

## Applying Airline Safety Practices to Medication Administration

Theresa (Tess) M. Pape

*Medication administration errors (MAE) continue as major problems for health care institutions, nurses, and patients. However, MAEs are often the result of system failures leading to patient injury, increased hospital costs, and blaming. Costs include those related to increased hospital length of stay and legal expenses. Contributing factors include distractions, lack of focus, poor communication, and failure to follow standard protocols during medication administration.*

Limited research exists addressing human factors and work redesign to reduce medication errors. Most available studies identify causes and possible resolutions to medication errors, but few have provided practical interventions. Standard protocols for medication administration have been taught for years. However, health care organizations and nurses continue to use trial and error approaches rather than recommended or researched practices.

Evidence-based practice (EBP) uses the most current evidence-based research outcomes to establish policies and procedures for everyone to follow. The use of best practices for multiple clinical situations has recently become an important issue; however, medication administration processes have been virtually ignored in the search for EBP. In addition, the entire domain of patient safety in terms of EBP has been overlooked. This research study helped resolve that problem by providing significant evidence of safe medication administration practices. This new knowledge provides nurses and health care organizations with the evidence to establish EBP guidelines and standard operating pro-

cedures for medication administration, which can ultimately reduce medication administration errors (MAEs).

The key to prevention lies within other industry standards, in which safety measures have shown decreases in errors. One such industry is the airline industry with efforts in place that improve pilots' focus when preparing to fly a plane. For example, pilots are not allowed to engage in conversation unrelated to the flight checklist (sterile cockpit situation) when the plane is below 10,000 feet. This allows for increased focus during critical periods and reduces crashes (Cohen, 1999). Medication administration should be considered as critical as piloting a plane, because patients place their lives in the hands of health care professionals.

This study was conducted to measure the effect of two targeted interventions based on airline industry safety measures for decreasing nurses' distractions during medication administration. The study involved three groups of nurses, with those in the control group using customary medication administration procedures. Nurses in the second group used a

---

Theresa (Tess) M. Pape, PhD, RN, CNOR, is an Assistant Professor, Department of Acute Nursing Care, University of Texas Health Science Center, San Antonio, TX.

**Note:** The author received a 2002 MEDSURG Nursing Writer's Award for this article in the "Best Practice" Category.

focused protocol, and the third group used the Medsafe® protocol. Significant reductions in distractions were found with both the focused protocol and the Medsafe protocol, with the largest mean difference between the control and the Medsafe group.

## Background

MAEs remain third in the list of causes of sentinel events leading to patient death or loss of function. Most MAEs occur in general hospitals as opposed to behavioral hospitals, outpatient facilities, long-term care facilities, or home care settings (Joint Commission on Accreditation of Healthcare Organizations [JCAHO], 2002). The term "sentinel event" is used because it sounds a warning that something needs to be done to prevent future similar incidents. The new criteria for determining whether a medication error is considered sentinel include patient death, paralysis, or coma associated with a medication. Any "near miss" medication error is now considered nonreportable (JCAHO, 2001). An estimated 10 to 20 sentinel events occur in every U.S. hospital annually (Kobs, 1999). Nevertheless, complex systems rather than humans are frequently the source of MAEs in health care settings. Medication administration involves a complex set of steps in achieving the desired goal of getting the medication to the patient in a timely manner. A multitude of contributing factors often lead to medication errors as nurses encounter constraints within the system, work design problems, and human and environmental factors.

Recently the Agency for Healthcare Research and Quality (AHRQ) and the Institute of Medicine (IOM) recommended using teamwork, decision support, and checklists borrowed from the aviation industry to improve medication safety (AHRQ,

2001; IOM, 2001). There is a need to simplify systems, use standard protocols, improve communication and teamwork, and build in redundancy to defend against system errors. Also, basic psychological limitations should be considered for those involved in the task (IOM, 2000). These include a person's ability to focus in the face of distractions, conversation, and noise while trying to administer medications efficiently and safely.

According to the IOM (2000), preventable events resulting from medical errors cause nearly 100,000 deaths in hospitals annually, with almost 2% of these being medication related. This finding translates to 2,000 medication-related deaths annually. Regardless of the reported number, medication error reduction is critical to patient safety and the viability of the health care industry. An increased interest in identifying and implementing MAE safety measures has followed the IOM's 1999 report. However, more needs to be done to improve medication safety.

## Medication Errors

Medication administration errors occur when there is a breach of one of the seven rights of medication use: right patient, right drug, right dose, right time, right route, right reason, and right documentation. MAEs often result in patient injury, increased hospital costs, and nurses being blamed for the incident.

Based on a 1999 study involving 56 hospitals, most medication errors occur at the point of administration (United States Pharmacopeia [USP], 2000). Furthermore, as much as 1.6% to 38% of all medications administered are in error, excluding about 25% of those that are not reported (Osborne, Blais, & Hayes, 1999). With millions of doses of medications administered in the United States annually, error rates as small as 0.1% would produce error

totals that exceed other industries. An equivalent in other industries would include two plane crashes at a major airport per day, and 16,000 pieces of mail lost per hour (Beardsley & Woods, 1999). These staggering numbers cause great concern for organizations struggling to remain viable in today's health care market.

## System Issues

Medication administration is an example of a complex system involving several phases and steps. When such elaborate systems are faulty, the potential for multiple errors accumulate over time and finally result in a major accident. Even with systems of verification in place, most medication administration processes are convoluted and error prone. System failures include both design failures and environmental failures. High noise levels, interruptions, difficult-to-read equipment displays, illegible dosage labels, and similar shapes, colors, and sizes of bottles are all system failures in the hospital work environment (Moray, 1994). Medication administration, in fact, involves countless environmental elements continually interacting with one another.

## Design Failures

Design failures involve problems with processes, tasks, or equipment. In the past nurses were more identifiable due to the presence of nurses' caps and distinctive white uniforms. The assigning of only one or two medication nurses reduced the problems with distractions from other personnel. Other staff simply left the medication nurses alone to perform their job.

Many hospitals today use the modified case method in which several nurses have responsibility for and deliver medications to a group of assigned patients. Consequently, it is often challenging to



identify whether nurses are administering medications or performing other duties. Because of similar uniforms and small print on name tags, it is also difficult to determine which employees are nurses. When people are unaware of when a nurse is administering medications, they are likely to interrupt to obtain answers for trivial information and cause the nurse to lose focus during medication administration.

**Organizational culture.** Culture is a set of norms, attitudes, and values inherent within the organization defined by the importance placed on the work done. The hospital's organizational culture shapes the work, the change process, and the impact of external forces (Harrison & Shirom, 1999) or value for safety. The beliefs and standards of employees merge with those of managers to produce the norms and standards of the organization's culture. The hospital's culture also affects how nurses respond to problems (Wakefield, Wakefield, Uden-Holman, & Blegen, 1996; Wakefield, Wakefield, Uden-Holman, Blegen, & Vaughn, 1999a; Wakefield, Wakefield, & Uden-Holman, 2000).

If managers are not perceived as concerned about safety, employees will follow with the same attitude. Further, if employees do not trust management, they will reject any new safety initiatives. When new employees are hired, someone who exemplifies the safety culture should mentor them (Helmreich & Merritt, 1998). If the organization hierarchy values safety and researched practices, employees will adopt the same beliefs. Ultimately organizational culture either supports or detracts from organizational effectiveness.

**Teamwork.** Teamwork may also be important in assisting nurses to avoid distractions during medication administration.

Team structures often lose cohesiveness as social pressures cause them to dissolve into informal groups. Likewise, when a conscientious authority structure is lacking, the team functions ineffectively. Even if someone in the team remains effective, social pressures by other team members can eventually cause behavior conformity (Moray, 1994).

The airplane cockpit demonstrates one example of the importance of teamwork, with clear lines of authority and effective communication. Airline research indicates that errors occurred most often because of failures in teamwork and coordination. Intricate work such as that involved in health care also requires teamwork. Thus, following the example of the aviation industry by teaching harmonious teamwork can improve patient safety. Pilots follow standard operating procedures and checklists, which direct appropriate actions. However, when deviations in flight occur, team members coordinate efforts with the captain and the airplane's computer to return the plane to safety. Health care often exhibits the "captain of the ship" culture, especially in the operating room. Surgeons sometimes invoke their authority over anesthesiologists and nurses when situations become tense. Conversely, the health care industry is beginning to realize the importance of team training to prevent errors (Helmreich & Merritt, 1998).

**Standard operating procedures/protocols.** The five rights of medication administration have now evolved into the seven rights: right drug, right patient, right dose, right time, right route, right reason, and right documentation. These standard elements of medication administration include knowledge of the medication's use, usual dosage and route, actions, side effects, drug and

food interactions, and contraindications (Pape, 2001).

The standard procedure or evidence-based practice for medication administration taught to nursing students begins with obtaining the medication administration record (MAR) and verifying the order for accuracy. Once the medication is obtained, the container label is compared to the MAR. The label is then rechecked while preparing the medication, and verified one last time when replacing the drug container. After checking the patient's identification bracelet and asking the patient to state his/her name, the nurse then administers the medications. Simultaneously the drug's purpose and pertinent side effects are explained to the patient. The dosage, time, and nurse's signature are documented. Finally, the patient is evaluated after 30 minutes for any effects of the medication (Kozier, Erb, Berman, & Burke, 2000). When a nurse is in a hurry or is distracted, deviation from these previously learned procedures for medication administration may occur, and increased medication errors result. Other contributing factors often lead to medication errors as the nurse encounters constraints within the system, work design problems, and human and environmental factors.

### Environmental Failures

Another problem nurses encounter today is high traffic and congestion on many nursing units, which adds to distractions and confusion about roles and identities. Situations that increase distractions and prevent focus contribute to medication errors. The inability to concentrate on the medication administration process and feeling rushed during medication administration can easily lead to errors (Wolf, 2001). A lack of available nursing staff can cause additional chaos and distractions as nurses

attempt to complete multiple tasks.

**Distractions.** For this study, a distraction was defined as any action that draws away, diverts, or disturbs the mind or attention from achieving the medication administration goal. Distractions can take many forms including preoccupations, conversation, noise, interruptions, other peoples' increased activity, and shift changes.

Interruptions as distractions while preparing medication are a primary environmental factor contributing to medication errors (American Nurses Association, 1998). Studies show that most MAEs are the result of distractions, overwork, inexperience, communication gaps, performance deficits (lack of focus), and failure to follow protocols during medication administration (Gladstone, 1995; USP, 2000; Walters, 1992). Inevitably, an investigation that focuses only on system design problems, to the exclusion of human factors, would be meaningless.

**Human factors.** Safety occurs on a continuum from increased to decreased likelihood of error, with many errors resulting when human performance limits have been exceeded (Helmreich & Merritt, 1998). Limits on human cognition affect the ability to be consistently accurate. Precise motor skills involve primary and working memory, attention, focus and concentration, and the connections that must be made (Moray, 1994). The capacity to maintain attention in the presence of excessive stimulation (distractions) is almost impossible. This deficit may be explained by the human tendency for the attention from a task, contained by one side of the brain, to be depleted by an environmental stimulus (Driscoll, 1994).

### Active Failures

Other problems that con-

tribute to errors include active failures (personal mistakes, slips, and lapses of memory) which affect the system for a short time. An example of active failures includes functioning in the "automatic mode," which requires less thinking and is common for experienced nurses. However, MAEs occurring as distractions cause the automatic thought process to be lost or interrupted, and an incorrect choice made. This action is like going to another room to get something and forgetting the purpose of the trip (Cohen, 1999).

Slips and lapses result from a deviation from the plan, whereas mistakes result from the wrong plan. Slips and lapses precede the detection of a problem and are associated with monitoring failures.

Mistakes occur because of applying a bad rule or misapplying a good rule (Reason, 1990). For example, the observer who receives an ambiguous signal such as an alarm may decide that the alarm pattern matches a familiar sound, and may make a wrong choice by ignoring a true alarm, thinking it was false (Moray, 1994). Mistakes also happen when the person is not equipped to handle unexpected changes (Reason, 1990). For instance, the ambiguous sounding alarm may be totally foreign to the person. The nurse may thus try to silence a true alarm or take other inappropriate actions.

On the other hand, a more experienced nurse may know the character and timing of the change and the corresponding response to it but fail to plan an alternate choice (Reason, 1990). For example, the charge nurse may have allowed too many personnel to go to lunch. When the ambiguous alarm sounds while the nurse is busy with another task, he/she fails to act.

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

### Latent Failures

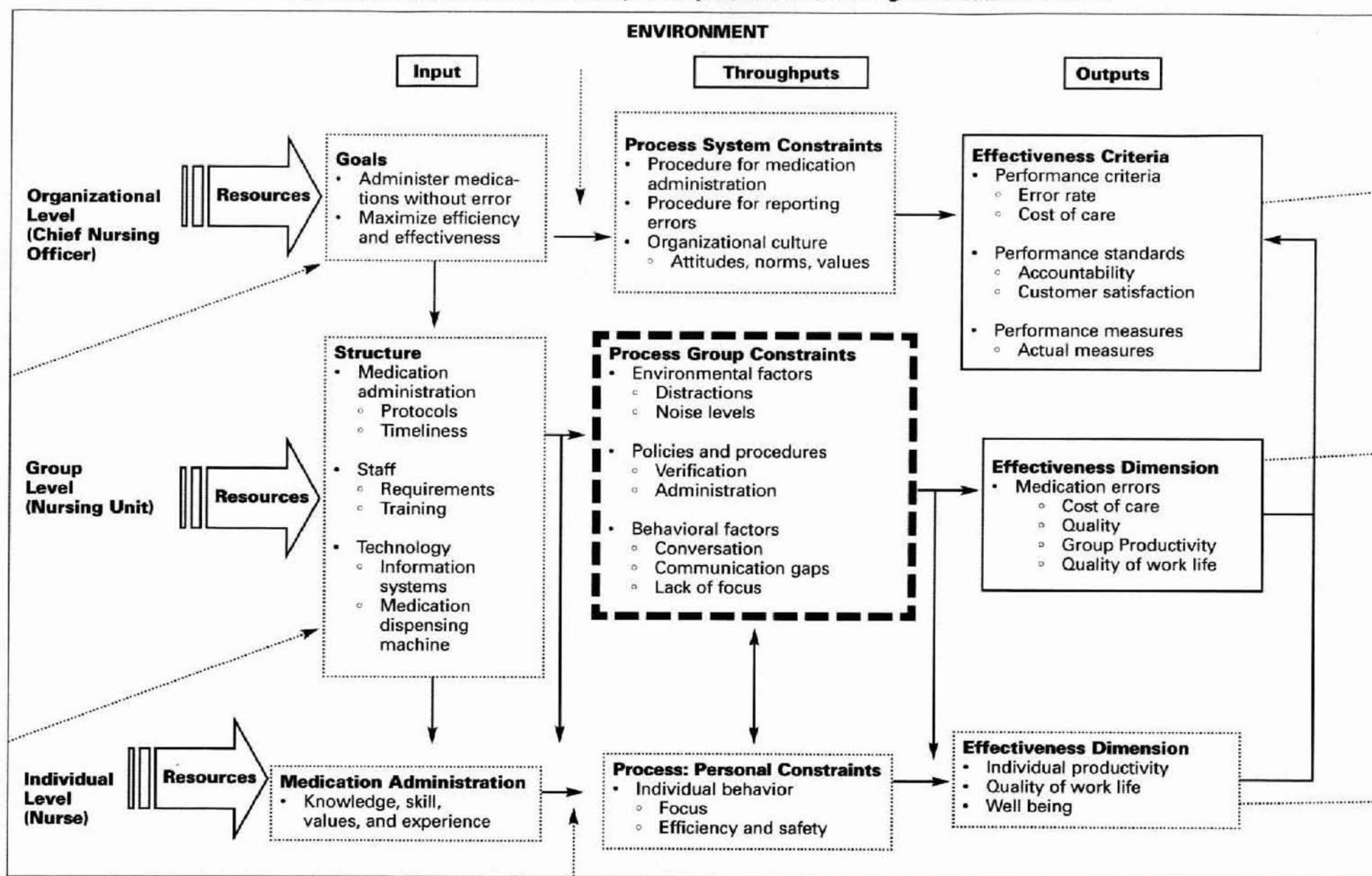
In contrast, latent conditions (distractions, overwork, fatigue, and inexperience) allow failures to continue (Reason, 2000). They are linked to conditions within the external work situation. When latent conditions combine with active failures, repeated mistakes happen (Reason, 1990; 2000). Redirected action becomes more difficult when the distraction was unrelated to the current action (Reason, 1990).

### Safety and Error Prevention

Measures to counter errors are developed from the idea that although we cannot change the human condition, we can redesign the work system to help humans avoid errors. When the system fails to prevent an error, the focus should not be on who made a mistake, but on how and why the defenses failed (Reason, 2000). System redesign is a critical component of future health care safety in creating a culture where prevention is everyone's responsibility (Leape et al., 1998). For this research study, safety in aviation was evaluated as a model for safety in medication administration.

Pilots are not allowed to engage in conversation unrelated to the flight checklist (sterile cockpit situation) as long as the plane is below 10,000 feet (Cohen, 1999). Accordingly, a similar tactic includes requiring the nurse to focus on medication administration, without engaging in unrelated conversation, as long as he/she is involved in

**Figure 1.**  
**Medication Administration for Safety in Hospitals (MASH): An Organizational Framework**



Adapted from Harrison & Shirom (1999).

**Figure 2.**  
**Demographic Data Form**

Participant # _____	Date _____	Dept _____
<p>To assist in data analysis and interpretation, I would appreciate if you would provide me with the following information. All information will be held strictly confidential.</p> <p>1. What is your age? _____</p> <p>2. What is your gender?</p> <p>(1) Female</p> <p>(2) Male</p> <p>3. What is your ethnicity? _____</p> <p>4. What is your highest level of nursing education?</p> <p>(1) LVN/LPN</p> <p>(2) Diploma</p> <p>(3) ADN</p> <p>(4) BSN</p> <p>(5) Masters degree in nursing</p> <p>5. How many years of nursing experience do you have? _____</p> <p>6. What level of nursing expertise do you feel that you have?</p> <p>(1) Novice</p> <p>(2) Advanced beginner</p> <p>(3) Competent</p> <p>(4) Proficient</p> <p>(5) Expert</p>		

administering medications. The nurse is also required to follow a medication safety checklist with visual reminders for accuracy.

### Protocols and Visible Signage

Using visible hazard warnings, following written protocols and procedures, and encouraging accurate documentation promote medication administration safety (Wolf, 2001). Humans have increasingly become symbol-making, symbol-using, symbol-dominated creatures. First, symbols represent something of value to humans. Second, symbols are transmitted by learning processes. Third, the connection between the symbol and the value represented must be either imposed

from outside or come from within (von Bertalanffy, 1967).

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

In a study of 203 parents and their children, Barrett (1994) found that children rated both male and females dressed in a white lab coat as most competent when compared with four other types of dress. In a qualitative study examining the components

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

Signs can serve as warning of impending danger before the fact (Reason, 1990). Signs and symbols can serve various purposes in the medication administration process. For example, attire is a symbol that identifies the nurses in health care institutions, so that others recognize a certain level of knowledge and expertise. Signs are useful reminders of the priority of safety, and serve as activators to direct behavior (Geller, 2001). Thus, we often see workers attired in orange vests to remind passersby of the intended safety message.

One problem often encountered with signage is the phenomenon known as *habituation*. This process causes people to learn not to respond to an event that occurs repeatedly. However, the organization's value for safety reduces the potential for habituation and increases the potential for continued sign compliance. People must believe that the safety goal is worthwhile, or that consequences are unacceptable (Geller, 2001). Desiring to arrive home safely will cause people to respect the worker's orange vest while following traffic around a hazardous situation. Likewise, decreasing the potential for medication errors provides a worthwhile safety incentive for personnel to acknowledge the

nurse's visible symbol (in this study, a vest) as a reminder to avoid interruptions during medication administration.

No known studies exist that have implemented and evaluated any intervention to reduce distractions during medication administration. Thus, this study used focused protocols (checklists), teamwork, and the application of a vest as a visible outward sign, as interventions to decrease nurses' distractions while administering medications.

### **Conceptual Framework**

The conceptual framework for this study was formulated from Harrison and Shirom's (1999) organizational assessment structure. The Medication Administration for Safety in Hospitals (MASH) open systems model includes *inputs* that feed into the system to promote accurate delivery of medications to patients (see Figure 1). *Throughputs* involve constraints and barriers found at the organizational, group, and individual levels, which impede the process of getting medications to patients. *Outputs* include safe medication administration, and *feedback mechanisms* are the communication and reports from inside and outside the organization that provide safety evidence. System effectiveness is measured by safe delivery of medications to every patient.

This study tested the bolded group component of the throughput section (see Figure 1) that was the most intervenable to reducing system problems. The group constraints included in medication administration are environmental factors (distractions and noise), procedure and policies (failure to establish and follow standard operating procedures and protocols), and behavior factors (inability to focus or lack of focus, communication problems, and conversation).

### **Assumptions**

- The system moves on a planned course and constraints lead to performance problems (Theory of Constraints Center [TOC], 2000).
- Environmental constraints (distractions, lack of focus, conversation) affect work-groups making them less productive, less cohesive, and less committed to the task (Harrison & Shirom, 1999).
- Ineffectiveness at one level affects all other levels and directly affects outcomes (Harrison & Shirom, 1999).
- Manipulation of more accessible constraints is more likely to result in successful change (Harrison & Shirom, 1999).
- Once the constraint is removed, the system moves to a higher level of performance, thus reducing system problems (TOC, 2000).

### **Methods**

This quasi-experimental three-group design tested the effects of two interventions to reduce nurses' distractions during medication administration. Hallmarks of the quasi-experimental design include manipulating the independent variable to observe its effect on the dependent variable, controlling for confounding variables, and using a convenience sample (Knapp, 1998; Polit & Hungler, 1995). Thus the independent variable was group identity of first the control and then the two interventions, to prevent distractions during medication administration. The dependent variable was the number of distractions through eight cycles of medical administration for each group.

One research hypothesis and one research question were proposed for the study. The research hypothesis stated: Two targeted interventions, a "focused" protocol and a "Medsafe" protocol, both

with educational interventions, will reduce nurses' distractions during medication administration cycles when compared to a control group of similar nurses who do not use either intervention. The research question was: Which distractors are more predictive of nurses being distracted during medication administration cycles?

**Instruments.** The Demographic Data Form (see Figure 2) was used to collect information about age, gender, ethnicity, level of nursing education, years of nursing experience, and self-reported level of nursing expertise for observed nurses. The Medication Administration Distraction Observation Sheet (MADOS) was used to count nurses' distractions during medication administration cycles. A medication cycle started when the nurse began the administration of all assigned patients' medications at a scheduled time. The medication cycle ended when the nurse completed charting the medications given.

The MADOS (see Figure 3) is a 10-item instrument designed to count distractions during medication administration. Potential distraction sources included physician, other personnel, phone call, other patient, visitor, missing medication, wrong dose medication, emergency situation, conversation, and external noise. The nurse researcher collected data by observing distractions during medication administration for both the control and the intervention groups. Slash marks were made under the corresponding cause of the distraction each time a distraction occurred. The scheduled medication time and total time interval for each observation period were also entered on the MADOS form. Higher scores corresponded to increased frequency of nurses' distractions during medication administration.

**MADOS validity and reliability.** The MADOS was designed follow-

**Figure 3.**  
**Medication Administration Distraction Observation Sheet (MADOS) with Definitions of Distraction Categories While Administering Medications**

<input type="checkbox"/> Control Group <input type="checkbox"/> Experimental Group 1 <input type="checkbox"/> Experimental Group 2 Department _____ Date of obs. _____ Observation # _____										
<b>Scheduled Medication Time</b>	<b>Number of Distractions</b>									
	Physician	Other personnel	Phone call	Other patient	Visitor	Missing medication	Wrong dose medication	Emergency situation	Conversation	External noises
<b>Start Time</b> _____										
<b>Stop Time</b> _____										
<b>Elapsed Time</b> _____										
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.									

**Table 1.**  
**Means and Standard Deviations for Number of Distractions Nurses Experienced During Scheduled Medication Administration for the Control, Focused Protocol, or Medsafe Protocol Group Interventions (N=24)**

<b>Distractions Experienced During Medication Administration</b>			
<b>Group</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Total of All Distractions</b>
Control (n=8)	60.50	12.91	484
Focused protocol (n=8)	22.50	8.47	180
Medsafe® (n=8)	8.00	4.50	64

ing a literature review of the domain content of distractions. The MADOS instrument was then developed into a survey for content validation using Fehring's (1987) diagnostic content validation (DCV) model. The final MADOS was based on expert opinions of nurses (N=26), who validated the instrument using a rating scale (Fehring, 1987). The nurses rated each characteristic by placing an "X" on a visual analogue scale consisting of a 10 cm line with the words "not important" at one end, and the words "extremely important" at the other end of the scale (Wieck, 1996). These referred to how important the defining characteristic was to distracting the nurse during medication administration. The scores were obtained by measuring the distance in centimeters from the left end of the line to the subject's mark. Data were entered into an SPSS 10.0 data file.

The responses were recoded into five groups to coincide with Fehring's model for evaluation (0 to 2 cm=1; 2.1 to 4 cm=2; 4.1 to 6 cm=3; 6.1 to 8 cm=4; 8.1 to 10 cm=5). Subsequently, the DCV score was determined by using weighted ratios for each of the five

groups (1=0, 2=.25; 3=.50; 4=.75, and 5=1.0). Those items that received high scores indicated that the nurses considered the items important sources of distraction during medication administration. Items receiving a DCV over 0.3 were considered valid for inclusion in the instrument. Items that received very low scores were excluded.

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

Following the pilot conducted

for this study, an effect size of 1.32 for a power of .80 and alpha of .05 (one-tailed) was established. According to Lipsy (1999), a sample size of 5 is considered adequate to determine significant mean differences between groups. However, since few studies exist for comparison, a sample of eight medication administration cycles for each group was observed.

**Population and setting.** The population included high-volume medication administration cycles. A convenience sample (N=24) of medication cycles was selected for one control and two intervention groups during high-volume medication administration times. Medication administration cycles were the measured elements in this study. A medication cycle started when the nurse began the administration of all assigned patient medications and ended when the nurse completed documentation of administered medications. The setting included a medical-surgical nursing unit with an average patient census of 30 in a 520-bed acute care hospital in a large metropolitan city in South Texas. Observed nurses were selected from those who volunteered to participate and met study inclusion criteria. Participants were included if they (a) were English-speaking male and female nurses, (b) routinely administered medications, (c) were routinely assigned to the nursing unit, (d) had not participated in the pilot study, and (e) were not precepting another staff member.

**Protection of human subjects.** After obtaining approval from the institutional review board and permission from the study hospital, study dates and times were established. A convenience sample was selected from those who volunteered to participate and met study inclusion criteria. Participation was voluntary, and all subjects provided informed consent. Potential

**Table 2.**  
**One-Way Analysis of Variance (ANOVA) for Differences Among Groups on Number of Distractions Nurses Experienced During Medication Administration (N=24)**

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

Dependent Variable: Total number of distractions

\* $p < .05$

R squared = .867 (Adjusted R squared = .854)

**Table 3.**  
**Tukey HSD Post Hoc Pairwise Comparisons for Mean Differences Between Groups on Number of Distractions Nurses Experienced During Medication Administration (N=24)**

Group	Group	Mean Difference	Standard Error	P
Control (n=8)	Focused Protocol	*38.00	4.64	.000
Focused Protocol (n=8)	Medsafe	*14.50	4.64	.014
Medsafe (n=8)	Control	*52.50	4.64	.000

Based on observed means. Dependent variable: Total distractions.

\* The mean difference is significant at the .05 level.

risks were discussed with each study participant. Participants were told that they could withdraw from the study at any time.

Nurses to be observed were approached individually and provided with an explanation of the study purpose and protocols. Verbal and written consent were obtained just prior to each observation period. Confidentiality of data was established with code numbers, study materials were kept in a locked file cabinet, and participants were assured that they would not be identified in

written reports.

*Data collection.* For the control group (n=8), distractions were observed while nurses used customary medication administration procedures. Observed participants and other employees were asked to maintain normal conditions and behavior. Even though the planned inservices were replaced with individual instruction, participants seemed receptive to the study protocols. Observer influence may have affected the study to some extent, which is one limitation of the

study. However, the influence did not seem to change the ultimate outcome of the study and was consistent throughout each of the three protocols.

For the next set of eight medication administration cycles, the *focused protocol intervention* was implemented, and nurses' distractions were counted. Staff members were asked not to interrupt or distract the "special nurse" being observed unless the distraction related to medications being administered. Instead they were asked to intercept phone calls and other distractions for the observed nurse. The observed nurse was also asked to refrain from conversation unrelated to medications during medication administration.

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

Distraction observation continued for each group until the sample of eight medication cycles for each group was reached. Nurses were observed during weekday scheduled medication administration times of 9:00 am, 1:00 pm, 5:00 pm, and 9:00 pm for each study group.

*Sample.* The majority of the 24 participant observations during medication administration included Caucasians (n=19, 79%) and females (n=23, 95%). The majority of participants (n=11, 46%) were

**Table 4.**  
**Means, Standard Deviations, and Frequencies of All Categories of Distractions Nurses Experienced During Medication Administration for the Control, Focused Protocol, or Medsafe Groups (N=24)**

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

LVNs, followed by 33% (n=8) ADNs, and 17% (n=4) were BSN nurses. Ages ranged from 26 to 51 years, and participants had 1 to 26 years of nursing experience. This distribution is fairly representative of most hospital systems in the United States today. Although no similar studies exist for direct population comparison, other studies addressing medication errors report similar participant allocations. For example, a study of medication errors (Osborne et al., 1999) reported that the majority of nurse survey respondents were Anglo (50%) and female (93%) between the ages of 31 to 50 with 11 to 20 years of experience. However, the majority held an associate's degree in nursing.

Wakefield et al. (1999b), who studied MAE reporting rates, also identified the majority of nurse participants with an ADN degree.

### Data Analysis

Statistical data were analyzed using SPSS 10.0 (Statistical Package for the Social Sciences) with alpha set at .05. The research hypothesis was examined using a one-way analysis of variance (ANOVA) and descriptive indices. The research question was analyzed using multiple bivariate regression to explain the extent to which each distraction category predicted distractions nurses are likely to experience.

The research hypothesis was addressed by observing eight

medication administration cycles for each of the two treatment groups and one control. The control group experienced 484 distractions during medication administration (mean =  $60.50 \pm 12.91$ ). When the focused protocol was used to guide medication administration, there were a total of 180 distractions (mean =  $22.5 \pm 8.47$ ). When the Medsafe protocol with vest was used, total distractions dropped to 64 instances (mean =  $8 \pm 4.50$ ). Table 1 presents means and standard deviations for the dependent variable of distractions during medication administration.

Mean differences in effectiveness of the two interventions to reduce distractions during med-

**Table 5.**  
**Bivariate Linear Regression Using Separate Predictors While**  
**Controlling for All Other Distraction Sources Nurses Experience**  
**During Medication Administration**

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

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

Dependent variable: Total distractions.

ication administration were analyzed using a one-way ANOVA. The ANOVA revealed statistically significant mean differences among the groups,  $F(2, 23)=68.229$ ,  $p=.000$ . The independent variable was group assignment for the control, the focused protocol group, or the Medsafe group. The dependent variable was the change in number of distractions experienced by nurses during medication administration depending on whether they were a part of the control group or one of the intervention groups. The model was able to predict that 86% of the time there would be a decrease in distractions depending on the intervention used (see Table 2).

Post hoc pairwise comparisons using Tukey's HSD were used in evaluating the effect of the type of intervention on number of mean distractions. The ANOVA relies on the assumption that the variance spread is the same in all

conditions. Since equal sample sizes existed in this study, no test for homogeneity of variance was performed. There was a significant mean difference in total distractions between the focused protocol group and the control group ( $p=.000$ ). There was also a significant difference between observed distractions for the focused protocol group and the Medsafe group ( $p=.014$ ), and between the control and the Medsafe protocol group ( $p=.000$ ) (see Table 3). These findings indicate that significantly fewer distractions occurred in the Medsafe vest-wearing group than in the protocol or control groups.

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

group, and 64 for the Medsafe group.

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

The control group experienced the most interruptions by personnel ( $n=154$ , 58%), followed by the focused protocol group ( $n=84$ , 32%) and the Medsafe group by other employees ( $n=29$ , 11%).

External conversation or nurse-initiated conversation accounted for nearly the same amount of interruptions ( $n=155$ , 72%) for the control group, less for the focused protocol group ( $n=50$ , 23%), and even fewer for the Medsafe group ( $n=10$ , 5%). The fewest distractions were caused by a wrong dose medication being present or an emergency situation in all three groups (see Table 4).

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

The potential distraction source was the independent variable and the total number of distractions was the dependent variable. Results of the simultaneous multiple regression analysis revealed

**Figure 4.**  
**Medication Administration Checklist for Focused Protocol**

1. Verify all assigned patients MAR forms with MD orders.
2. DO NOT engage in conversation not pertaining to medication delivery.
3. DO NOT allow interruptions or distractions while administering medications.
  - a. Hold your hand up and verbalize the need for no interruptions or distractions.
  - b. Other staff members "field" phone calls and interruptions for nurse.
4. Prioritize tasks.
5. Obtain medication and verify with MAR.
6. Look at items being read.
7. Use 7 rights.
  - a. Right drug, right patient, right dose, right time, right route, right reason, right documentation.
8. Administer medications to only one patient at a time.
  - a. Right patient
9. Take MAR and unit-dose packets to bedside.
  - a. Verify patient's armband name and MD name with exact spelling on MAR.
  - b. Ask patient to state name.
10. Read medication name aloud to patient while opening unit-dose packet.
11. Correctly document medications given.
12. Continue with second patient, etc.

**Figure 5.**  
**Medication Administration Checklist for Medsafe-Focused Protocol with Vest**

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

that all 10 distraction predictors were significantly related to the total number of distractions nurses experienced,  $R^2 = 1.0$ ,  $F(10, 13) = 2.96E + 15$ ,  $p = .000$ . Subsequently bivariate linear regression was used to estimate the unique effect of each variable, while holding other effects constant on the total number of distractions nurses experienced.

Independent variables are list-

ed in order of importance, from greatest likelihood to increase distractions to least likely to contribute to total nurses' distractions during medication administration. The wrong dose medication variable was nonsignificant in the bivariate regression analysis, indicating a low relationship to total distractions. Conversation accounted for the majority (93%) of

the variance in total distractions, followed by interruptions by personnel (90%), and loud noises (87%) (see Table 5).

Variables that involved people in the environment seemed to form a pattern of more increases in distractions compared to those factors related to medications.

The slope measures the rate of change for the independent

**Table 6.**  
**Comparison of Current Airline Industry Standards and Recommended Health Care Standards for Medication Administration**

Airline Industry	Health Care Industry Recommendations
1. Establish a safety culture.	1. Establish a safety culture.
2. No conversation during flight take off and landing.	2. No conversation during medication administration.
3. Use teamwork before and during flight.	3. Use teamwork during medication administration.
4. Wear a distinguishing uniform indicating rank. Establish clear lines of authority.	4. Wear a visible symbol during medication administration. Wear a large print name tag indicating educational status.
5. Use a checklist during flight take-off and landing.	5. Use a standard medication protocol checklist.

variable and is expressed as a positive number, indicating that the change in one independent variable is associated with upward changes in the dependent variable. A high slope indicates that changes in the specific independent variable were associated with more significant change in the dependent variable.

The closer the rate is to 1, the higher the predicted relationship to the potential to cause distractions. A score of .80 or higher indicates a strong relationship between the distraction source and the potential for total number of distractions experienced during medication administration. Distractions with the highest scores were conversation, other personnel, noise, phone calls, and physicians.

A positive linear relationship was shown between number of total distractions and conversation-related distractors. External conversation that distracted the nurse or conversation initiated by the nurse caused increased total

distractions during medication administration. A positive linear relationship was also associated with the total distractions experienced and personnel interruptions. Increases in interruptions by personnel corresponded to an upward change in total distractions. In fact, the total number of distractions increased as the number of people-related factors increased. Medication-related factors were less likely to produce a source of distraction for the nurses.

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

There was a nonlinear relationship in total number of distractions experienced from missing medications as distraction sources, indicating that pharmacy-related causes of distractions were much less likely to contribute to the total number of distractions than people-related distractions.

## Discussion

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

These results provide evidence that distractions during medication administration can be significantly reduced by educating staff members to the importance of not distracting nurses during medication administration. Distractions can be further reduced by nurses' avoidance of conversation, and by use of a visible symbol to indicate to others that distractions are unwanted for a time. Using checklists as reminders to focus on the appropriate medication administration procedure can also reduce attention deficits.

Most staff members applied the teamwork approach well during the study intervention periods. Their efforts to prevent distractions supported the nurses' ability to focus during medication administration. The evening shift personnel seemed to work better as a team compared to the day shift. A few staff members said it was not

feasible to avoid distracting all nurses giving medications, because they were all giving medications at once. They further suggested that, if there were more nurses and support staff, interruptions could be decreased. Nevertheless, they admitted that much of the distractions due to social conversation and noise could be reduced through personal efforts. Many nurses indicated that phone calls consistently caused them to stop what they were doing in order to do something else. Later they acknowledged that many of the calls could have waited or been redirected to someone else.

As a symbol, the Medsafe vest was effective as a visible reminder that distractions were unwanted for a time. Few nurses complained about wearing the vest for the purposes of research. Some of them did not want to give up the vest after their medications were dispensed, because they had accomplished their work quicker without the usual interruptions and wanted to continue getting things done. Other symbols such as special armbands may be just as effective in reducing distractions during medication administration. The novelty of the vest may have also played a role in its success. Without further study, it is unclear whether personnel would become accustomed to the vest as a symbol and begin to interrupt the medication nurse as much with the vest as currently is done.

Only one nurse kept the checklist in hand during the entire medication administration process. Most others read the checklist protocol, laid it with their chart papers, and agreed to follow the instructions. Many of the nurses agreed that the protocol checklist was the best way to administer medications. It reflected the technique they were taught, but they admitted that it was not the method they usually followed.

It was unknown just how many times the nurses referred to the checklist (see Figures 4 & 5). Items on the checklist included verifying orders, not engaging in conversation, looking at items being read, using the seven "rights," taking the MAR to the patient's bedside, taking medications in unit-dose packets to the bedside, verifying the armband, asking the patient to state his/her name, and correctly documenting medications given. However, most nurses did not take the MAR to the bedside, and some opened unit-dose packets and dropped the medications into a pill cup at the nurses' station. It is unknown what method the nurses used to verify patient identity since they were not visible to the observer in most patients' rooms. Nevertheless, the nurses stated that the checklists helped by offering reminders of the proper method of administering medications, and made them think more about what they were doing.

The study findings support the necessity of using distraction-reducing techniques to improve medication safety. Changes in working relationships must be addressed immediately to increase nurses' focus during critical tasks such as medication administration. Improving teamwork should be considered as an effective distraction-decreasing technique. Leaders must demonstrate support for safety and expect employees to model an attitude of safety in work relations.

To improve concentration, protocols used should be specific to the most frequently occurring sources of nurses' distractions. Environmental factors, such as high noise levels and conversation, should be decreased as much as possible. For the study hospital in particular, perhaps a medication room with walls would facilitate nurses' ability to concentrate on the task without external influ-

ence. In addition, a rule could be implemented that nurses should be left alone when they stand at the medication dispensing machine. A sign strategically placed near the medication area could serve as an additional reminder to avoid conversation and distractions.

### **Limitations**

Generalizability of the study findings is limited to male and female English-speaking nurses who routinely administer medications in mid-sized acute care hospital settings. The study results are limited to facilities using the modified case-method nursing model, and therefore cannot be generalized to other nursing models. Also, only one nurse was observed at a time, and therefore results cannot be generalized to medication administered at the same time by many nurses. Medication administration cycles used in the study were high-volume weekday scheduled medication times. Another limitation was the selection of a nursing unit without a medication room. The fact that people tend to change their behavior when observed (Hawthorne effect) also provided a limitation to this study. Some nursing units have medication rooms, which may decrease the number of distractions possible.

### **Conclusions**

The key to preventing medication errors lies within adopting protocols from other safety-focused industries. The airline industry, for example, has methods in place that improve pilots' focus and provide a milieu of safety when human life is at stake (see Table 6).

Within the limitations of the study and based on the results, health care leaders should (a) discourage unnecessary conversation, (b) use educational interventions and teamwork to reduce dis-

tractions, (c) use visible symbols during medication administration times, (d) use checklists that serve as reminders to improve focus, and (e) limit other sources of distractions such as other personnel interruptions and external noise.

### Implications

Many of the constraints inherent in medication administration can be reduced by changes in work design, including providing no interruptions in a noise-free environment. Educational interventions and teamwork should be used to decrease nurses' distractions during medication administration. Standard protocols for medication administration should be established based on evidence-based guidelines. Medication administration methods should be modified to include standard protocol checklists as safety reminders. A visible symbol is needed that identifies nurses, indicates to others that nurses are administering medications, and signifies that distractions are unwanted. Large-print name tags and differences in uniforms for hospital personnel could help identify nurses from other persons to preclude fewer interruptions during medication administration. In light of the nursing shortage and the results of this study, hospitals should again consider adopting the team nursing model in which the nurse is the team leader. Well-trained medication aids and other assistive personnel could alleviate some of the stress currently placed on nurses in an often chaotic environment. These practical and inexpensive approaches to medication safety offer health care organizations evidence-based practice guidelines for medication safety.

### Recommendations For Further Study

The research study should be replicated in multiple settings with

varied days and time frames, and used with other nursing models. Further research should investigate the use of various types of visible symbols to identify nurses during medication administration, and varied educational interventions. Further research should investigate the use of various nursing models to decrease distractions.

### Summary

The increased costs of medication errors, societal pressures, and government agency support have provided the impetus for current patient safety research. As a result, a considerable amount of medication error literature has erupted. Yet few studies provide evidence-based practices so health care organizations can establish best practice guidelines for medication safety. This study helped close this research gap by examining the effect of two targeted interventions on the medication administration practices of nurses.

This quasi-experimental study measured the effect of two targeted interventions based on airline industry safety measures for decreasing nurses' distractions during medication administration. The safety checklists outlined an optimal EBP medication administration procedure. Conversation was limited and a visible symbol was used. Significant reductions in distractions were found with both the focused protocol and the Medsafe protocol with vest. The largest mean difference was between the control and the Medsafe group, demonstrating that a visible symbol, worn during medication administration as a sign that distractions are unwanted, can make the greatest difference for nurses in preventing interruptions. Nevertheless, the study also revealed that staff education increased their awareness and cooperation with reducing the potential hazards of distractions,

noise, and unnecessary conversation.

The study results infer that changes in work design using teamwork and targeted interventions can significantly reduce nurses' distractions during medication administration, ultimately reducing medication errors. Nurses' satisfaction and morale may improve as a result of increased efficiency of medication delivery and fewer errors. Therefore, redesigning systems using these research findings should be done immediately to prevent distractions and improve patient safety. Environmental factors such as high noise levels and conversation should be reduced as much as possible. Protocols used should be specific to the most frequently occurring sources of nurses' distractions in order to improve focus and reduce medication errors. Ultimately, establishing a safety culture during medication administration will save lives. ■

### References

- Agency for Healthcare Research and Quality. (2001). *Evidence report/technology assessment: Making health care safer: A critical analysis of patient safety practices summary*. Retrieved from <http://www.ahrq.gov/clinic/ptsafety/summary.htm>
- American Nurses Association. (1998). Reducing health care error: Systems-based approaches and nursing perspectives. *Nursing Trends & Issues*, 3(8), 1-13.
- Barrett, T.G. (1994). Sartorial eloquence: Does it exist in the paediatrician-patient relationship? *British Medical Journal*, 309, 1710-1712.
- Beardsley, D., & Woods, K. (Eds.). (1999). *First do no harm: A practical guide to medication safety and JCAHO compliance*. Marblehead, MA: Opus Communications.
- Cohen, M.R. (1999). *Medication errors: Causes, prevention, and risk management*. Sudbury, MA: Jones & Bartlett Publishers.
- Driscoll, M.P. (1994). *Psychology of learning for instruction*. Needham Heights, MA: Allyn & Bacon Publishing.
- Fehring, R. (1987). Methods to validate nursing diagnoses. *Heart and Lung*, 16(6), 625-629.



- Gladstone, J. (1995). Drug administrations errors: A study into the factors underlying the occurrence and reporting of drug errors in a district general hospital. *Journal of Advanced Nursing*, 22(4), 628-637.
- Geller, E.S. (2001). *The psychology of safety handbook*. Boca Raton, FL: Lewis Publishers.
- Harrison, M.I., & Shirom, A. (1999). *Organizational diagnosis and assessment: Bridging theory and practice*. Thousand Oaks, CA: Sage.
- Helmreich, R.L., & Merritt, A.C. (1998). *Culture at work in aviation and medicine: National, organizational and professional influences*. Brookfield, VT: Ashgate Publishing.
- Institute of Medicine Committee on Quality Health Care in America. (2000). In L.T. Kohn, J.M. Corrigan, & M.S. Donaldson (Eds.), *To err is human: Building a safer health system*. Washington, DC: National Academy Press.
- Institute for Safe Medication Practices. (2001). *It's time for a new model of accountability*. Retrieved August 8, 2001, from [www.ismp.org](http://www.ismp.org)
- Joint Commission on Accreditation of Healthcare Organizations. (2001). *Sentinel event alert*. Retrieved from [www.jcaho.org/ptsafety\\_frm.html](http://www.jcaho.org/ptsafety_frm.html)
- Joint Commission on Accreditation of Healthcare Organizations. (2002). *Sentinel events statistics*. Retrieved January 23, 2002, from [www.jcaho.org/search\\_frm.html](http://www.jcaho.org/search_frm.html)
- Knapp, T.R. (1998). *Quantitative nursing research*. Thousand Oaks, CA: Sage.
- Kobs A. (1999). Closet incidents: Sentinel events. *Nursing Management*, 30(3), 48-9.
- Kozier, B., Erb, G., Berman, A.J., & Burke, K. (2000). *Fundamentals of nursing* (6th ed.). Upper Saddle River, NJ: Prentice Hall.
- Leape, L.L., Woods, D.D., Hatlie, M.J., Kizer, K.W., Schroeder, S.A., & Lundberg, G.D. (1998). Promoting patient safety by preventing medical errors. *Journal of the American Medical Association*, 280(16). Retrieved from [jama.ama-assn.org/issues/v280n16/full/jed80080.html](http://jama.ama-assn.org/issues/v280n16/full/jed80080.html)
- Lehna, C., Peterson, T.G., Grubaugh, K., Mastropietro, S., Schottle, B., Pfoutz, S., Oegner, K., Lorenz, L., Rogens, L.S., & Seek, L.L. (1999). Nursing attire: Indicators of professionalism. *Journal of Professional Nursing*, 15(3), 192-199.
- Lipsy, M.W. (1999). *Design sensitivity: Statistical power for experimental research*. Newbury Park, CA: Sage.
- Moray, N. (1994). Error reduction as a systems problem. In M.S. Bogner (Ed.), *Human error in medicine* (pp. 67-91). Hillsdale, NJ: Erlbaum Associates.
- Osborne, J., Blais, K., & Hayes, J.S. (1999). Nurses' perceptions: When is it a medication error? *Journal of Nursing Administration*, 29(4), 33-38.
- Pape, T.M. (2001). Searching for the final answer: Factors contributing to medication administration errors. *The Journal of Continuing Education in Nursing*, 32(4), 152-160, 190-191.
- Polit, D.F., & Hungler, B.P. (1995). *Nursing research: Principles and methods* (5th ed.). Philadelphia: Lippincott.
- Reason, J. (1990). *Human error*. New York: Cambridge University Press.
- Reason, J. (2000). Human error: Models and management. *British Medical Journal*, 320, 768-770.
- Theory of Constraints Center. (2000). *Your gateway to the theory of constraints*. Retrieved from [www.tocc.com/index2.htm](http://www.tocc.com/index2.htm)
- United States Pharmacopeia. (2000). *Summary of the 1999 information submitted to medmarx: A national database for hospital medication error reporting*. Retrieved from [www.usp.org/medmarx](http://www.usp.org/medmarx)
- Von Bertalanffy, L. (1967). *Robots, men and minds: Psychology in the modern world*. New York: George Braziller.
- Wakefield, D.S., Wakefield, B.J., Uden-Holman, T., & Blegen, M.A. (1996). Perceived barriers in reporting medication administration errors. *Best Practices and Benchmarking in Healthcare*, 1(4), 191-197.
- Wakefield, D.S., Wakefield, B.J., Uden-Holman, T., Blegen, M.A., & Vaughn, T. (1999a). Understanding why medication administration errors may not be reported. *American Journal of Medical Quality*, 14(2), 81-88.
- Wakefield, D.S., Wakefield, B.J., Uden-Holman, T., Blegen, M.A., & Vaughn, T. (1999b). Understanding and comparing differences in reported medication administration errors. *American Journal of Medical Quality*, 14(2), 73-80.
- Wakefield, B.J., Wakefield, D.S., & Uden-Holman, T. (2000, Spring). Improving medication administration error reporting systems. *Ambulatory Outreach*, 16-20.
- Walters, J.A. (1992). Nurses' perceptions of reportable medication errors and factors that contribute to their occurrence. *Applied Nursing Research*, 5(2), 86-88.
- Wieck, K.L. (1996). Diagnostic language consistency among multicultural English-speaking nurses. *Nursing Diagnostics*, 7(2), 70-78.
- Wolf, Z.R. (2001). Understanding medication errors. *Nursing Spectrum Metro Edition*, 29-33.

## Three Nursing Programs Honored in Geriatric Education

The John A. Hartford Foundation Institute for Geriatric Nursing, in collaboration with the American Association of Colleges of Nursing (AACN), is pleased to announce the winners of the 2002 Awards for Exceptional Baccalaureate Curriculum in Gerontologic Nursing. The awards were given to three schools of nursing: First Place to Texas Tech University Health Sciences Center; Second Place to The University of Iowa; and Honorable Mention to Southeastern Louisiana University.

For an application for the 2003 awards, contact the Hartford Institute at 212-998-5568; ([www.hartfordign.org](http://www.hartfordign.org)).

## Editorial

*continued from page 75*

critical elements for a health care system that is being heavily scrutinized by consumers (Brady et al., 2001).

Although you may not feel prepared to sit for the first examination on May 3, I encourage you to include medical-surgical certification in your plan for professional development. Begin now to prepare for the fall exam, or look ahead to the 2004 test dates by forming a study group with your colleagues. With other medical-surgical nurses, you will be affirming our common knowledge, our utilization of the nursing process, and our commitment to a high level of skill in adult-nursing practice. It's another opportunity for excellence. ■

## References

- Benner, P. (1984). *From novice to expert: Excellence and power in clinical nursing practice*. Menlo Park, CA: Addison-Wesley.
- Brady, C., Becker, K., Brigham, L.E., Goldman, J., Wilson, B.B., & George, E. (2001). The case for mandatory certification. *Journal of Nursing Administration*, 31(10), 466-467.



## Answer/Evaluation Form: Applying Airline Safety Practices to Medication Administration

**MSN J304***This test may be copied for use by others.***COMPLETE THE FOLLOWING:**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Preferred telephone: (Home) \_\_\_\_\_ (Work) \_\_\_\_\_

State where licensed and license number: \_\_\_\_\_

AMSN Member Expiration Date: \_\_\_\_\_

Registration fee: AMSN/ISONG Member: \$15.00

Nonmember: \$20.00

**Objectives**

This educational activity is designed for nurses and other health care professionals who are responsible for medication administration. The evaluation that follows is designed to test your achievement of the following educational objectives. After reading this article, you will be able to:

1. List system and design issues related to medication errors.
2. Discuss the relationship between airline industry and health care industry safety standards.
3. Describe strategies for improving medication administration safety.

**Answer Form:**

1. Name one new detail (item, issue, or phenomenon) that you learned by completing this activity.
- 
- 

2. How will you apply the information from this learning activity to your practice?
- a. Patient education.
  - b. Staff education.
  - c. Improve my patient care.
  - d. In my educational course work.
  - e. Other: Please describe.
- 

**Posttest Instructions**

1. To receive continuing education credit for individual study after reading the article, complete the answer/evaluation form to the left.
2. Detach and send the answer/evaluation form along with a check or money order payable to **Jannetti Publications/MEDSURG Nursing** to **MEDSURG Nursing, CE Series, East Holly Avenue Box 56, Pitman, NJ 08071-0056**.
4. Test returns must be postmarked by April 30, 2005. Upon completion of the answer/evaluation form, a certificate for **4.6 contact hour(s)** will be awarded and sent to you.

**Evaluation**

	<b>Strongly disagree</b>	<b>Strongly agree</b>
--	------------------------------	---------------------------

The offering met the stated objectives.

1. List system and design issues related to medication errors. 1 2 3 4 5
2. Discuss the relationship between airline industry and health care industry safety standards. 1 2 3 4 5
3. Describe strategies for improving medication administration safety. 1 2 3 4 5
4. Time required to complete reading assignment and posttest: \_\_\_\_\_ Minutes

**Comments**

---

---

---

---

This independent study activity is provided by Anthony J. Jannetti, Inc., which is accredited as a provider and approver of continuing education in nursing by the American Nurses Credentialing Center's Commission on Accreditation (ANCC-COA).

This article was reviewed and formatted for contact hour credit by Dottie Roberts, MSN, MACI, RN,BC, ONC, **MEDSURG Nursing** Editor; and Sally S. Russell, MN, RN,C, AMSN Education Director.