errors (Cousins et al., 2007; Conrad et al., 2009). Prior to administration of medication, the nurse must complete specific steps to ensure safety by checking the prescription, timing, and the supply, identifying adverse reactions, assessing the patient prior to administration, preparing the drug, and checking patient identification. The process provides for several opportunities for error (The Joint Commission, 2011). At any time these steps can become delayed or fragmented due to interruption or distraction. Medication administration is considered a high risk activity for nurses for two reasons. First, according to Buchini and Quattrin (2012) “drug administration is the most interrupted of all nursing activities” (p. 328) and second, interruptions have a significant impact on medication error (Scott-Cawiezell et al, 2007; Biron et al., 2009). Commonly, O’Shea (1999) concluded interruptions contributed to medication administration errors. Interruptions have high “distractive power; even when their duration is short, they can

divert the nurses' attention and cause them to lose concentration while administering a drug, thus creating the risk of error" (Buchini & Quattrin, 2012, p. 328). Ebright et al. (2003) added distractions equally contributed to administration errors. Small occurrences such as having to locate supplies or a disorganized medication room are a distraction to the nurse's focus and critical thought. The current literature suggests nurses are interrupted between 2.8-14 times per hour. These findings support the idea that nurses are constantly bombarded with patient information, patient needs, phone calls, and questions in an excess of up to 14 times an hour (Hedberg & Larsson, 2004; Alvarez & Coiera, 2005).

#### Statement of the Problem

In the hospital of interest medication errors are defined by the institution as any circumstance that has the capacity to cause error regardless of harm to the patient (Medication Error Report, April 2012). In the last five months this hospital averaged 36-58 medication errors per month. The highest error rate was recorded in February with a total of 58 infractions. The medical surgical unit of interest averages four errors monthly which is 10.7% of the total errors in the hospital.

In 2006 the Institute of Medicine recommended there should be "research effort aimed at learning more about preventing medication errors" (p. 3). One way to achieve this goal is to better understand what contributes to medication errors during administration. Many medication administration errors are a direct result of "imperfections in the work system, work assignment, staff understanding and the working conditions" (Buchini & Quattrin, 2012, p. 327). Identification of interruptions or

distractions can reduce medication administration errors. Understanding interruptions and distractions creates a body of knowledge for policy adjustments and future quality improvement.

### Purpose

The purpose of this project is to identify interruption trends during medication administration among nursing personnel on one medical-surgical unit in a hospital in Montana. This project will identify the need for a specific intervention to improve medication administration safety.

### Project Objectives

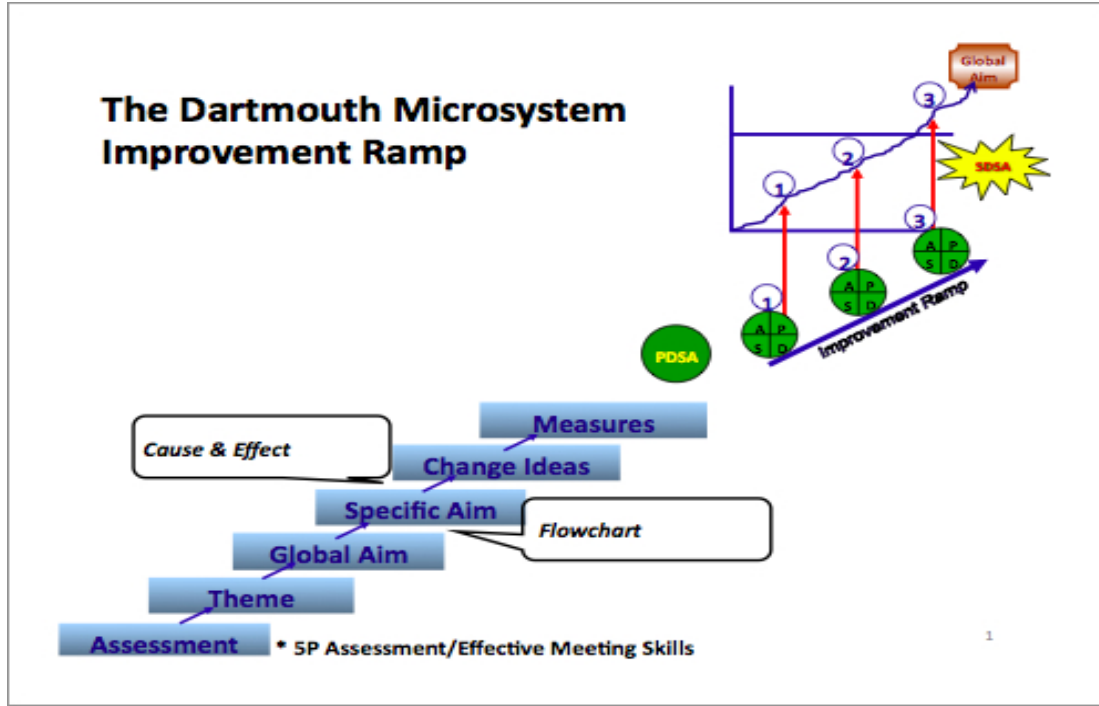
This project will address the following objectives:

1. Observe and document the current system (process) of medication administration on a medical surgical unit.
2. Observe and document nurse medication administration interruptions over random days and times of day.
3. Record interruptions based on type, time, and frequency across times of day.
4. Review of the literature regarding interruptions during medication administration and the outcomes of those interruptions.

### Conceptual Framework

The conceptual framework for this project is the Plan Do Study Act (PDSA) component of a model which is part of the Dartmouth Microsystem Improvement Ramp. This system aims to look at a process, break down the components influencing this process, create a plan of change using the information gathered through assessment, then evaluate the changes to meet a global aim or final outcome. The Dartmouth Microsystem Improvement Ramp below was designed and tested by health care professionals. It is a systematic approach to a problem and change through clear assessment, aims, ideas, measures, and implementation with continued evaluation (Nelson, Batalden & Godfrey, 2007).

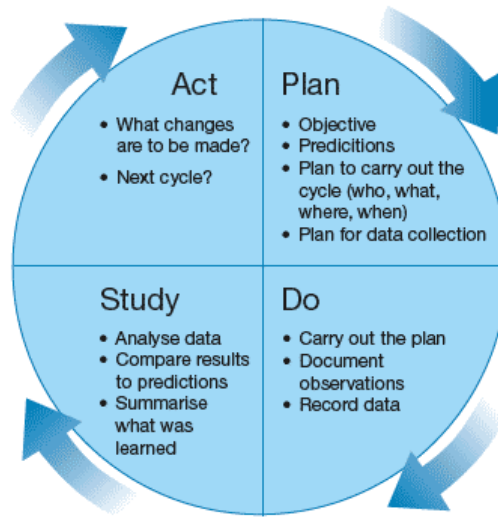
Part of the Dartmouth Improvement Ramp includes the PDSA cycle which is the heart of continuous improvement. The PDSA cycle was designed to promote continued improvement and encompass the concepts of change as well as reflection. The *plan* stage includes gathering data on the current situation and past history. The *do* stage is actually an experiment stage where possible improvements are tested as pilots. This phase focuses on ensuring that the new practice is standardized and done consistently. In the *study* stage the results of the experiments are examined. This stage measures consistency of the



(The Dartmouth Microsystem Improvement Ramp (n.d.), Retrieved from, <http://www.ashpfoundation.org/lean/ImprovementRamp.jpg>)

Figure 1. Dartmouth Microsystem Improvement Ramp with PDSA Cycle

practice adoption and identifies obstacles and barriers to adoption and need for further change. The *act* stage is used to adopt improvements if the experiment finds successful methods. This stage determines the need for modification, restandardization or need to return to a PDSA testing cycle. The image below illustrates the continued process of the PDSA cycle as change is evaluated to eventually reach the global aim or successful improvement (Nelson, Batalden & Godfrey, 2007).



(Plan, Do, Study, Act, (n.d.). Retrieved from, <http://www.scotland.gov.uk/Resource/Img/209291/0061564.gif>)

Figure 2. Plan Do Study Act Cycle

This project will focus primarily within the microsystems planning phase. This project aims to collect or assess the interruptions and distractions affecting a medical surgical unit in order to prevent the global aim of medication errors. Findings will then provide information regarding a plan to implement improvement interventions to decrease distractions and interruptions. The who, what, when, and where will be answered in this project. A full plan for data collection will be discussed and findings presented. Finally this project will summarize findings with the intention of creating a plan to carry out change.

### Significance of the Project

Understanding how and why medication errors occur is essential to patient safety and health outcomes. By ensuring the environment is distraction free, the nurse will be able to focus on medication administration and decrease the chance for error. In return, patient satisfaction will improve (Heinemann D., Lengacher CA., VanCott ML., Mabe P., Swymer S., 1996; Seago JA ; Williamson A ; Atwood C., 2006). As patients feel the nurse is attentive and thorough, this will demonstrate care as well as safety, something all humans appreciate. Additionally, as medication errors decrease so will the cost of medication errors. Costs pertaining to extended patient stays, physician and auxiliary staff care, as well as treatments needed as a result of medication error will all be eliminated as error is decreased. Patients will also decrease their personal costs. Costs of lost time from work as well as pain and suffering will be eliminated for the patient. Finally, nurse job satisfaction will improve as medication errors are addressed. Nurses take their job very seriously, resulting in stress and anxiety. These problems could be reduced by giving the nurse an environment as well as time to focus on the task of medications. The end result could be increased job satisfaction as the nurse begins to see the interventions to ensure client safety.

### Operational Definition of Terms

Several terms must be clearly understood in order to accurately interpret this project. The following definitions are;

- *Medication Error*- a preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health-care professional, patient, or consumer” (Buchini & Quattrin, 2012, p. 327). Medication errors occur in all health care settings and may or may not be responsible for an adverse drug event.
- *Interruption*- Any activity or event that takes place when the nurse is diverted from the task at hand (Ebright et al., 2003). Interruptions can take place by personal initiative or another person.
- *Distraction*- any “interruptions during working activity in order to perform a secondary task” (Buchini & Quattrin, 2012, p. 328). This may be initiated by other providers or may result from not having the needed supplies at hand.
- *Administration Error*- one type of five categories of medication errors. Administration error occurs when there is a discrepancy between the pharmacological therapy prescribed by the physician based on good clinical practice and the drug received by the patient (Conrad et al., 2009).
- *Adverse Drug Event*- “injuries that result from medication use” (Buchini & Quattrin, 2012, p. 327). Adverse drug events can be caused by preventable error.

#### Assumptions and Limitations

1. Nurses desire to perform safely and without error.
2. Nurses on a local medical surgical unit are exposed to similar distractions and interruptions as discussed in the literature review.
3. The findings will be limited to a local medical surgical unit in the Northwest U.S.

### Organization of the Remainder of the Paper

This paper will explore the topic of interruption and distraction related to medication administration by nurses on a medical surgical unit. In chapter two the current literature will be explored for studies related to interruptions, distraction, and medication errors. Chapter three will cover the study design and data collection process. In chapter four the observations will be analyzed and summarized. Finally, in chapter five the results, implications, and future recommendations are suggested based on the findings.

## CHAPTER TWO

## LITERATURE REVIEW

Introduction

Medication error is the most common type of error affecting patient safety; it also is the most common preventable cause of adverse events for patients (IOM, 2006). Drug administration is predominantly a nursing responsibility. For this reason there is a need to better understand how nurse-related errors happen. This review will examine the published literature regarding why medication errors happen related to nursing. Additionally, the review will focus particularly on interruption and distractions to better describe the events that occur including the outcomes of those events.

Search Methods Terms/Results

Three nursing/healthcare databases were used to begin the literature review; CINAHL, Cochrane, and Medline. Each of these three databases include differences in terms of search modifiers, e.g. record title, keyword, subject, abstract. Each database produced significant findings, verbiage and modifiers. Each database was searched until repetitious authors and titles were found between databases. Keywords used to search were: nurse interruptions, medication administration interruption, medication time out, distraction and medication errors, nurse overload, and specifically with the Cochrane Library--medication error prevention.

The Cochrane Library database was the least productive for the literature review. The “subject” was utilized to search key words. No limitations were made during the search except the publication year of 2008-2012. The keywords listed above were searched. One hundred and forty-two articles were found for medication “time out.” In addition, one article was found under medication error prevention (a key word not used in other searches). Finally, only eight results were noted for medication administration interruption when the modifier was changed from “subject” to “abstract.” Otherwise, no other key words produced articles of interest.

The CINAHL database was more productive. Key words listed above were searched using only the limitation of year and English language. The modifier used was “abstract” since this appeared to be the most broad. Nurse interruptions produced four articles, medication administration interruption produced two, medication time out produced six, distractions and medication errors produced four, and finally nurse overload produced four articles after eliminating duplications and repeats.

Finally, the Medline database was searched and proved to be the most productive. The limitations were year and English language. The broadest modifier used was “topic.” Thirty-one articles were located for nurse interruptions, 45 for medication administration interruption, 1028 for medication time out, 20 for distractions and medication errors and 40 articles were found for nurse overload. Results were refined to a more manageable number for medication time out by limiting to the “title”. This resulted in only one article.

In conclusion, many key words and phrases were explored to complete the literature review. Additionally, a few limitations provided a manageable list of peer-reviewed articles to construct the literature review. Constant monitoring of necessary support literature was performed and subsequent literature searches ensued to fill the gap of missing empirical support to ensure a comprehensive literature review. The following section will describe the literature related to medication errors, incidence, system problems, distribution system, policy and procedure, knowledge deficit, workload, communication, interruptions/distractions, timing duration, causes/sources, channel/mode, time, and environment.

### Medication Errors

There is a significant amount of literature addressing the contributing factors for medication errors. One of the first challenges when reviewing the literature was clarifying the definition of a medication error. The published information appeared to have a variety of definitions, May & Duncan (2004) defined medication errors as a “deviation from a physician order” (p. 209), while Lasseter & Warnick (2003) stated error as; “a preventable mistake in prescribing or delivering medications to patients” (p. 177). The lack of consistency within the literature is a limitation that can affect the understanding of medication errors in healthcare. Brady, Malone, and Fleming (2009) performed an in depth systematic literature review of the most recent empirical literature to discover factors that contribute to error. Twenty-six studies were ultimately utilized in the literature review which shed light on some of the most common contributors to

medication errors. Findings from this study concluded “factors that contribute to medication errors are complex and multifaceted” (p. 680). Generally, the authors recommended etiology of errors could be divided into two sub-groups; system errors and health care professional errors (McBride-Henry & Foureur, 2006). In personal errors an individual seeks to attribute to causes whereas a systems approach attributes errors to policy or technology error. This literature review will first assess the incidence of medication errors, then some of the systematic etiology and conclude with individual health care professional research. A variety of peer reviewed articles will be presented which met the criteria discussed above. Utilizing the empirical evidence, a summary of the information reviewed will conclude this chapter.

### Incidence

In order to administer medication a complex set of steps are necessary to achieve the desired goal of safe administration in a timely manner. This complexity can lead to error while administering medication. Medication errors are on the rise with a 500% increase from previous decades (Scott, 2002). The literature indicated the most common phase for medication error was during the administration phase (Pham et al. 2011; United States Pharmacopeia, 2000). Barker et al. (2002) reported prevalence, medication errors occur in approximately one out of every five doses at a typical hospital. These authors concluded an error rate for 36 U.S. hospitals to be as high as 19%. Even more disturbing, Taxis & Barber (2003) found drug errors in 49% of all administration procedures. These extreme increases are thought to be underestimates as it is an industry prediction that

medication error is under reported. This poses a concern when trying to identify the etiology and outcomes of medication errors.

Pham et. al. (2011) conducted a 496 hospital cross sectional study to describe medication errors throughout the US. The authors concluded medication errors were most often occurred during the administration phase (36%) when given by a nurse. Similarly, Conrad et al., (2009) reported 42% of medication errors occurred during the medication administration phase. Comparatively, only 28% of the errors occurred during transcription and documentation, 15% during dispensing and 14% during prescribing.

The definition of an “administration phase” varied significantly in the literature. For some, this was considered the time the nurse was prompted to give the medication through preparation, administration, and documentation. Prescription, transcription, and dispensing medications were beyond the scope of this project. Keohane et al., (2008) defined six activities considering all six to make up the medication administration phase these were; obtaining and verifying medications, administering medications, managing orders, retrieving medication information, documenting medications and waiting for medications. Conversely, Battisto et al., (2009) identified five activities (retrieving, preparing, administering, and documenting medications). While Biron et al., (2009), Hall et al., (2010), and Westbrook et al., (2001) measured only two activities (preparing and administering medications). The scope of medication administration in the Keohane et al. (2008) study included a much broader definition than other studies. Additionally, protocol for their observations varied with some following nurses into a room to complete an observation (Keohane et al., 2008) while others relied on nurses to describe

what took place inside the rooms (Battisto et al., 2009; Elganzouri et al., 2009). These differences between studies indicated inconsistencies in information gathered.

### Systematic Problems

#### Distribution System

System failures occur because of design and environmental failures. The distribution system contributes to medication errors including components of how a medication is distributed and documented. Williams (2004) reported medication errors were more likely to occur when there is an inappropriate reliance on manual documentation or when information systems fail to interconnect (e.g. computer systems between pharmacy and a nursing unit). Additionally, errors occur when the medication was not in stock or there was general difficulty locating the item due to generically prescribed but brand name supplied products (Taxis et al., 1992). Similarly, Greenall and Wichman (2006) document the potential for error caused by similar packaging and labeling. This led to the wrong dose and/or wrong medication administered. Technology also contributes to error. Different types of infusions, tubing, and pumps or other equipment often leads to confusion and complexity (Mayo & Duncan, 2004). In summary, evidence supports that error can occur at any time during transmission of the prescription, locating the medication, and/or utilizing appropriate technology to deliver it safely to the patient.

### Workload

A nurse's patient assignment and the acuity level of those patients directly impact medication error rates. Evidence suggests a correlation between workload and medication errors (Blegen et al., 1998; Tissot et al., 2003; Ludwick and Cipriano, 2003; Pape, 2003; Mayo and Duncan, 2004). Williams (2004) concluded that workload fatigue was a major contributor to medication errors. This finding was supported in a study by Dean (2005) who reported workload to be the most common cause of medication errors at 25.3%. The researchers concluded that a higher number of registered nurses staffed on a unit decreased the number of medication errors reported.

### Environment

The practice environment can contribute to nurse medication errors. A "chaotic environment for medication administration with multiple delays including the need to clarify orders and correct inaccurate information" were significant contributors to error (Conrad et al., 2009, p. 139). Previously, Biron et al., (2008) concluded the evidence related to the physical environment in which nurses are interrupted is limited. In contrast, a plethora of recent information was found linking environmental factors to medication errors. For example, the most frequent error-prone area appeared to be (22% of the time) in the medication room (Potter et al., 2005; Elganzouri, Standish, and Androwich, 2009). Elganzouri, Standish, and Androwich (2009) reported a major "bottleneck" at the accudose machine while nurses waited for others to dispense medications. Additionally, retrieval time took longer "because medications were not all situated in the same location" (p.208). Biron et al., (2008) implemented significant changes in the

interruption process as well as reorganized how medications were dispensed and stored. With these changes medication errors decreased 22% in the first year and by the end of the third year the medication error rate decreased by 53% (Conrad et al., 2009). As a result the authors stated “nurses were more satisfied with the ease of obtaining and administering medications while patient care quality was improved” (p. 144). The researchers indicated the significant impact the environment had on interruptions and the benefits environmental modification contributed to lowering the error rate.

### Human Problems

#### Knowledge Deficit

System failure was the first category of cause found in the literature. The second category of errors could be attributed to human error. A frequent assumption is that error lies within the worker rather than the system. No nurse intends to harm, however, a nurse can unintentionally make mistakes. This can be due to inadequate training, or knowledge deficit (Williams, 2004). Han et al. (2005) concluded that one-fifth of all continuous infusions have some kind of error, this was due to lack of understanding or knowledge about administration on the part of the nursing staff. Similarly Zahn et al. (2006) concluded 57.9% of medication error could be attributed to knowledge deficit. Tang et al. (2007) further supported this finding, with 37.5% of medication errors due to new staff turnover or inexperience of the nursing staff. Although lower, Pham et al. (2011) also reported knowledge deficit as the primary etiology for medication error (29%).

The process of medication management involves significant intellectual activity and critical thinking. There is some concern that nurses have an inadequate pharmacological knowledge base to facilitate safe dispensing of medication. Manis & Bullock (2002) and Morrison-Griffiths et al. (2002) found nurses knowledge regarding pharmacological foundations may be lacking. This lack of knowledge would account for Taxis & Barbers (2003) findings that 79% of all medication errors by nurses were a result of insufficient knowledge. Errors are not only from a poor knowledge base but also miscalculations or poor math skills. In 1994 Segatore et al. concurred that the inability for nurses to accurately calculate medication dosages was a significant contributing factor to medication errors.

#### Policy and Procedure

Pape et al. (2005) carried out a quasi-experimental three group intervention on a medical surgical unit to reduce distractions during medication administration. Failure to follow policy and procedure while administering medication whether intentional or due to lack of knowledge contributed to medication errors. This author was the only source who addressed policy.

#### System & Human Problems

#### Prescription and Reconciliation

Medication reconciliation is the systematic validation and verification of a prescription with physician orders. Evidence indicates significant medication errors occur during the process of reconciling the medication with the original order. A study by

Gleeson et al. (2004) found discrepancies between patient history and drug prescriptions in more than half the patients resulting in a 50% error rate. These findings were supported by Midlov et al, (2005) in which they found an average of two reconciliation errors per patient.

Reconciliation can also be considered a human problem in that part of nursing and medical professional responsibilities is to find and correct these errors. Physicians, nurses and pharmacists all hold responsibility to understand the patient's medication regimen and to identify potential medications that are improperly dosed or interfere with the current medications ordered.

### Communication

An additional system and human error source involved communication. The literature indicated communication to be a serious problem that contributed to error. Ineffective written or verbal communication in relation to medications or prescriptions can lead to an error. In 1995, Gladstone was one of the first to document this issue finding incomplete or illegible prescriptions were associated with medication errors by nurses. Contributing factors varied from poor physician handwriting, similarities between drug names, over use of abbreviations, and ambiguous or incomplete orders (The Joint Commission, 2011; Abushaiqua et al., 2007; Mayo & Duncan, 2004; Kelly, 2004). Significant steps have been taken in the last few years to try and address communication problems in an attempt to decrease errors. However, the evidence still indicates this mode of error to be significant.

### Interruptions/Distractions

Distractions and interruptions are a known and accepted part of a nurse's job. Inevitably information is needed and communicated continuously in the health care system. The need for continuous transmission of information between nurses and other health care providers is part of the job description; however, hampered communication also poses significant safety risks during certain nursing tasks. Medication administration was the most interrupted nursing activity identified in the literature and accounted for 29% of all work interruptions (Hedberg & Larsson, 2004). In a literature review Nguyen et al. (2009) concluded "the most common contributing factors that have been identified by different studies were interruptions and distractions" noting a rate between 25.3%-94% of all causes for medication errors (p.225). Similar findings were reported by Pham et al. (2011). A nationwide descriptive study of 496 hospitals found distractions to be the main cause of medication errors (7.5%). Additionally, Westbrook et al. (2002) concluded interruptions to occur in 53% of all medication administrations. In summary, interruptions innately are part of every nurse's daily routine. However, nurses must have professional diligence during the medication administration process to ensure patient safety (Eisenhauer et al.,2007). When due diligence is missing, errors happen.

The literature clearly supported interruptions as contributing to medication administration errors (Scott-Cawiezell et al., 2007). In a study of six wards at two large teaching hospitals in Sydney Australia, researchers found interruptions were associated with a 12.7% increase in clinical errors. The more interruptions a nurse experienced influenced the number of clinical errors the nurse made. Additionally, error severity

increased with interruption frequency. Without interruptions the estimated risk of a major error was 2.3%. With four interruptions or more, this risk doubled to 4.7%. Clearly, there was an association between interruptions and medication error (Westbrook et al. 2010).

Significant empirical support explored interventions that decrease medication errors by limiting distractions and interruptions. One of the most common interventions was the use of signage to inform others medication administration was in process. This was done using vests worn by nurses indicating “Time Out” or a red apron to indicate “caution.” Relihan et al. (2012) reported this intervention significantly decreased interruption/distraction volume as well as medication errors. The post intervention distraction/interruption rate was 0.43 times lower than that of the pre-intervention level. A second study created a visible “no interruption zone” while nurses prepared medications. This zone was indicated by a red line around the medication area. While a nurse was in this area, others were educated not to interrupt the nurse’s work. The findings demonstrated a significant decrease of 40.9% in the number of interruptions with a statistically significant effect size of 1.3 (Anthony et al. 2010). Conrad et al. (2009) implemented urgent phone calls only during medication passing times. Additionally, signs were posted alerting hospital staff and families during high medication times. As a result of these interventions, unnecessary interruptions decreased from a median of 4 to a median of 1 per medication administration. Additionally, the time for administration decreased from 15 to 10 minutes and most importantly medication errors decreased 53%. The results from these various interventions were significant. Findings support the aim of limiting distractions and interventions in order to decrease medication errors.

### Timing/Duration

Frequency and the duration interruptions had on medication administration was an area clearly defined in the literature. Some studies reported interruption rates in percentages while others provided ratios. Westbrook et al. (2010) found interruptions to occur in 53.1% of all medication administrations. In addition, Kreckler et al. (2008) reported an average of 11% of each nurse's drug rounds was spent dealing with interruptions. This resulted in an average of 2.61 interruptions per round. Similarly, Kostis (2011) concluded in a descriptive, observational study a rate of 3.3 interruptions per RN during rounds. Additionally, Biron et al. (2008) concluded an interruption rate per nurse of 6.7 per hour or about every 9 minutes. The Biron et al. results were derived from a systematic review of 14 studies that reported interruption frequency and total length of observation based on 2,622 interruptions and 402.5 hours of observation. Elganzouri, Standish, and Androwich (2009) concluded 1.21 interruptions occurred per rounds for each RN. This was similar to Relihan et al. (2012) who reported a rate of 1.6 interruptions per rounds which consumed on average a total of 60.5 minutes. Although the frequency of interruptions using the same denominator e.g. percentage, ratio etc..., was not found in the literature, it was clear that nurses experienced a significant number of interruptions ranging from an average of 1.21- 6.7 interruptions during drug rounds.

Some authors choose to report interruptions based on time rather than on drug rounds. Conrad et al. (2009) reported that nurses had an average of 11 interruptions during a single administration procedure. This is a significant variation which could be accounted for by hospital or even unit variables. The same authors revealed that the

medication administration process took between 7-20 minutes per patient with an average of 15 minutes. This led to a single administration taking 20 minutes to complete due to the interruptions with an average of 11 interruptions during the process. In contrast a descriptive study by Elganzouri, Standish, and Androwich (2009) reported only 1.21 interruptions per pass, they estimated an average medication pass time of 15 minutes 7 seconds. Therefore an average hourly rate of 4.8 interruptions hourly could be concluded. Most concerning about all the studies reviewed was that the findings demonstrated a fragmented process and loss of concentration for the nurse's critical thinking.

Depending on the type and source of an interruption the duration could vary significantly. A systematic review found the average mean duration of interruptions varied, ranging from 45 seconds to one minute 22 seconds (Spencer et al., 2004; Tang et al., 2007; Kreckler et al., 2008). When accounting for as many as 11 interruptions hourly, this could result in as much as 8.25-15 minutes of interruptions per hour. This assumption was validated by Palese et al. (2009) who summarized their research findings as interruptions lasting approximately 10.48 minutes hourly. Appendix A outlines this observational study's interruption times based on time of day as well as the ten most common causes of interruption specified with duration and frequency. The literature supported the idea that interruptions not only broke the nurse's critical thinking or train of thought, but the interruptions also required a significant amount of the nurse's time.

The evidence indicated the most critical time to prevent a medication error is during administration. In addition, Elganzouri, Standish, and Androwich (2009) found

“time and motion observation to be a useful method to increase understanding of nursing workflow in the administration process” (p. 210). These researchers studied not only the activity surrounding medication administration, but also the timing involved.

### Causes/Source

The causes or source of interruptions varied in the literature. Buchini and Quattrin (2012) published a study conducted in northern Italy. The purpose was to describe interruptions and identify solutions to reduce the number of “avoidable interruptions.” The study found nine avoidable causes for error including request for information from the family, hand washing not done in the room, other provider’s requests, poor readability or completeness of the prescription, supply of the drug or needed supplies, incoming phone calls, documentation, other patient call bells, and patient requests. These results indicate nursing and logistics to be the main source of interruptions. Similarly, Conrad et al. (2009) documented interruptions related to searching for medications, supplies, waiting to access medications, performing unexpected tasks and difficulty accessing laboratory information because of limited computer access as further contributors to error. These interruption sources were also considered nursing as well as logistical sources. In contrast, earlier research concluded the most frequent source of interruptions was nursing staff which accounted for 36.5% of all interruptions (Hedberg and Larsson, 2004) and patients were second with 24.7%-26.4% of interruptions (Lyons et al., 2007; Pape, 2003). Similar results were also reported in the study by Elganzouri, Standish, and Androwich (2009). This observational study reported LPN’s often interrupted RN’s during medication passing to ask questions. The technical or logistical sources were

much lower with 4.5%-13% as the cause for interruption (Tucker & Spear, 2006; Hedberg & Larsson, 2004). Similarly, Nichols et al. (2008) concluded pharmacologic and personnel as well as supply as the sources for interruption. These interruptions were due in part to multiple locations to obtain patient medications and supplies, physicians and nurses asking for help with other patient matters, resupplying medication cups, and repositioning patients. In contrast, Nichols et al. (2008) concluded 62% of interruptions occurred during direct patient care. Similarly, Kreckler et al. (2011) performed a qualitative observational study related to interruption sources and also reported most distractions were “from patients- either because they demanded care, or because the nurse delivered other aspects of care during the drug rounds” (p. 1328). However, this study also found documentation to be the next most common activity to cause interruptions at 14%; other work interruptions were basically equally divided among the remaining nursing care activities. In summary, the literature did not specify one common cause or source for interruptions. The evidence concluded a variety of nursing and non-nursing interruptions contribute to the problem.

#### Channel/Mode

Additionally, Kreckler et al. (2011) analyzed the channel or the medium through which interruptions were conveyed. The channels could be the face-to-face interactions, telephones, pagers etc; different mediums in which interruptions occurred. The evidence supported face-to-face as the most important channel to convey work interruptions accounting for 87%-95% of all interruptions (Coiera & Tombs, 1998; Coiera et al., 2002; Spencer et al., 2004; Alvarez & Coiera, 2005; Kosits & Jones, 2011). The literature

discussed vaguely the influence of other modes of interruptions, but there was no published data on the impact of these less frequently documented modes of interruption.

### Time of Day

The peak time for interruptions varied between studies. Kositis and Jones (2011) reported most interruptions occurred in an emergency room department during the evening shift. In contrast, Palese et al. (2009) found the morning and afternoon shift to have more interruptions on a medical surgical unit. These are interesting findings since Palese et al. determined the quantity of medications dispensed was greater in the evening than any other time of day. In analysis, more medications were dispensed in the evening yet, there were more interruptions during the morning and afternoon shifts.

### Summary

Medication error is the most common type of error affecting patient safety and is the most common preventable cause of adverse events for patients (IOM, 2006). The nurse most often administers medication, therefore exploring the literature related to interruptions of nurses was the most obvious choice. After an extensive literature search of three most common nursing databases, over 49 articles were reviewed. Medication errors are on the rise with a 500% increase from previous decades (Scott, 2002). This is in part due to increased complexity of technology as well as higher expectations on nurses. Medication errors are linked to distribution, system, policies, poor knowledge base, high workloads and poor communications issues. Most importantly, medication errors are happening due to interruptions and distractions causing strain and

fragmentation on the nurse's train-of-thought. A nurse can expect interruptions to increase his/her risk for medication error and to take up a significant amount of time during the workday. While no one cause or source of interruptions could clearly be identified in the literature review, it is evident that there are a variety of nursing, non-nursing, as well as environmental sources all contributing to the problem. The most prominent channel to communicate interruptions was face-to-face contact; however, the time of day was not as clearly defined in the literature. Table 1 below summarizes the literature review, sub-topics and references support. In conclusion medication errors are a significant problem in the US health system. While there are many causes and contributing factors related to errors. The challenge is to understand where the system is breaking down in order to address problems effectively. By understanding individual and unique contributing factors specific to each unit, successful interventions can be proposed to decrease the error rate.

Table 1- *Literature Review Reference Table*

<u>Topic</u>	<u>Sub-Topic</u>	<u>Reference</u>
Systematic Problems	Distribution System	Williams, 2004 Taxis et al., 1992 Greenall and Wichman, 2006 Mayo & Duncan, 2004
	Workload	Blegen et al., 1998 Tissot et al., 2003 Ludwick and Cipriano, 2003 Pape, 2003 Mayo and Duncan, 2004 Williams, 2004 Dean, 2005

Table 1 Continued

	Environment	Conrad et al., 2009 Biron et al., 2008 Potter et al., 2005 Elganzouri, Standish, and Androwich, 2009
Human Problems	Knowledge Deficit	Williams, 2004 Han et al., 2005 Zahn et al., 2006 Tang et al., 2007 Pham et al., 2011 Manis & Bullock, 2002 Morrison-Griffiths et al., 2002 Taxis & Barbers, 2003
	Policy and Procedure	Pape et al., 2005
System & Human Problems	Prescription and Reconciliation.	Gleeson et al., 2004 Midlov et al, 2005
	Communication	Gladstone, 1995 The Joint Commission, 2011 Abushaiqua et al., 2007 Mayo & Duncan, 2004 Kelly, 2004
Interruptions & Distractions		Hedberg & Larsson, 2004 Nguyen et al., 2009 Pham et al., 2011 Westbrook et al., 2002 Eisenhauer et al., 2007 Scott-Cawiezell et al., 2007 Westbrook et al., 2010 Relihan et al., 2012 Anthony et al, 2010 Conrad et al., 2009
	Timing/Duration	Westbrook et al., 2010 Kreckler et al., 2008 Kostis, 2011

Table 1 Continued

	<p>Biron et al., 2008  Elganzouri, Standish, and Androwich, 2009  Relihan et al., 2012  Conrad et al., 2009  Spencer et al., 2004  Tang et al., 2007  Palese et al., 2009</p>
Cause/Source	<p>Buchini and Quattrin, 2012  Conrad et al., 2009  Hedberg and Larsson, 2004  Lyons et al., 2007  Pape, 2003  Elganzouri, Standish, and Androwich, 2009  Tucker &amp; Spear, 2006  Hedberg &amp; Larsson, 2004  Nichols et al., 2008  Kreckler et al., 2011</p>
Channel/Mode	<p>Kreckler et al., 2011  Coiera &amp; Tombs, 1998  Coiera et al., 2002  Spencer et al., 2004  Alvarez &amp; Coiera, 2005  Kosits &amp; Jones, 2011</p>
Time of Day	<p>Kositis and Jones, 2011  Palese et al., 2009</p>

## CHAPTER THREE

## METHODS

Introduction

Interruptions and distractions are known to increase workers stress levels “as a result of competing demands for attention” (Relihan et al., 2012, p. 1). Therefore, reduction of stress and subsequent risk of medication errors can be accomplished by minimizing unnecessary interruptions and distractions. The focus of this project was to identify interruptions and distractions during medication administration to improve safety. This was accomplished by making process and/or policy recommendations without blaming and/or identifying individual performance issues. The literature review detailed distraction and interruption etiology and outcome and also highlighted the substantial time nurses spend in the medication process. The findings emphasized the need to increase patient safety and decrease costs associated with nursing time and medication administration.

The purpose of this project was to identify interruption trends during medication administration among nursing personnel on one medical-surgical unit in a hospital in Montana. This project identified the need for a specific intervention to improve medication administration safety. In this chapter study design, population description and protection, measures, the procedure, and the item analysis are discussed.

### Observation Design

The literature supported medication errors most commonly occurred during the phase of administration (Conrad et al., 2009). Additionally, the investigation of activity as well as timing as it relates to administration was helpful in fully understanding medication error. For this study, in order to better understand the process surrounding medication administration as well as timing and possible distractions or interruptions, a descriptive observational design was used.

### Setting/ Sample Population

This project took place at a 253 bed, not-for-profit rural hospital in the northwestern United States currently seeking magnet status. (Since the conclusion of this study, the hospital was awarded Magnet status by the American Nurses Credentialing Center (ANCC). The medication observation project was implemented on a 26 bed medical surgical unit, which has an average daily census of 13 patients, an average length of stay of 3.7 days, and approximately 3.3 discharges and 2.0 admissions per day. The average daily census is 52.26% (S. Hoogana, personal communication, October 2, 2012). There are three nurse's stations, two medication rooms, 26 private rooms, and two semiprivate rooms on the unit. The patient population was primarily trauma and post-surgical patients.

Thirty-three registered nurses are assigned to the unit with a patient-to-nurse ratio average of 4/5:1 during the day and 5/6:1 during the night. The observed subjects were all registered nurses, 75% had bachelors in nursing and 25% were associate degree graduates

(S. Hoogana, personal communication, October 2, 2012). There were no Licensed Practical Nurses working on the unit.

#### IRB/Subject Protection

The facility where observation took place is a designated teaching hospital. The assumption with this designation is that research will be conducted and carried out in the institution. All policies and procedures of the hospital institutional review board were followed. Since employees of the hospital were the subjects, permission to participate in the study was obtained through informed consent. The project leader (PL) was responsible for handing out and explaining all consent forms. Informed consent/assent forms were signed by the participants. Once signed, consent forms were kept in a locked and secure file cabinet. A sample of the cover letter and informed consent form can be found in Appendix B. This consent clearly described the goals, objectives, aims, benefits, and risks of the proposed study.

During a regularly scheduled staff meeting the registered nurses received a cover letter with the consent form. The cover letter briefly described the study and requested the nurses' participation (Appendix B). The consent form was attached. The PL of the project verbally presented the information and answered questions during the meeting. The staff was encouraged to read the cover letter and fill out the permission form if they agreed to participate. Only those participants with signed consents were allowed to participate. Once signed, the nurses were instructed to return forms to the PL. All forms were transported in a secure manner by the PL.

There were no anticipated physical, social, or legal risks for participants in this study. Emotional distress was the only possible risk for study participants. The knowledge of feeling observed or “watched” can possibly increase a participant’s anxiety or stress. To accommodate for this risk, the PL began each observation by introducing himself and explaining the procedure of data collection and observation. The PL made participants aware of the risks prior to data collection. Nurse questions were answered prior to beginning the observation. Additionally, data was collected from a neutral point of observation which was not obstructing the nurse’s work nor interfering with the daily routine of the unit.

#### Measures/Instruments

Measures included observation and recording of interruptions and distraction based on the type, cause, time, location and duration, this information was obtained over a variety of days and times. For the purpose of this project interruptions was defined as any activity or event that takes place when the nurse is diverted from the task at hand (Ebright et al., 2003). Interruptions could take place by personal initiative or due to another person. Kostis and Jones (2011), performed a descriptive observational study exploring interruptions experienced by RN’s in the work place at a major academic medical center. Data was collected using three different data collection tools. The first tool collected RN demographic data. The second tool was created to record environmental data (e.g. shift of observation, number of nurses on duty, patients on unit). For the purpose of this project a modified Nurse Demographic and Environmental data collection sheet was created after the ones discussed in the Kostis and Jones (2011) study

to collect data about the nursing staff and environment where observation took place (Appendix C). The final tool from the Kosits and Jones (2011) study, the Interruption Data Collection Tool, was used in this project to measure the number and type of interruptions during observation, (Appendix C). The tool was created by the researchers after a literature review of the domain content of interruptions. This tool recorded interruptions and further categorized them as interruptions of communication and self. A communication interruption “an interruption caused by one of several different types of communication” such as overhead page, phone, equipment alarms etc.... (p. 5). Self-interruptions were individual or independently suspended activity to perform another task. This tool had good interrater reliability (Fleiss Kappa Statistic of 0.825) and was designed after portions of it were successfully implemented in previous research (Brixey et al., 2005; Chisholm et al., 2000; Laxmisan et al., 2007; Spencer, Coiera, Logan, 2004). Interrater reliability as well as observational sampling was utilized to further validate the tool. Permission from the authors to utilize this instrument was granted in writing (L. Kosits, personal communication, October 2, 2012).

For the purpose of this project distractions were defined as “interruptions during working activity in order to perform a secondary task” (Buchini & Quattrin, 2012, p. 328). Distractions may be initiated by other providers or may be due to the absence of needed supplies. The modified, “Medication Administration Distraction Observation Sheet (MADOS), allowed collection of a standardized data set of distractions during observation. This tool was designed and tested by Theresa Pape (2003) when studying distractions during medication administration, as modeled after airline safety practices.

The MADOS was a 10-item instrument designed to count distractions during medication administration (Appendix D). It was created after a literature review of the domain content of distractions. For the tool potential distraction sources were answering physician or personnel phone calls, other patients, visitors, missing medications, wrong dose, emergencies, conversations and external noise. This tool recorded the time it took to administer the medications as well as the frequency and cause of distractions. The MADOS was validated using the Fehrings (1987) diagnostic content validation model and expert opinions of nurses using a rating scale (Fehring, 1987). Additionally, the tool was tested for interrater reliability and established a power of 90% indicating high interrater reliability, significantly above the 0.80 cutoff. This tool was also validated in a pilot study by nurses (Pape, 2003). Permission from the authors to utilize this instrument was granted in writing.

### Procedures

For the purpose of this study, using the most recent definition from Pham et al., (2011), medication administration was defined as; the time the nurse was prompted to give the medication through preparation, administration, and documentation. Prescription, transcription, and dispensing medications were not part of this time frame. To decrease the influence of extraneous variables such as self-report or missed infraction, observation of administration were directly observed at all times. The data collection procedure consisted of 9 steps, during this time the nurse would be directly observed by the PL and notes taken in relation to interruptions and distractions as well as timing and

any other unusual activity other than those listed below. The PL would be present during each of the following steps:

Step 1 The nurse is prompted to administer a medication;

Step 2 The nurse reviews the patient medication record;

Step 3 The nurse enters the medication dispensing area;

Step 4 The nurse obtains the medication/s needed;

Step 5 The nurse prepares the medication for the correct administration route;

Step 6 The nurse walks to the patient's room and enters;

Step 7 The nurse prepares/administers the medication;

Step 8 The nurse documents the medication provided in the patient chart ;

Step 9 The nurse exits the room.

The observer timed the medication administration process using a stopwatch, and then tracked nurse's activities through the documentation phase of administration as listed above. Multiple nurses were observed during each data collection period, however, only one nurse was observed at a time during the administration procedure. To decrease bias, nurses were randomly selected during the observation process. On average, 2.75 nurses were observed in each two hour data collection period. Observations were recorded on a data sheet during this process which was kept on a clip board with the PL at all times.

The data analysis was conducted with interprofessional consultation of Dr. David

Claudio and Dr. Maria Velazquez. Both are systems engineers at Montana State University and assisted in the data analysis and statistical evaluation of the results.

The published literature lacked consensus about the timeframe (days and times) most medication errors occurred. Pham et al., (2011) found errors most likely to happen during the evening shift (42%) however the authors identified this finding may be different for every institution based on census and facility schedules. In agreement, most studies conducted specific time increments of data collection rather than 24 hour data collection. Using these findings, this project observations were started at the time a nurse identified the need to begin medication administration until the medication was administered, this time frame included documentation. Additionally, during medication administration observation was continued into the patient room for first hand data collection. Observation and data gathering took place during the busiest days and highest dispensing times in order to “capture the constraints of both clock and process time” (Jennings et al., 2011, p. 1449). Facility specific data from the institution where this project took place indicated the most common times for medication administration were 0730-0930 and 2000-2200 (Appendix E). Finally, in a study by Pape (2003), five observation periods documenting distractions during medication administration were required to determine significance. Therefore the current study conducted 8 cycles of observation during the study. Using all the above data, observation took place during the highest medication administration times 0730-0930 and 2000-2200. Additionally, the highest patient census days at the facility where data collection took place were Mondays through Wednesdays , therefore, the observation schedule was implemented for 2 hours

on Monday, Tuesday, and Wednesday over a two week period (S. Hoogana, personal communication, October 2, 2012). In total this provided eight observation periods for data collection (Appendix F).

The Hawthorne Effect is a bias which can occur any time live subjects are participating in data collection. This effect was addressed in the study. As written in chapter one the definitions of interruptions and distractions illustrate these events are “uncontrollable” on the part of the nurse. It was acknowledged that nurses may have felt the need to perform better while the PL was collecting data, but this essentially should not have affected the uncontrollable distractions and interruptions imposed during the process. The Hawthorne effect was further decreased due to random selection of the nurses during observation and the fact most of the nurses professionally knew the PL as a colleague prior to data collection.

### Data Analysis

Multivariate statistical analysis enabled an estimation of the relative contributions from interruptions and distractions as they related to medication administration. In the future, this process will facilitate prioritization of efforts toward reducing errors. To accomplish this, descriptive statistics such as frequency, percentages, central tendency values and linear correlations were evaluated using the Pearson’s Test. To better understand the statistical significance between time and days of medication administration as they relate to interruption and distraction, an ANOVA test with a significance of  $p < 0.05$  was utilized. This identified what days the most distractions and interruptions occurred and what times were most significant for these events.

Additionally to identify patterns of interruptions and distractions, a comprehensive list of interruptions was accumulated and categorized based on findings.

## CHAPTER FOUR

## RESULTS

The purpose of this project was to identify interruption trends during medication administration among nursing personnel on one medical-surgical unit in a hospital in the Northwest United States. The project will identify the need for a specific intervention to improve medication administration safety.

The goals of this project were to:

1. Observe and document the current system (process) of medication administration on a medical surgical unit.
2. Observe and document nurse medication administration interruptions over variable days and times of day.
3. Record interruptions based on the type, cause, time, location and duration.
4. Identify interruptions by types, duration, and frequency across times of day.

#### Research Participants

A random cross sectional convenience sample of 74 medication administrations were observed during data collection from 22 different nurses ( $N=22$ ). Sixteen of the administration observations were nurses working a 12 hour shift and six were working an eight hour shift. Each nurse invited to participate signed the consent; none declined

observation. Data collection took place between March and April 2013 on a 253 bed, not-for-profit rural hospital in the northwestern United States. The medication observation project was implemented on a 26 bed medical surgical unit. There were three nurse's stations, two medication rooms, 26 private rooms, and two semiprivate rooms on the unit. The patient population was primarily trauma and post-surgical patients.

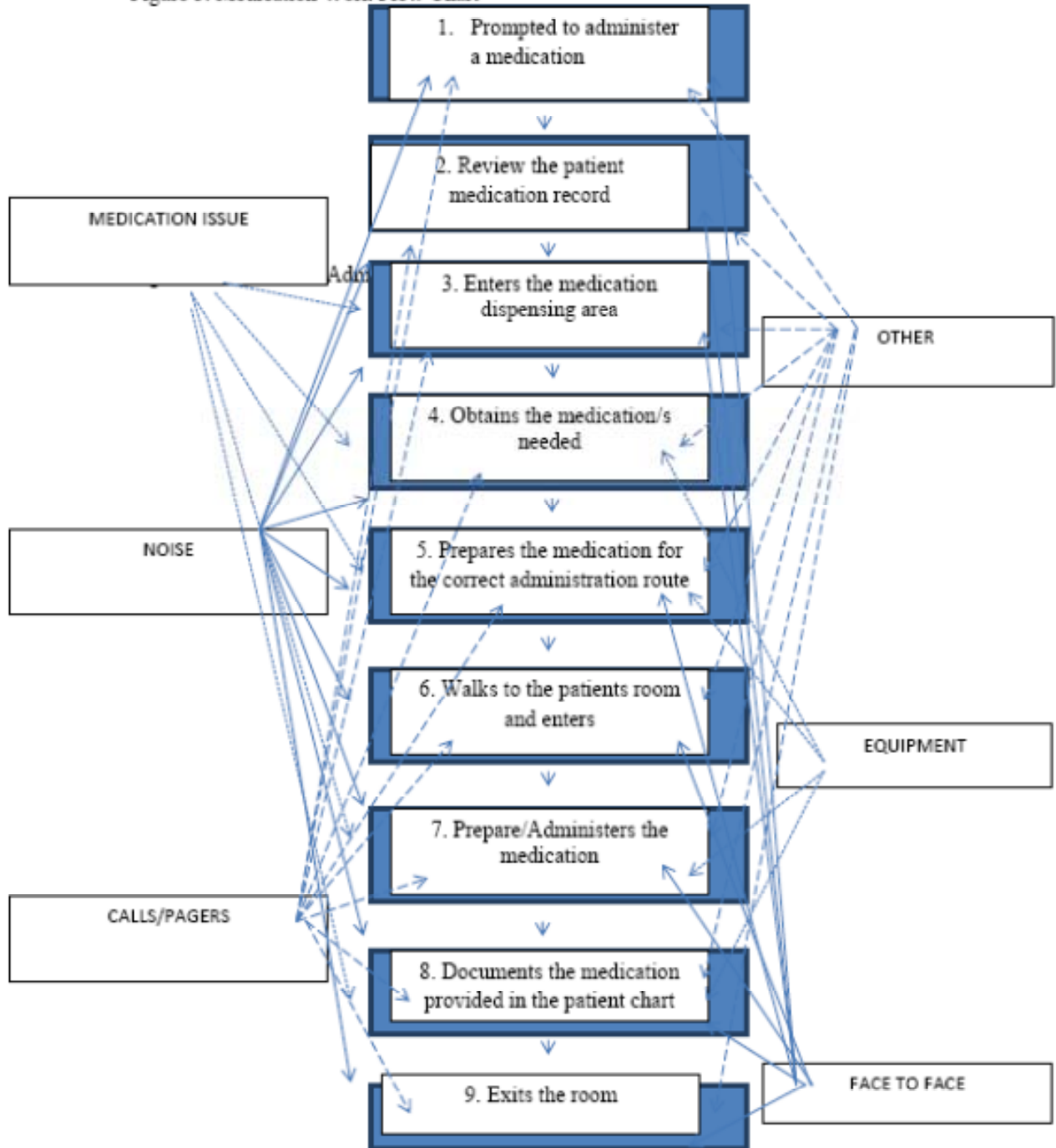
### Demographic Information

The average nurse's age was 40 years with an average of 12.5 years in the nursing profession. Each nurse had worked on the floor for an average of 9.54 years. Each nurse averaged 4.05 patients per shift with an average daily census of 17.5 patients on the unit. This calculated into an average of 5.49 nurses on the unit per shift. Twenty-one (95%) of the twenty-two nurses were female. Twelve (55%) of the twenty-two nurses had a Bachelors in Nursing degree, ten (45%) had an Associate Degree in Nursing.

### Project Goal 1

The first goal of this project was to *observe and document the current system (process) of medication administration on a medical surgical unit*. Figure 3 below demonstrates a work flow for medication administration on the unit. The six variables measured during data collection were interfaced with the nine medication administration steps. Each arrow indicates when the variable causing distractions/interruptions interfered with the medication administration process.

Figure 3. Medication Work Flow Chart



When medication was to be given, the first step was a prompt to the nurse that a medication was due. The nurse then looked at the patient electronic chart to verify the medication, route, dose, and time. Additionally, the nurse verified any other procedures or orders associated with the medication administration (e.g. labs, diagnostics etc....). Next the nurse entered the designated area on the unit to obtain the dispensed medication. This was usually done through a machine called a pyxis, which dispensed just the requested medication through a specific drawer which opened upon programming by the nurse. Additionally, some medications were kept in bulk drawers or cabinets, the nurse could also dispense medications from these locations. These were often more common medications such as IV drugs, insulin syringes, and inhalers. Once the medication was obtained, the nurse may prepare the medication for administration while still in the medication dispensing area. This may have meant pulling a diluent from the omni cell in order to mix medications in the room. In the sixth step the nurse walks to the patient's room. Seventh, the nurse prepares/administers the medication. In the eighth step the nurse documents the administration in the patient chart. The nurse then exited the patient's room in the final step of administration.

There were six variables affecting the relationship of distractions and/or interruptions measured during the data collection; face-to-face, medication issues, other, equipment, noise, and pagers. *Face-to-face* interruptions included anytime a nurse was disrupted by patient, family, or hospital personnel. This could have been questions from the family or patient, or personnel asking about patient care. *Medication issues* were recorded anytime the nurse found the medication unable to be administered. This could

mean the medication was not available, was not in the right form for administration, was not properly ordered in the record. Usually medication issues required some form of delay in administration while the issue was corrected, often this meant additional time was taken to address the issue. Other issues meant anything causing a distraction or interruption which was not categorized by the other five variables. The *other* category often was documented when the nurse had to utilize special sterile techniques in the patient room, isolation attire was required, or an emergency situation was occurring which distracted or interrupted the administration process already under way. *Equipment* was documented whenever there was a problem with equipment necessary for medication administration. This often meant the pharmacy did not have the proper medications or malfunctioned during use. It could have meant the IV pump was not working, the computer chart failed to be accessible, patient vitals machines would not work prior to administration or monitors were malfunctioning. All the equipment necessary to safely administer medication was observed for proper function, but if it failed, an equipment distraction/interruption was noted as the nurses had to take extra steps to resolve the issue. Similarly, the *noise* experienced by a nurse added to distractions and interruptions. Most often noise from the television was the largest distractor, however, other issues like the loud beeping of an IV pump, patient's cell phone, electronics for the patients personal use, nurses talking very loud outside in the hall etc. these all contributed to extra noise, thus causing a distraction in the administration process. Finally, the nurse's *paggers/calls* otherwise known as vocera's were distractors. The vocera is a voice activated beeper system all nurses wear during shift. These transmitters allow for nurses to easily be

located and communication transmitted at any time during shift. Unfortunately, this also includes during the medication administration process which can distract the nurse. The vocera first alerts the nurse with an alarm, then the person paging asks the nurse to accept the call. If the nurse accepts the call the paging person can then talk with the nurse. The nurse can also decline the call, none-the-less, the nurse still is distracted to decline the call. Calls/pages occur constantly during the nurse's day, these transmissions are often routine, but can be emergent. For example, a nurse may be called to take a new patient arriving on the floor, or a nurse may be called to a patient's room for an emergency using the vocera.

In the flow chart from Figure 3 an arrow from a distractor variable to the medication administration process indicated anytime a nurse experienced one of the variables listed above. It became evident very quickly that most variables affect 90% of all administration steps. Occasionally, one variable was not applicable to a patient administration step such as equipment and entering the medication dispensing area. Equipment was not necessary to perform this step, therefore, equipment did not cause distractions or interruptions during this administration step. In conclusion, the flow chart identified many different types of distractions and interruptions that occurred during the administration process. There was not one step which appeared more vulnerable to distractions/interruptions; rather, the entire process contributed to distractions/interruptions.

Project Goal 2:

The second goal of this project was to *observe and document nurse medication administration interruptions over variable days and times of day*. Of 74 medication observations, 36 (49%) were during the 0730-0930 morning time frame and 38 (51%) were during the 2000-2200 evening time frame. These two time frames were chosen for observation because they represent times when the highest peak of medication is administered. In Figure 4 below, peak administration times could be observed. The highest peak was 0842 with the second highest peak time being 2103. Additionally, before and after each of these times there is also an increase of medication administration for approximately one hour before and one hour after, therefore, a two hour observation time was utilized to collect data. Similarly, the highest patient census on the unit of concern was Mondays, Tuesdays, and Wednesdays. Therefore, observation was performed on two Mondays, two Tuesdays, and four Wednesdays for a total of eight observation periods during the months of March and April 2013. As mentioned in chapter three, in a study by Pape (2003), five observation periods documenting distractions during medication administration were required to determine significance. Therefore, four am shifts and four pm shifts were utilized for this data collection project.

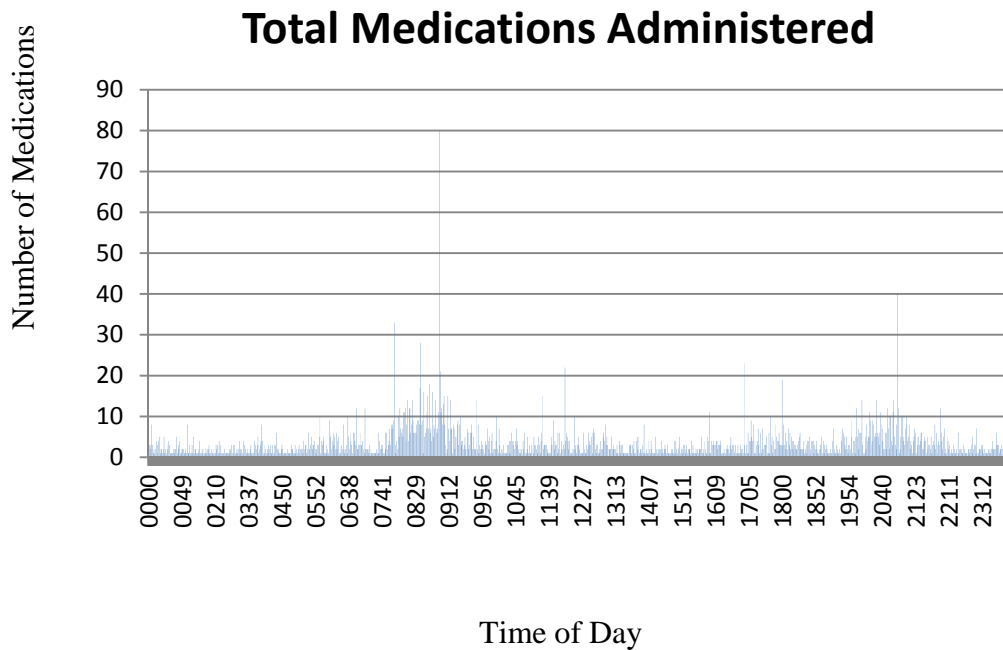


Figure 4. Thirty Day Accumulation Medication Administration Times Five South

### Project Goal 3:

The third goal of this project was to *record interruptions based on type, time, and frequency across times of day*. A data collection tool was used to collect data on interruptions and distractions as they occurred. Two tools from previous research were combined to create the one used in this project (Appendix G). Once a nurse was identified who needed to give medications, an informed consent was obtained and questions were answered. A stop watch was used to obtain the exact *time* it took to administer the intended medications. Time was kept in minutes and seconds. There were 39 medication observations on the evening shift (53%) and 35 (47%) of the observations during the morning shift. The average morning shift took 10 minutes 51 seconds to administer medications, while the evening shift took 10 minutes 54 seconds to

administer. These times were very similar which demonstrated consistency between evening and morning medication administration as well as the impact of distractions and interruptions upon administration time.

The distractions and interruptions were categorized by *type* once they occurred. There were six different categories; noise, face to face, calls/pagers, medications, other issues, and equipment. Additionally, the distraction or interruption was identified by medication phase; medication order review, medication retrieval, medication preparation, administration, or documentation. Therefore, each distraction or interruption was not only categorized by *type*, but also categorized by when in the administration process the incident occurred.

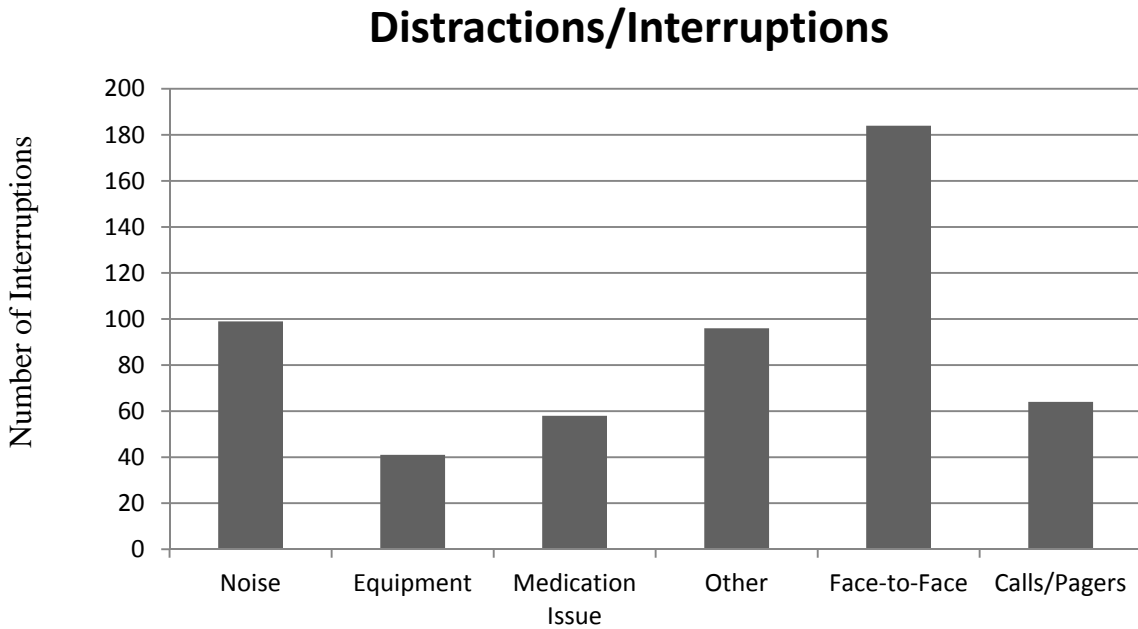


Figure 5. Type and Number of Interruptions/Distractions

Figure 5 demonstrates the most common *type* of interruption and distraction was face-to-face, the second most common was noise, and the third was other, then calls/pagers, medication issues and last was equipment problems. The length of administration took anywhere from as little as 2.25 minutes to as much as 38 minutes. The mean administration time was 10.54 minutes.

*Frequency* of interruptions/distractions was average per medication round when compared to current literature; however, it appeared to occur much more often. During observation there were a total of 543 distractions/interruptions. This amounts to approximately 7.3 interruptions/distractions per nurse per medication pass. The average medication administration time was 10.54 minutes. This resulted in one distraction or interruption every 1.44 minutes or 42 interruptions/distractions hourly per nurse during medication passing. These findings were within a range for those reported in the current literature. Elganzouri, Standish, and Androwich (2009) reported only 1.21 interruptions per pass, they estimated an average medication pass time of 15 minutes 7 seconds. Therefore an average hourly rate of 4.8 interruptions hourly could be concluded. In contrast, Conrad et al. (2009) reported that nurses had an average of 11 interruptions during a single administration procedure. Each administration took approximately 15 minutes to complete resulting in 44 distractions hourly.

Similarly, the data collection revealed a higher number of interruptions/distractions than previously reported in the literature. Figure 6 below reports the number of interruptions/distractions reported by previous authors per nurse medication round. The current data reported approximately 7.3 interruptions/distractions

per medication pass which is higher than those previously reported. This would indicate the unit of observation had significantly more distraction/interruptions than those previously reported in the published literature. This also indicates the current unit had higher distractions/interruptions than studies reported in the literature. However, it is uncertain how these variables were measured in other studies. Variables such as higher staff ratios and/or voceras may significantly increase the number of distractions/interruptions on the current unit, if these were not present in past studies, they would not impact the final statistics and timing. Additionally, these studies may have had different populations, facility size and microsystems. Therefore, the only conclusion that can be made is there were significantly more interruptions/distractions on the current unit of concern than most of those previously published. Additionally it took less time on average to pass medications than those previously published.

Source	# of interruptions/distractions per medication pass
Kreckler et al. (2008)	2.61
Kostis (2011)	3.3
Elganzouri, Standish, and Androwich (2009)	1.21
Relihan et al. (2012)	1.6
Conrad et al. (2009)	11
Current Data	7.3

Figure 6. Number of Interruptions/Distractions per Medication Pass Literature Review and Current Study

### Distractions and Interruptions by Shift

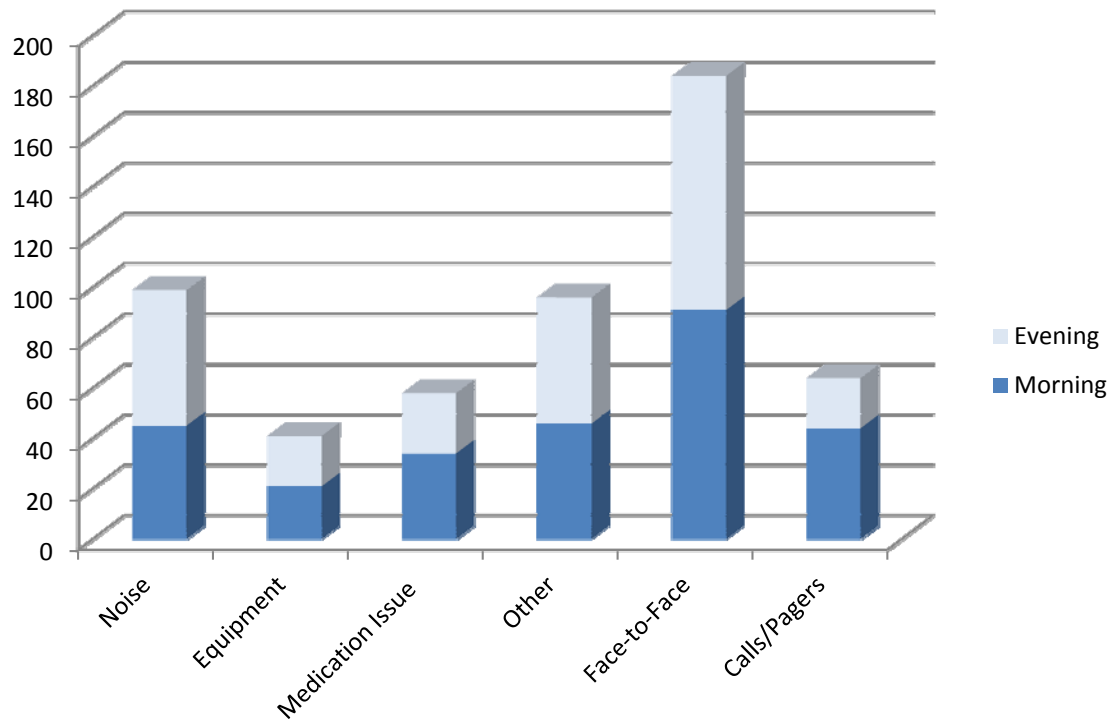


Figure 7. Morning Versus Evening Shift Distractions/Interruptions by Type

Figure 7 above demonstrates the *type* of distraction and interruption by *frequency across time of day*. Data was collected during the morning shift and the evening shift peak times. There was some variability between type of distraction/interruption during the morning and evening shift, however, there were no obvious significant differences noted. Thus, the type of distraction and interruptions occurring on morning shift appeared to be similar to those also occurring on the evening shift. Therefore, any proposed intervention to decrease the type of interruption/distraction occurring would be expected to have similar outcome effects on both shifts.

Phase of administration proved to be less reliable when reporting distractions and interruptions. As mentioned above, the tool allowed each distraction or interruption to be categorized in one of five phases of medication administration; medications order review, medication retrieval, medication preparation, administration, or documentation. However, accurately documenting these phases was difficult when an interruption or distraction occurred because often the event occurred over one or more phases. For example, a distraction of noise occurred during the medication administration and documentation phase in a patient room, therefore, this distraction had to be categorized in both phases of administration however it was only considered one distraction. The data quickly became disorganized and difficult to enter into statistical analysis once a range of medication phases were entered. Therefore, the decision was made to omit the phase of administration in which a distraction and interruption occurred and the data was focused on the type, time, and frequency across times of day.

### Summary Assessment Overall Findings

#### Project Goal 4

The last goal of this project was *to review of the literature regarding interruptions during medication administration and the outcomes of those interruptions*. The completion of this analysis will integrate the findings of the literature review on interruptions and distractions during medication administration and the data obtained in this project. Furthermore, the findings related to the literature on interruptions/distractions during medication administration will be integrated throughout chapters four and five.

Interestingly, upon deeper statistical analysis the data demonstrated that with the six variables collected for this research, using a correlation matrix, there was not one which could predict number of interruptions and distractions. When performing an Analysis of Variance (ANOVA) and a regression analysis, the R-squared for the model was 0.283 with an adjusted R-squared of 0.159. More sophisticated software was used to study possible interactions between the variables or nonlinearity of the data but the results continued to produce an R-squared which was 0.32 with an adjusted R-squared of 0.29. Therefore, the conclusion can be made there was no relationship between the total number of interruptions/distractions and a single variable; face-to-face, medication issues, other, equipment, noise, and pagers. Most likely cause represents a combination of many variables (including those not captured in the tool) increasing the predictability of distractions and interruptions (Appendix H).

Further data analysis using classification trees produced some interesting findings related to face-to-face, medication issues, other, equipment, noise, pagers and interruptions/distractions. However, the classification tree demonstrated there were no trends based on the experienced nurses (R-squared 70%). No one variable appeared to account more for interruptions and distractions (Appendix I). Furthermore, when reviewing specific groups of nurses, higher average number of interruptions could be identified. Unfortunately there was no explanation as to why specific nurses had more or fewer interruptions/distractions. The classification tree indicated the highest average interruptions were explained by three factors: First, when the *number of patients* on the floor was  $>20$  the average number of interruptions were 14 ( $n = 3$ ); second, *specific dates*

of data collection accounted for 14.33 interruptions ( $n = 3$ ); and finally, when *number of years* in nursing exceeded 20 years, interruptions were 11.2 ( $n = 5$ ).

The variables that accounted for the fewest number of interruptions related to *specific nurses* with the average of 4.42 ( $n = 19$ ) interruptions and the measured variable of *other* events (listed as “unusual events”) during the shift  $> 0.5$  with an average of 2 interruptions ( $n = 2$ ). Those nurses who experienced more “other” events during medication administration (e.g. sterile techniques in the patient room, isolation dress was required, or an emergency situation) actually had less interruptions and distractions. This is inconsistent with logical assumption that more unanticipated events would increase the number of distractions and interruptions. In conclusion, the classification tree points towards the possibility that randomness was the primary reason for variability between interruptions/distractions as they related to individual nurses.

Since the initial analysis did not reveal significant results related to interruptions/distractions, medication administration time was analyzed. A regression analysis was helpful in identifying variables which may effect medication administration time. As mentioned in the most common phase for medication error was during the administration phase (Pham et al. 2011; United States Pharmacopeia, 2000). Additionally, the more interruptions and distractions a nurse experiences the longer it takes to administer medications (Conrad et al. 2009; Kreckler et al.,2008; Palese et al. 2009; Spencer et al., 2004; Tang et al., 2007; Taxis et al., 1992). Therefore, looking at medication administration time was an indirect way to identify possible factors that impact interruptions and distractions.

The Analysis of Variance (ANOVA) identified several models which helped explain the time it took to complete medication administration. To further strengthen the analysis five outliers were removed. The normality of residuals for the ANOVA was sufficient to assume the residuals are normally distributed which is needed in order to use ANOVA and regression analysis Figure 8.

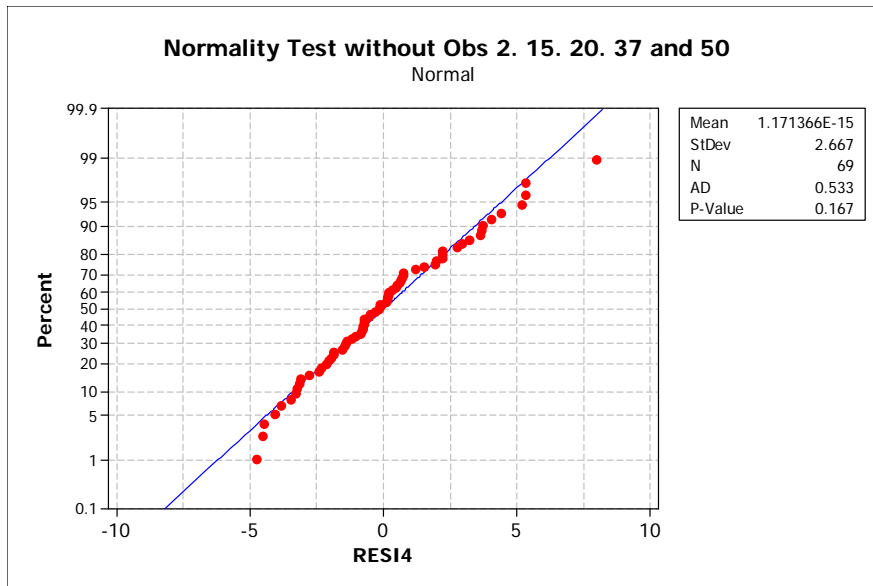


Figure 8. ANOVA Normality Distribution

The average time for medication administration was 10.53 minutes. The best model identified through the analysis identified six variables which could explain 73.197% of the variability for the time it took to administer medications (adjusted R-Squared of 70.60%). These variables were; face to face interactions, calls/pager, medication issues, equipment, other, and the RN's years in nursing. Using a significance value of 0.05, in 95% of the cases equipment added (1.27-3.26 minutes). The second highest indicator was medication issues (1.08-2.65 minutes), followed by calls/pagers (1.00-2.14 minutes), face

to face interaction (0.6-1.57 minutes), and other (0.5-1.75 minutes). Interestingly, there was inverse variability between years and nursing and medication administration time (-0.15-0.04 minutes). The more experienced a nurse, the less time it took to administer medications. Table 2 below contains the regression model which can be used to predict completion of medication administration. It also contains a table with the 95% confidence intervals of the coefficients.

Table 2- *Regression Model*

<b>Variable</b>	<b>Definition</b>	<b>Regression Coefficient</b>	<b>95% Confidence Interval</b>
Y	Time to complete medication administration (min.)	-	-
X <sub>1</sub>	Number of face to face interactions	1.09356	( 0.60886, 1.57826)
X <sub>2</sub>	Number of calls/pager interruptions	1.57439	( 1.00060, 2.14819)
X <sub>3</sub>	Number of medication issues	1.87225	( 1.08682, 2.65769)
X <sub>4</sub>	Number of equipment issues	2.26770	( 1.27416, 3.26123)
X <sub>5</sub>	Number of other issues/interruptions	1.16290	( 0.57564, 1.75017)
X <sub>6</sub>	RN's years in nursing	-0.10222	(-0.15732, -0.04712)

*Notes*  $Y = 2.884 + 1.094 X_1 + 1.574 X_2 + 1.872 X_3 + 2.268 X_4 + 1.163 X_5 - 0.102219 X_6$

### Summary

The nurse most often administers medication, therefore exploring the literature related to interruptions and distractions of nurses is the most obvious choice to improve

safety. Medication errors are happening due to interruptions and distractions causing strain and fragmentation on the nurse's train-of-thought or concentration. A nurse can expect interruptions to increase his/her risk for medication error and to take up a significant amount of time during the workday. Medication error is the most common type of error affecting patient safety. Medication error also is the most common preventable cause of adverse events for patients (IOM, 2006). Medication errors are on the rise with a 500% increase from previous decades (Scott, 2002). The most important reason medication errors occur is because of system failures. Implementing a standardized protocol as mentioned above will help reduce some of these potential errors that may occur. In conclusion improving the nurse's capability to concentrate will be a significant intervention to address the problem of medication errors at the facility and improve overall patient safety and satisfaction.

## CHAPTER FIVE

## PROJECT OUTCOMES/RECOMMENDATIONS

Overview of Entire Study

Medication errors are on the rise with a 500% increase from previous decades (Scott, 2002). The error rate is in part due to increased complexity of technology as well as higher expectations on nurses. It is estimated 44,000-98,000 deaths occur in hospitals each year from preventable errors with medication errors being the most common. The end result is a \$17-\$29 billion dollar cost to the health care system yearly. Of these costs \$1.56-\$5.6 billion is attributable directly to medication error (IOM, 2006). These medical errors are not only costly, but they also decrease the public's trust in the health care system and diminish satisfaction for both patients and health care professionals. Further investigation into medication error revealed the issue is rarely due to individual error or recklessness; rather, medication error is usually a result of a faulty system, process, and conditions that are related to human error. This fact remained true when reviewing the medication error rate and etiology at the facility where data was collected. After reviewing the data, a variety of possible etiology leading to distractions and interruptions were found, the overall underlying theme was a problem related to neurocognition (Ebright et al. 2003; Palese et al. 2009; Taxis & Barber, 2003). This means a distraction or interruption occurred, delaying the administration process or distracting the nurse from the approved medication administration procedure. Neurocognitive inhibition has been the independent observation of the investigator as

well as other nurses on the unit. Once called away from medication administration, an error is more likely to occur. The purpose of this project was to identify interruption trends during medication administration among nursing personnel on one medical-surgical unit in a hospital in Montana. The long term goal of the project was to identify the need for specific interventions to improve medication administration safety.

The PDSA cycle, a component of the Dartmouth Framework which guided this project was utilized to identify the process of medication administration and break down the components influencing this process. Once the influence of interruptions and distractions was further understood, a policy change can be recommended for future implementation. In the future, further evaluation of recommended changes should be analyzed to realize the outcome benefits and implement further system modification. In keeping with this framework, the planning stage of the PDSA cycle was assessed in this project. This included gathering data on the current situation and past history. In the future, the next step in the PDSA is the “do” stage. This stage will experiment with implementation of a recommended policy change or intervention. This phase focuses on ensuring that the new practice is standardized and done consistently. The ultimate goal utilizing the framework would be to adopt the policy improvements if found they meet a global aim or final outcome.

Data collection took place on a 26 bed medical surgical unit, which has an average daily census of 13 patients, an average length of stay of 3.7 days. The average daily census is 52.26% of the possible bed rate; the patient population was primarily trauma and post-surgical patients (S. Hoogana, personal communication, October 2,

2012). Data was collected during high volume times over a period of eight different time frames. Information related to type of distraction, cause, and timing during the administration process was recorded. Seventy-four medication administrations were observed in twenty-two different nurses. Findings revealed no one variable was responsible for distractions or interruptions. However, the variables of face to face interactions, calls/pager, medication issues, equipment, other, and the RN's years each helped explain the time it took to complete medication administration. Since the more interruptions and distractions a nurse experiences the more likely he/she is to experience a medication error, these findings are helpful in creating interventions aimed at decreasing the number of interruptions and distractions thus improving patient safety (Conrad et al. 2009; Kreckler et al.,2008; Palese et al. 2009).

#### Critique of the Data: Strengths, Limitations, Changes for the Future

The data collection tool (Appendix G) had to be augmented prior to data collection in order to make it more efficient and to decrease duplicate data recording. The original two tools utilized to collect data were combined into one with the permission of the tool authors. A large amount of data was easily gathered related to the type of distraction/interruption as well as when the distraction/interruption occurred during the medication administration process. This specific information was helpful in identifying frequency and cause of when distractions/interruptions were most common. Additionally, demographic information regarding the nurse such as years on the unit, patient ratios, years in nursing were also collected to identify how experience or workload may effect

distractions/interruptions. The comprehensive data set collected during this observational experience provided a vast wealth of information which assisted in determining the best and most efficient interventions to decrease distractions and interruptions.

A second strength of the data collection was the large number of observation opportunities and the diverse data collection approach. Data was collected during heavy administration times and when the patient census was high. A total of 74 medication administrations involving 22 different nurses were observed in total. Day as well as evening shift were included as well as a large variation of nursing experience. The diverse data collection methods as well as diverse nursing population observed strengthens the results of the data analysis with good representation of a cross sectional approach.

An obvious limitation of this observational project was the applicability of the results to other institutions or other units within the target institution. Data was collected at one institution on one specific unit. Therefore, the data were limited to the specific unit-based microsystem. Caution should be taken when interpreting the results in relation to other units or institutions.

An additional limitation to the data set was the interference of the observer in the interruption/distraction process. Multiple times the observer was involved in a distraction due to presence in the observational experience. Prior to starting the observation, nurses were asked to ignore or not involve the data collection investigator, however, this proved difficult to enforce. In the future it may be helpful if the person collecting data were not known to the nurses under observation. Additionally, it may be helpful if data were

collected by someone other than a nurse in order to decrease bias or professional judgment when recording data.

In the future, data related to the necessity of the interruption or distraction should be collected. Some interruptions were essential and emergent; therefore they could not be avoided. Data needs to reflect those situations that may have been unavoidable or detrimental if they had been ignored. Data then could reflect how many interruptions/distractions were modifiable vs. those that were essential.

Additionally, it would be helpful to gather data on a variety of units during other high frequency medication administration periods at other institutions. A larger more varied sample would create standardized data more applicable to a larger number of institutions.

#### Recommendation for Future Research

As mentioned, data needs to be collected regarding interruptions and distractions on a larger scale in order to improve the applicability of the observational findings to other units and facilities. A larger sample size will validate or disqualify the findings of this study. Additional data should be collected in relation to the necessity of the distraction/interruption. This would assist the administration in realistically understanding how many distractions and interruptions could be decreased as well as time and cost savings.

Similarly, following the PDSA framework data needs to be collected long term after policy implementation to identify outcomes as they relate to distractions and

interruptions. Data in regards to distractions/interruptions, necessity, time, number, and frequency should be recorded. Additionally, a more detailed cost/benefit analysis would be helpful in understanding the cost savings to the facility and patients as a whole.

Medication administration is considered a high risk activity for nurse because interruptions have a significant impact on medication error (Scott-Cawiezell et al, 2007; Biron et al., 2009). Interruptions have high “distractive power; even when their duration is short, they can divert the nurses’ attention and cause them to lose concentration while administering a drug, thus creating the risk of error” (Buchini & Quattrin, 2012, p. 328). Ebright et al. (2003) added distractions equally contributed to administration errors. Small occurrences such as having to locate supplies or a disorganized medication room are a distraction to the nurse’s focus and critical thought. The current literature suggests nurses are interrupted between 2.8-14 times per hour. These findings support the idea that nurses are constantly bombarded with patient information, patient needs, phone calls, other nurse question in an excess of up to 14 times an hour (Hedberg & Larsson, 2004; Alvarez & Coiera, 2005).

There are multiple approaches one could take to decrease medication error. These include empowerment of patients, team-building programs, and cultivation of a culture of safety. However, over time standardization holds the most significant promise by increasing the knowledge among health care providers about the neurocognitive basis for human error. This is accomplished by aggressive standardization of the health care processes to reduce error risk at all cognitive levels. For example, removing high concentrations of toxic medications from all care delivery areas or labeling similar

looking medications with different colored labels all decrease the risk of error. Even utilizing SBAR (situation, background, assessment, recommendation) to communicate patient status or creating a checklist for routine processes eliminate the neurocognitive human error rates. Prior to creating an intervention to decrease error, the CNL must first have a good assessment of the neurocognitive basis for error. This includes understanding different task types through risk assessment strategies (Andersson, 2012).

Multiple interventions to reduce distractions and interruptions can be implemented on the nursing unit to improve nursing neurocognitive focus. Creating a no-distraction zone and eliminating multitasking reduce skill-based mistakes. A standardized checklists and handoff tool can assist in reducing error. All these interventions must be framed in understanding of risks associated with different types of cognitive levels related to work flow on a particular unit. This includes understanding why even non-clinical activities or support services can heighten or decrease risk for error, for instance inventory management and clerical support (Andersson, 2012).

A commonly investigated intervention to decrease medication error is creating a “Safety Zone” within the medication administration area. This is accomplished by cutting out unnecessary distractions and interruptions, thus decreasing the likelihood of an error. Multiple studies have demonstrated the effectiveness of this intervention. Anthony et al, (2010) studied a no interruption zone by placing red cut tape around all areas where medication was prepared. While inside this zone, nurses could not be distracted with outside information such as telephone calls, questions, or even non-urgent

patient needs. This study found all self-interruptions could be eliminated and a 40.9% decrease in interruptions from outside sources.

As mentioned in the literature review there are a vast number of contributing factors to medication administration errors; workload, environment, policy, knowledge deficit, systems, communications, distractions/interruptions. Data findings from this project support the notion there are significant interruptions and distractions occurring on the nursing unit. Therefore, addressing the interruptions and distractions would be useful in improving patient safety. Safety and standard of care are the two primary recommendations to address as a result of the data collected. Safety can be improved by (a) decreasing the time it takes to administer medication and (b) utilizing safer techniques while administering medication which will decrease errors as well as potential long term sequelae.

In the early part of this century the “sterile cockpit” principle used by pilots to conduct safety checks prior, during, and after flight took notice in the health care field. The principle of the “sterile cockpit” required no flight crew to engage in any activity during ground operations, taxi, takeoff and landing. The intent was to decrease any interference or distraction from the task at hand (Federal Aviation Administration, 1981). In early 2003, Pape first introduced this protocol into the health care field with the intent to decrease medication errors. The multi-faceted protocol included a focused medication protocol, staff education, and vests identifying the activity as well as signs to act as reminders to those in the surrounding environment. Part of the protocol was asking staff to assist in diverting non-emergent needs from the nurse until administration was

completed. This included answering and intercepting patient needs in order to decrease the administering nurse distractions or interruptions. The bright colored vests and signs used by the nurses read “do not disturb” to alert those around the nurse of his/her activity. Additionally, the inclusion of a protocol checklist resulted in a decrease of distractions and interruptions by 87%. These findings have been replicated several times since Pape et al. (2003), first introduced the protocol.

Data from this project indicated several factors that contributed to medication administration time (equipment, medication issues, calls/pagers, face to face interaction and other distractions). Since time, interruptions/distractions, and medication errors are correlated, addressing these factors could ultimately improve administration time and patient safety. A similar protocol could be proposed for the nurses and staff on the hospital unit in order to decrease distractions and interruptions. Nurses who are administering medications would wear red “safety vests” which state “do not disturb” on them, this will identify the nurse as in the process of giving medications. Additionally, nurses could be educated about the importance of a distraction/interruption free administration process. Emphasis will be placed on safety and accuracy during the short 30 minute in service education. Signage will be utilized throughout the medication administration station, to alert other hospital workers and staff to the medication administration process. Signage will state “red vest” do not disturb medication rounds in process” or “shhh, medications rounds in process.” Additionally, nurses will be required to turn off their vocera voice operated speakers to decrease interruptions. The vocera is used to alert nurses to phone calls, patient needs, and admissions. It is a communication

device used by all staff and providers. This device would be in the off position during the administration process. Finally, nurses will have a detailed medication administration checklist to follow each time they administer medications. This checklist will be placed in each administration station and will need to be followed for every administration.

### Outcome Implications: Community and Hospital

Decreasing interruptions and distractions have many implications for the specific department, individual personnel, the facility as a whole, and community at large. Primarily, when decreasing interruptions/distractions, there is expected to be a decrease in medication errors. Research supports the fact that interruptions and distractions lead to higher rates of medication errors. By decreasing the interruptions and distractions experience by nurses, there is expected to be up to 50% decrease in medication errors on the unit (Conrad et al. 2009).

Decreasing medication errors is significant to the facility and community because “a patient centered approach to safe medication administration depends on the thoughtful use of the best available evidence, honest communication, and shared decision making with clinicians” (Hughes & Oritz, 2005 p.21). The protocol may help the organization fine tune their culture of safety already in place. It will encourage stakeholders to at least think about ways to create a safer medication administration practice during their phase of care. Additionally, it will allow patients more shared communication in their plan of care since nurses will have more time to care for their patients.

Decreasing interruptions and distractions is expected to result in decreasing the time it takes to administer medications. Research has shown a decrease by approximately

30% in the time it takes to pass medications once distractions and interruptions are decreased (Conrad et al., 2009). On the unit of concern, nurses spend approximately 167 minutes of a 12 hour shift administering medications which is approximately \$73.35 of the nurse's salary for a 12 hour shift (S. Hoogana, personal communication, March, 25, 2013). This time could be cut by 30% which is \$22.00 of nursing salary saved per shift as well as approximately 50 minutes of time. Yearly this is a savings of \$3,400 and 130 hours of time per nurse. Increased time allowed on nursing duties could lead to increased satisfaction for both nursing and patient populations.

A decrease in distractions and interruptions expects to lead to significant cost savings. By implementation of the proposed protocol the literature supports a potential 40.9% decrease in distractions and interruptions (Anthony et al. 2010). This translates into 53% fewer medication errors (Conrad et al. 2009). Medication errors are costly, each error which occurs can cost \$8750 (IOM, 2006). The expected cost savings is at least \$505,000 annually to the facility as a whole (see Appendix J).

There are very few challenges to implementation of the proposed policy recommendation on the community level. Patients naturally want a safer and more inclusive health care experience. Cost may be a challenge for the community since ultimately the patients pay for the services. A cost-based analysis (Appendix J) implementing the recommended policy determined the approximate implementation on an annual basis to be \$891 in the first year with no less than \$283 annually for every year after. This is minimal costs passed on to patients and the community for the benefit of safer care.

A second possible challenge to implementation could be community “buy-in.” On a large scale the community may not understand the depth and scope of medication errors and the contribution of distractions/interruptions to this issue. It will take education to emphasize the importance of this protocol. The community will need to not only understand the statistics, but also the monetary, family, and personal cost of errors for patients, this will facilitate better acceptance of the proposed protocol.

Finally, a long term implication could be an improved hospital reputation known for quality and safety. This in turn will increase community and employee confidence. The upward ladder of improvement illustrates, improved patient safety and promotes a positive work environment which can lead to better nurse satisfaction and retention (Dunton, Boyle & Cramer, 2013). Nurse and patient satisfaction as well as community approval are long term benefits that will result from improved quality and safety (Prosavac, 2011).

### Conclusion

The purpose of this project was to identify interruption trends during medication administration among nursing personnel on one medical-surgical unit in a hospital in Montana. A review of the literature revealed significant safety concerns in relation to medication errors as a result of nursing distractions and interruptions. Observation of the medication administration process on a medical surgical unit identified some significant concerns for patient safety and potential for cost as well as time savings. These results indicate an immediate need to decrease distractions and interruptions. The ultimate goal

would be to create a standard medication administration process for enhanced efficiency and patient safety. By utilizing the “safety zone” policy as originally designed by airline pilots, significant cost savings can be realized as well as enhanced patient safety and satisfaction.

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APPENDICES

APPENDIX A

PALESE OBSERVATION RESEARCH TIMES

**Table 2**

Drug rounds: patients having medications, medications administered, interruptions and length of interruption

Time of drug round	Patients		Interruptions		Drug round		
	Having medications (media $\pm$ )	Number of medications taken (average $\pm$ )	No./drug round (average $\pm$ )	Length/drug round (media $\pm$ )	Starting time (median)	Finishing time (median)	Time taken (average $\pm$ )
08.00	10.9 $\pm$ 4.7	2.3 $\pm$ 0.61	6.50 $\pm$ 5.18	0:13:02 $\pm$ 0:05:42	0725:00	0850:30	1:20:21 $\pm$ 0:49:37
12.00	4.5 $\pm$ 1.4	1.7 $\pm$ 0.44	2.36 $\pm$ 2.24	0:04:16 $\pm$ 0:01:49	1129:00	1153:00	0:25:29 $\pm$ 0:10:18
16.00	3.8 $\pm$ 2.7	1.2 $\pm$ 0.23	7.86 $\pm$ 5.85	0:16:54 $\pm$ 0:11:25	1451:30	1542:30	0:56:55 $\pm$ 0:23:40
20.00	11.1 $\pm$ 2.8	2.5 $\pm$ 0.53	4.57 $\pm$ 2.98	0:09:00 $\pm$ 0:05:20	1851:30	1955:30	0:58:51 $\pm$ 0:19:02

Palese, A., Sartor, A., Costaperaria, G., Bresadola, V. (2009). Interruptions during nurses' drug rounds in a surgical wards: Observational study. *Journal of Nursing Management*, 17, 185-192. Retrieved June 1, 2012 from EBSCO host database

**Table 3**

Frequency, average duration and phase in which interruptions mainly occurred and the risk of error perceived by the nurses interviewed

Cause	Observed interruptions			Risk of error perceived (0 none to 10 maximum) by the nurses interviewed (n = 26)			
	Frequency (%)	Duration (average $\pm$ )	Phase in which they occurred (n; %)*	$\Sigma$ †	Average $\pm$	Median	Range
1. Obtaining medications or materials not available on the trolley	93 (31.2)	1'10" $\pm$ 53"	Preparation (41; 44.1)	131	5 $\pm$ 2.44	5	1–10
2. Management of patients' requests or problems (e.g. need to be moved, need to drink)	79 (26.5)	2'30" $\pm$ 3'	Verification (39; 49.4)	130	5 $\pm$ 2.40	4	1–10
3. Management of questions arising from other staff members (e.g. whether a patient has had a chest X-ray, blood tests, has gone to theatre, etc.)	47 (15.8)	1'12" $\pm$ 55"	Verification (22; 46.8)	146	5.6 $\pm$ 2.90	5	1–10
4. The nurse being observed doing activities other than attending to the drug round (e.g. making beds, emptying drainage bags, etc.)	26 (8.7)	3' $\pm$ 0.000	Verification (26; 100)	141	5.4 $\pm$ 3.00	6	1–10
5. Answering patients' call bells	16 (5.4)	1'02" $\pm$ 40"	Verification (10; 62.5)	180	5 $\pm$ 2.50	8	1–10
6. Answering the telephone	11 (3.7)	1'40" $\pm$ 1'30"	Verification (6; 54.5)	184	5 $\pm$ 3.10	8	0–10
7. Offering to help other staff members manage patients of another team (e.g. moving a patient)	5 (1.7)	6' $\pm$ 4'	Verification (4; 80)	139	5 $\pm$ 2.80	5	1–10
8. Documentation (e.g. writing requests for drugs out of stock)	2 (0.7)	1' $\pm$ 07"	Verification (2; 100)	119	5 $\pm$ 3.10	4	1–10
9. Management of emergencies (cardiac arrest)	1 (0.3)	40' $\pm$ 0.000	Preparation (1; 100)	182	5 $\pm$ 2.90	8	1–10
10. Other	18 (5.9)	3' $\pm$ 2'40"	Verification (12; 92.3)				

\*Phase in which it mainly occurred.

†Values were added together for each of the 26 nurses interviewed (from 0 to 10).

Palese, A., Sartor, A., Costaperaria, G., Bresadola, V. (2009). Interruptions during nurses' drug rounds in a surgical wards: Observational study. *Journal of Nursing Management*, 17, 185-192. Retrieved June 1, 2012 from EBSCO host database

APPENDIX B

INFORMED CONSENT AND COVER LETTER

November 27, 2012

Re: Distraction and Observation Data Collection

To Whom It May Concern,

Medication error is one of the most common preventable problems in the United States (U.S.) medical system today (IOM, 2006). The average hospital patient can expect to experience one or more medication errors per day. Medication administration is the most interrupted of all nursing tasks (Buchini & Quattrin, 2012), this greatly accounts for medication error (Scott-Cawiezell et al, 2007; Biron et al., 2009). In order to better understand the effects of interruption and distraction for nurses on your unit I am going to collect data of distraction and interruption information during medication administration.

Please read the attached Informed Consent form. If you agree to participate in this data collection project please sign and date the consent form. Your participation is completely voluntary, there are no consequences if you choose not to participate. Thank you for your time and energy in collecting this information. It will provide better understanding of why, when, and how interruptions and distractions occur on your floor during medication administration.

Best Regards,

Darin Wines RN, BSN

SUBJECT CONSENT FORM  
FOR  
PARTICIPATION IN HUMAN RESEARCH AT  
MONTANA STATE UNIVERSITY

Informed Consent Form for Nurses

Darin Wines BSN  
Montana State University  
College of Nursing

## B. Project Title

*Interruptions and Distractions for Nurses during Medication Administration on a Medical Surgical Unit*

## C. Introduction

You are being asked to voluntarily participate in a research study about distractions and interruptions as they pertain to medication administration.

## D. Rationale

Medication error is one of the most common preventable problems in the United States (U.S.) medical system today (IOM, 2006). The average hospital patient can expect to experience one or more medication errors per day. Medication administration is the most interrupted of all nursing tasks (Buchini & Quattrin, 2012), this greatly accounts for medication error (Scott-Cawiezell et al, 2007; Biron et al., 2009). Identification of interruptions or distractions can reduce medication administration errors. Understanding interruptions and distractions create a body of knowledge for policy for future quality improvement.

## E. Participants

You were selected to participate in this study because you are a current employee of Saint Patrick Hospital who is assigned to the five south unit. Participation is voluntary. If you agree to participate you will be asked to allow observation of your routine nursing duties surround medication administration. This includes medication identification, collection, administration and recording. Participation is voluntary and you can choose to not answer any questions you do not want to answer and/or you can stop at any time.

#### F. Procedure

Participation is voluntary. If you agree to participate you will be observed for a period of two to three hours during high medication administration times. You may be subject to one or more data collection periods. Prior to the data collection process, you will be asked some routine questions in relation to your experience, age, and education. Once data collection starts, the observer will be silent and positioned in a neutral place so as not to interfere with the medication administration process. The researcher will record data about interruptions and distractions during the process. Data will be collected starting when the nurse identifies the need for a medication through the recording process. Please note, this does include the administration phase when the nurse is providing direct patient care. Participation is voluntary and you can choose to not answer any questions you do not want to answer and/or you can stop at anytime.

#### G. Risks

There are no anticipated physical, social, or legal risks for participants in this study. Emotional distress was the only possible risk for study participants. The knowledge of feeling observed or “watched” may have increase a participant’s anxiety or stress. To accommodate for this risk, the PI will begin each observation by introducing himself and explaining the procedure of data collection and observation. Nurse questions will be answered prior to beginning the observation. Additionally, data will be collected from a neutral point of observation which will not obstructing the nurses work nor interfering with the daily routine of the unit.

#### H. Benefits

The study is of no benefit to you. If you decline to participate there will be no detrimental or punitive effects. There is no source of funding for this project nor is there any cost to participants. We encourage participants to ask questions at any time during the research process and data collection.

#### I. Decline to Participate

You may decline to participate at any time, there are no repercussions to your job or work place if you decline participation.

J. Funding

There is no source of funding for this project

K. Cost to Participate

There is no cost to the subject to participate in this study

L. Questions

You are encouraged to ask questions

M. Confidentiality

No names or identifying information will be recorded during data collection. All records will be kept in a locked file cabinet only accessible to study administrators and committee members. Records and consents will be destroyed six years after completion of the research project.

N. Injury and Compensation

In the event your participation in this research directly results in injury to you, medical treatment consisting of a physical/mental exam will be available. Further information about this treatment may be obtained by calling Darin Wines at 370-9040.

O. Contact

If you have questions about the research, please contact Darin Wines at 406-370-9040 or [nursewines@hotmail.com](mailto:nursewines@hotmail.com). Additionally, if you have questions about the rights of human subjects they can contact the Chair of the Institutional Review Board at Montana State University, Mark Quinn, (406) 994-4707 or [mquinn@montana.edu](mailto:mquinn@montana.edu).

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**Authorization Statement**

"AUTHORIZATION: I have read the above and understand the discomforts, inconvenience and risk of this study. I, \_\_\_\_\_  
(*name of subject*), agree to participate in this research. I understand that I may later refuse to participate, and that I may withdraw from the study at any time. I have received a copy of this consent form for my own records.

Signed: \_\_\_\_\_

Witness: \_\_\_\_\_ (optional)

Investigator: \_\_\_\_\_

Date: \_\_\_\_\_

(Copy for Researcher)

SUBJECT CONSENT

FOR

PARTICIPATION IN HUMAN RESEARCH AT

MONTANA STATE UNIVERSITY

Informed Consent Form for Nurses

Darin Wines BSN

Montana State University

College of Nursing

**Authorization Statement**

"AUTHORIZATION: I have read the above and understand the discomforts, inconvenience and risk of this study. I, \_\_\_\_\_  
(*name of subject*), agree to participate in this research. I understand that I may later refuse to participate, and that I may withdraw from the study at any time. I have received a copy of this consent form for my own records.

Signed: \_\_\_\_\_

Witness: \_\_\_\_\_  
(optional)

Investigator: \_\_\_\_\_

Date: \_\_\_\_\_

(Copy for Participant)

APPENDIX C

KOSTIS AND JONES EMERGENCY ROOM STUDY TOOL

ED RN Interruptions Observation Tool	Interruption	KEY		Task	KEY	
		<i>Interruption Type:</i>	<b>Code</b>		<i>Task Interrupted:</i>	<i>Code</i>
		Communication	C		Communication	C
ID #		Overhead page	OP		patient report	PR
Date:		Phone	PH		patient interview	PI
Start Time:		Equipment Alarms	A		case discussion	CD
		Face-to-face	FF		telephone conversation	TC
End Time:		Family	FA		Assessment	A
		Patient	PT		physical assessment	PAS
Comments		Nurse	RN		vital signs	VS
		Patient Care Technician	PCT		data analysis	DA
		Physician	MD		Other	O
		Secretary/Registrar	BA		Intervention	I
		Other	O		Medication preparation	MEDP
		Self	S		Medication retrieval	MEDR
					Medication order review	MEDOR
					Medication administration	MEDA
					IV insertion	IV
					Blood draw	BA
					Patient education	E
					Other	O
					Documentation	D
					medical record	MR
					computer	COMP
					medication administration	MAR
					other	

Kosits, L., Jones, K. (2011). Interruptions experienced by registered nurses working in the emergency department. *Journal of Emergency Nursing*, 37 (1), 3-7.

APPENDIX D

MADOS DATA COLLECTION TOOL

Figure 3.  
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 Medication Time _____	Number of Distractions									
	Physician	Other personnel	Phone call	Other patient	Visitor	Missing medication	Wrong dose medication	Emergency situation	Conversation	External noises
Start Time _____										
Stop Time _____										
Elapsed Time _____										

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.

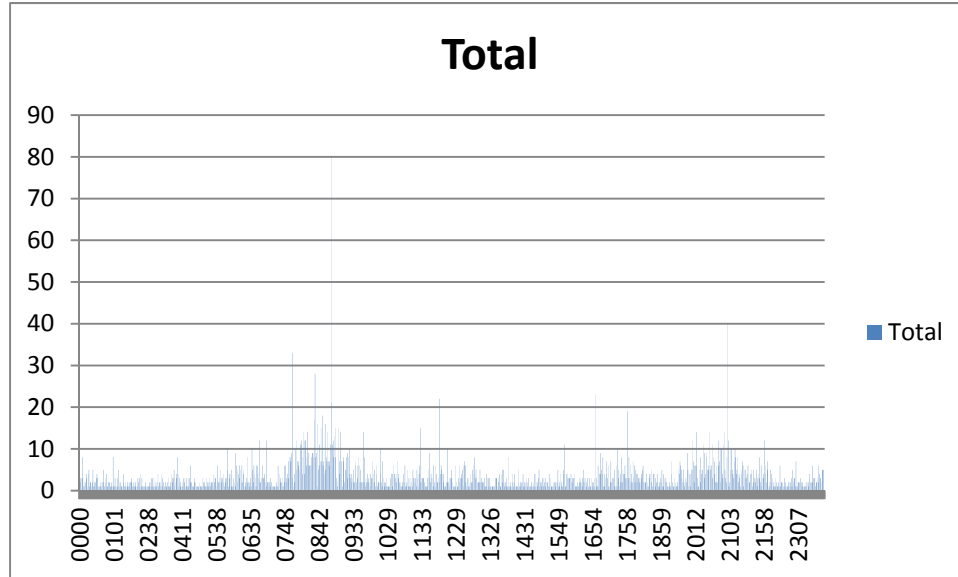
<b>Physician</b>	Physician or other medical provider (NP or PA) distracts or interrupts the nurse administering medications.
<b>Other personnel</b>	Other personnel distract or interrupt the nurse administering medications.
<b>Phone call</b>	The nurse administering medications is interrupted by a phone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

Pape, T. (2003). Applying airline safety practices to medication administration. *Medsurg Nursing*, 12, 77-93

APPENDIX E

THIRTY DAY ACCUMULATION MEDICATION  
ADMINISTRATION TIMES ON FIVE SOUTH

### 30 Day Accumulation Medication Administration Times Five South



APPENDIX F

DATA COLLECTION SCHEDULE

## Data Collection Schedule

	0730-0930	2000-2200
Monday	X	X
Tuesday	X	X
Wednesday	X	
Monday	X	
Tuesday		X
Wednesday		X

APPENDIX G

DARIN WINES DATA COLLECTION TOOL



APPENDIX H

CORRELATION MATRIX

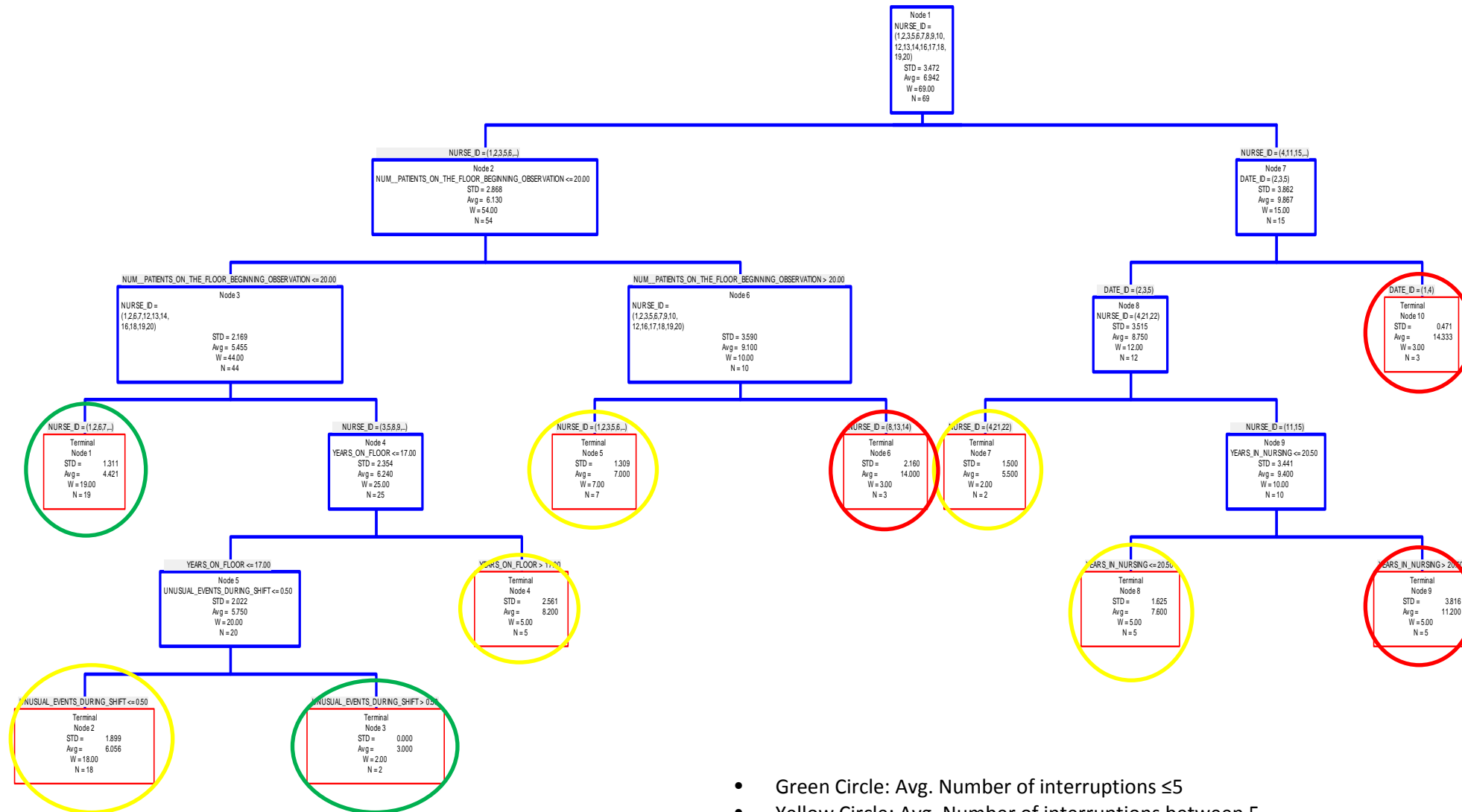
	Nurse ID	Years in Nursing	Years on floor	Num. patients as	Num. nurse on th	Staffing ratio	Num. patients on	Unusual events	Face to face:	Calls/Pager	Medication Issue	Noise	Equipment	Other	Total Num Interruptions	Time Elapsed
Nurse ID	1	0.08386	0.12373	0.08306	0.46267	0.06404	0.52688	-0.1322	0.04402	0.10186	0.16281	0.12071	-0.05915	0.29375	0.22151	0.12479
Years in Nursing	0.08386	1	0.85755	-0.05882	0.0598	-0.09779	0.01008	-0.02175	0.08149	0.28255	0.15748	0.09572	-0.12103	-0.05651	0.15859	-0.1266
Years on floor	0.12373	0.85755	1	-0.12176	0.13901	-0.15381	0.06078	-0.10372	0.15373	0.34699	0.22712	0.10507	-0.13794	-0.0135	0.24414	-0.02243
Num. patients as	0.08306	-0.05882	-0.12176	1	0.28123	0.84079	0.43023	0.12202	-0.06234	0.21356	0.16903	-0.07959	-0.31902	-0.055	-0.00962	-0.05702
Num. nurse on th	0.46267	0.0598	0.13901	0.28123	1	0.30595	0.89571	0.05186	0.11688	0.22381	0.11525	0.27036	-0.13557	0.29582	0.30917	0.08365
Staffing ratio	0.06404	-0.09779	-0.15381	0.84079	0.30595	1	0.47167	0.25408	-0.09707	0.08535	0.13056	-0.12817	-0.33134	-0.0593	-0.09727	-0.15874
Num. patients on	0.52688	0.01008	0.06078	0.43023	0.89571	0.47167	1	0.01951	0.09913	0.24641	0.24018	0.14382	-0.19572	0.31729	0.30371	0.17966
Unusual events	-0.1322	-0.02175	-0.10372	0.12202	0.05186	0.25408	0.01951	1	-0.19553	-0.18255	-0.09917	-0.08533	-0.03735	0.04203	-0.18854	-0.22757
Face to face:	0.04402	0.08149	0.15373	-0.06234	0.11688	-0.09707	0.09913	-0.19553	1	0.1888	0.15104	0.05185	-0.06966	0.1404	0.57084	0.42654
Calls/Pager	0.10186	0.28255	0.34699	0.21356	0.22381	0.08535	0.24641	-0.18255	0.1888	1	0.12007	0.4025	-0.06039	0.04635	0.58195	0.40179
Medication Issue	0.16281	0.15748	0.22712	0.16903	0.11525	0.13056	0.24018	-0.09917	0.15104	0.12007	1	0.05851	0.09954	0.27563	0.50136	0.49333
Noise	0.12071	0.09572	0.10507	-0.07959	0.27036	-0.12817	0.14382	-0.08533	0.05185	0.4025	0.05851	1	0.24508	0.2219	0.58102	0.37068
Equipment	-0.05915	-0.12103	-0.13794	-0.31902	-0.13557	-0.33134	-0.19572	-0.03735	-0.06966	-0.06039	0.09954	0.24508	1	0.14802	0.29449	0.36901

Other	0.29375	-0.05651	-0.0135	-0.055	0.29582	-0.0593	0.31729	0.04203	0.1404	0.04635	0.27563	0.2219	0.14802	1	0.58738	0.4897
Total Num Interruptions	0.22151	0.15859	0.24414	-0.00962	0.30917	-0.09727	0.30371	-0.18854	0.57084	0.58195	0.50136	0.58102	0.29449	0.58738	1	0.79686
Time Elapsed	0.12479	-0.1266	-0.02243	-0.05702	0.08365	-0.15874	0.17966	-0.22757	0.42654	0.40179	0.49333	0.37068	0.36901	0.4897	0.79686	1

APPENDIX I

CLASSIFICATION TREE

# Classification Tree for Total Number of Interruptions



- Green Circle: Avg. Number of interruptions ≤ 5
- Yellow Circle: Avg. Number of interruptions between 5 and 10
- Red Circle: Avg. Number of interruptions > 10

APPENDIX J

COST BENEFIT

<b>Cost Benefit Analysis Summary</b>
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	Year 0	Year 1	Year 2	Year 3
<b>Implementation Costs</b>				
1) Red Vests	320	80	80	80
2) Detailed Medication Checklist	39		39	
3) Education of Staff and Nurses	434	66	66	66
4) Signage	98	-	98	-
<b>Total Implementation Costs</b>	<b>891</b>	<b>146</b>	<b>283</b>	<b>146</b>
<b>Operating Expense Savings</b>				
Money Saved from Lost Time Spent Dispensing				
1) (savings per year)	80,300	80,300	80,300	80,300
Patient injury and additional hospitalization				
2) (yearly savings)	210,000	210,000	210,000	210,000
3) Legal Fees (savings)	216,000	216,000	216,000	216,000
<b>Total Opex Savings</b>	<b>506,300</b>	<b>506,300</b>	<b>506,300</b>	<b>506,300</b>
<b>Total Net Benefit</b>	<b>\$ 505,410</b>	<b>\$ 506,154</b>	<b>\$ 506,017</b>	<b>\$ 506,154</b>

Internal Rate            20%  
Net Present Value    \$1,571,518