The Art and Science of Infusion Nursing

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The Effect of a Safe Zone on Nurse Interruptions, Distractions, and Medication Administration Errors

ABSTRACT

Patient safety is a health care priority. Yet medical errors are ranked the eighth leading cause of death. Medication administration errors (MAEs) often result from multiple environmental and individual factors. This quality improvement initiative adapted a protocol based on airline industry safety measures to decrease nurse distractions and interruptions during medication administration, with the goal of decreasing MAEs. Sources of distractions, interruptions, and MAEs were measured pre and post intervention. Patient satisfaction scores were measured concurrently. Results of this initiative differ from previous studies in which similar interventions reduced both distractions and MAEs. An unexpected finding was dramatically increased patient satisfaction.

Key words: distractions, interruptions, medication administration errors, patient safety, protocol, safe

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Conflicts of Interest and Source of Funding: Dr Yoder received an honorarium from the Midwest Alliance for Health Education. Dr Schadewald and Ms Dietrich have no conflicts of interest to disclose.

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DOI: 10.1097/NAN.0000000000000095

Safe, quality health care is a primary concern for health care professionals and consumers. An emphasis on safety has been highlighted by the Institute of Medicine (IOM), The Joint Commission (TJC), the Institute for Safe Medication Practices, the Institute for Healthcare Improvement (IHI), the National Quality Forum (NQF), the American Society of Health-System Pharmacists (ASHP), the National Coordinating Council for Medication Error Reporting and Prevention, the United States Pharmacopeia (USP), and the Agency for Healthcare Research and Quality (AHRQ).[1]

One measure of quality in acute care settings is the frequency of medical errors or adverse events.[2] In 1999, the IOM report *To Err Is Human: Building a Safer Health System* brought nationwide attention to the negative impact errors have on both human life and health care economics.[1] Medical errors, including medication errors, have been ranked as the eighth leading cause of death in the United States.[1,3] Steadily increasing on an annual basis from 1995 to 2008, 554 sentinel events (death or serious injury) related to medication errors have been reported to TJC.[4] Preventable medication-related adverse events in the United States cost an estimated $3.5 billion each year.[5] This quality improvement initiative targeted reduction of medication administration errors (MAEs) in an inpatient setting with the aim of improving outcomes for the project site.

Multiple strategies to reduce errors have been suggested. In 2006, the IOM published evidence for strategies to prevent medication errors.[5] The interventions were categorized as technological, use of clinical pharmacists, medication use process, and miscellaneous. Miscellaneous interventions included adopting a systems-oriented approach, improving communication practices, reducing workplace fatigue, creating a culture of safety, medication reconciliation, improving the work environment for medication preparation, dispensing and administration, improving errors detection and reporting, and promoting a nonpunitive atmosphere.

Interventions to improve the work environment had limited evidence but still were recommended by the IOM, IHI, NQF, and ASHP.[1] Since the IOM report, the Safe Medication Use Expert Committee of the USP also has published a document titled *Physical Environments That Promote Safe Medication Use*.[6] Table 1 includes a summary of findings regarding work environment improvements to consider.[7–24]

An environmental factor correlated with increased MAEs is distraction during medication preparation.[25,26] A recommendation from the AHRQ for improving patient safety is to "keep medication preparation areas free of clutter, distraction, and noise."[27(p3)] Yet nurses continue to experience an average of 6.7 interruptions an hour.[28] Interventions to reduce distractions or interruptions for nurses have been shown to be effective in reducing MAEs in various inpatient settings.[10,11,29] However, these interventions have not been implemented at the project site or with student nurses.

SYNTHESIS OF SUPPORTING EVIDENCE

A vast amount of literature on medication errors has been published nationally and internationally in the past 20 years in nursing, health service, and medical journals, and by multiple national health care entities. One literature review found 90 primary research studies published in English in peer-reviewed journals between 1964 and 2002 that focused on adverse events in the acute care setting.[2] More than 70% of the studies were published between 1995 and 2002. Brady et al[30] conducted a review of the literature from 1988 to 2007 on medication errors in nursing practice and found studies conducted in 10 countries.

Medication error literature can be organized into 4 categories: (1) significance of errors; (2) types and frequency of errors; (3) antecedents, contributing factors, and causes of errors; and (4) strategies to reduce errors. The focus of the literature review for this project was limited to contributing factors (specifically, interruptions and distractions) and strategies to reduce errors.

FACTORS CONTRIBUTING TO MEDICATION ERRORS

Table 2 outlines 12 studies published between 1999 and 2010 that examined system and individual factors related to nurse MAEs. System factors identified were number of hours worked, staffing patterns, lack of system supports, illegibility of prescriptions, and pharmacy dispensing issues. Individual factors examined were nurse fatigue or stress, deficient math skills, knowledge deficits, lack of a BSN degree, inexperience, and deviation from policy. These factors may contribute to MAEs but are not easily addressed by a quality improvement initiative. For this reason, they are not addressed in this project.

Other literature suggests that distractions and interruptions have both system and individual components and have a positive association with MAEs. Many researchers have implicated distractions and interruptions in 45% to 50% of medication errors.[40-42] However, 1 meta-analysis suggested that evidence on the extent to which interruptions in health care lead to adverse effects is lacking,[43] and, in another literature review, only 1 nonexperimental study conducted in a nursing home established that interruptions were significantly ($P = .01$) associated with MAEs.[28] Although the extent of the impact of distractions and interruptions on MAEs may be lacking, these factors can be addressed by a quality improvement initiative. Because of this, they became the focus of this project.

FREQUENCY AND SOURCES OF INTERRUPTIONS

It has been documented that nurses are interrupted frequently during the course of their workday. In a review of the literature from 1980 to 2008, 14 observational studies reported an average rate of 6.7 interruptions per hour.[28] In a follow-up study, Biron et al[25] found that an average of 6.3 interruptions per hour occurred during medication administration on a medical unit. Moreover, a later Canadian study reported that nurses experience as many as 14 interruptions per hour and that 21% of these interruptions occur during tasks such as medication delivery and verification when a high risk to patient safety exists.[44] Other researchers have reported ranges of 11% to 22% of time spent on drug rounds or administration as spent dealing with interruptions.[44-46] Interruptions have been recorded from number of interruptions per hour[47] to number of interruptions per medication administration.[8]

Interruptions can be caused by individuals (eg, health care professionals, patients, family members) or inanimate objects (alarms, missing or malfunctioning equipment). Nurses can be interrupted through face-to-face

TABLE 1

Necessary Elements for Work Environment Improvements

Use a multidisciplinary, organization-specific approach.[7]	Ensure administrative support.[8,9]
Redesign the environment to reduce distractions and interruptions during medication administration.[10-12]	Reduce workplace stress.[13]
Define what constitutes a medication error at your agency and identify the when, how, and what factors contributing to those errors.[7,14-16]	Anticipate patient needs through interventions, such as hourly rounding to decrease interruptions that potentially lead to errors.[17]
Evaluate current policies and procedures.[16]	Institute strategies that have an impact on multiple factors.[18]
Increase error reporting, a blame-free culture, and/or a nonpunitive approach to increase understanding of how and when errors occur.[19-21]	Continuously educate nurses and other health care staff on medication safety-related issues, and assess competency.[13,15,22]
Ergonomically design work spaces and create visual or physical barriers for medication preparation spaces.[1,11,23]	Involve patients in decision making. Continuously educate them regarding medications and medication safety.[13,24]

conversation, phone calls, call lights, bed alarms, missing supplies, malfunctioning equipment, and emergency situations.[10-12,48] Overall, the literature indicates that most interruptions were from other personnel and by conversations,[11] with many of the interruptions being initiated by nurses themselves, either by starting a conversation or stopping to do other patient care activities.[10,11,17,25,28,45,48,49]

DISTRACTIONS, INTERRUPTIONS, AND ERROR THEORY

In cognitive psychology terms, distractions and interruptions can result in what is termed a *capture error*, an error that occurs when sequences from 2 different actions overlap.[23] Leape[50] suggested a cognitive framework for human error based on cognitive theory:

1. Even though some mental functioning is automatic, rapid, and effortless, some cognitive activities require problem-solving effort and attention.
2. Humans prefer regular, consistent routines that enable pattern recognition.
3. "Slips can occur with a break in routine while attention is diverted."(p1853)
4. Slips are defined as monitoring failures, errors of action, or unintended acts.
5. Physiological, psychological, and environmental factors can cause distractions that divert attention and lead to slips.
6. Examples of environmental factors that cause distractions are noise, visual stimuli, and motion.

Applying this framework, environmental factors that cause distraction will divert attention away from the cognitive task of medication preparation and administration, which requires problem solving and attention. This diversion potentially creates errors. Therefore, reducing distractions can reduce errors.

INTERVENTIONS TO REDUCE INTERRUPTIONS

Evidence is moderate to suggestive that interventions to reduce nurse distractions and interruptions are effective in reducing errors, according to the evidence-rating system developed by the AHRQ.[27] However, none of the 8 recent primary intervention studies to reduce nurse distractions or interruptions during medication administration met criteria for strong evidence because of a lack of experimental design, small sample sizes, and lack of generalizability. The design of the studies was either quasiexperimental with observation[11,29]; nonexperimental, descriptive, or observational[8,51-53]; or a preexperimental process-improvement study.[10] The number of participants, when reported, ranged from 20 to 72. Generalizability was limited because of varied settings and population demographics.

Although none of the studies qualified as strong evidence, 2 met AHRQ criteria for moderate evidence and 6 were suggestive that interventions can reduce nurse distractions and interruptions. Two studies were graded moderate because of quasiexperimental designs involving observation and use of control and experimental groups.[11,29] The 2 studies supported an association between selected interventions initiated during medication preparation and a reduction in nurse distractions. All 6 studies that qualified as suggestive evidence supported an association between selected interventions initiated during medication preparation and a reduction in nurse distractions,[8,10,51-54] with 5 showing a decrease in MAEs.[8,10,51-53] Two of the studies[8,54] had adapted interventions from Pape.[11] Pape and colleagues also

TABLE 2

Factors Contributing to Medication Administration Errors (1982-2010)

Author(s), Date(s), Participants, Setting	Individual (Nurse) Factors				System (Organization) Factors				System and Individual Factors
	Math Skills	Knowledge	Degree or Experience	Deviation From Policy	Hours Worked	Workload/ Staffing	System Supports	Quality of Scripts	Distractions and/or Interruptions
Studies based on nurse perception (ie, data obtained through survey, questionnaire, interview)									
Balas MC, Scott LD, Rogers AE. 2004; 393 hospital RNs in the United States[31]	NR	NR	NR	+	NR	+	NR	NR	+ (commonly described)
Stratton et al. 2004; 57 pediatric and 227 adult hospital nurses in the United States[20]	NR	–	NR	+	–	+	–	+	+ (in top 2 factors)
Balas MC, Scott LD, Rogers AE. 2006; 502 US critical care RNs[32]	NR	+/–	NR	+/–	NR	+	+/–	NR	+
Fry MM, Dacey C. Part II. 2007; 139 RNs at a London hospital[33]	+	NR	–	NR	NR	NR	NR	+	+ (94% of respondents)
Leung SF, Chong SYC, Arthur DG. 2007; 466 Hong Kong nurses in 27 hospital wards[34]	+/–	+	NR	+/–	NR	NR	NR	+	+ (rated fourth by nurses and managers)
Chang Y, Mark BA. 2009; 279 US medical-surgical units[35]	NR	NR	+/–	NR	NR	NR	+	NR	NR
Petrova E, Baldacchino D, Camilleri M. 2010; 43 nurses, 8 medical wards, Malta[36]	–	–	NR	+	+/–	+/–	NR	+	+ (in top 3 factors)
Literature reviews									
O'Shea E. 1999 (1982-1989; United States, Canada, United Kingdom, and Australia)[37]	+	+	+/–	+	+/–	+	+	–	+
Carlton G, Blegen MA. 2006 (1988-2004, incidence/ antecedents)[38]	+	+	+/–	+	+	+	+	+	+
Fry MM, Dacey C. Part I. 2007 (dates not published)[39]	+/–	+/–	+/–	+	NR	+/–	NR	+	+ (loss of concentration)
Brady A, Malone A, Fleming S. 2009 (1988-2007, contributing factors)[30]	+	+	NR	+	NR	+	+	+	+ (evidence from ~10 studies)
Hewitt P. 2010 (literature review of nurse perceptions 2002-2008; 9 studies conducted in the United Kingdom, Taiwan, Japan, and United States)[14]	+	NR	NR	+	+/–	+/–	NR	+	+

Key: Correlation to medication administration errors: + = strong correlation; +/– = evidence is mixed/uncertain; – = no correlation; NR = not reported in study.

adapted Pape's interventions in a 2005 study[10] and noted a decline in reported errors within 3 weeks. Despite the fact that strong evidence was lacking, because the studies showed evidence that was rated moderate to suggestive that interventions to reduce distractions and interruptions reduce MAEs, it was decided to proceed with a similar intervention for this quality improvement project.

SUPPORT FOR A SAFE ZONE DURING MEDICATION ROUNDS

With her MedSafe protocol, Dr. T.M. Pape[7,10,11] has led the way in developing interventions focused on decreasing medication errors by determining steps to reduce distractions and interruptions. The MedSafe concept has been adapted or suggested in part by multiple hospitals, researchers, and health care agencies.[1,8,27,29,54-56] Other published terms for the concept are Medication Safety Zone,[56] No Interruption Zone,[29] and Healthcare Sterile Cockpit.[57] In addition to the 8 primary intervention studies previously cited, other researchers have suggested that interventions like those included in Pape's protocol are critical to error prevention.[12,18,19,23,45,47,58]

THE SAFE ZONE PROJECT

A 3-month quality improvement project was implemented to pilot a protocol for a safe zone during medication preparation and administration with 56 nurses and 24 student nurses on a 45-bed medical unit at a midsized, acute care, community-owned hospital. Permission for use of the protocol, as well as consultation in design of this project, was obtained from Dr. Pape (written communication, October 2010). The protocol was based on the airline industry's safety practice of a "sterile cockpit," which involves ensuring that the aircraft's pilot has no distractions or interruptions when performing the critical tasks of takeoff and landing.[10,11,56,59] Like pilots, nurses have people's lives in their hands during critical tasks such as medication administration. The Safe Zone protocol included:

1. clearly marked quiet areas to retrieve/prepare medications (Figure 1),
2. adherence to a checklist for medication preparation/administration and participant education about no conversation during the task (Table 3),
3. staff education regarding no conversation and no distraction or interruption during medication administration, and
4. a vest, bib, or sash worn by participants while in the medication preparation and administration process.

Figure 1 Sign used to designate Safe Zones. Floor-level signage.

A project team, consisting of 6 influential leaders representing all key stakeholders, assisted with implementation and evaluation.

CONCEPTUAL FRAMEWORK

Because medication errors have an impact on quality and safety outcomes, the Quality Health Outcomes Model fit well as the conceptual framework. Because interventions included in the Safe Zone protocol address both system and individual factors contributing to errors, the Quality Health Outcomes Model contends that the desired outcome of reduced medication errors will be achieved. Figure 2 shows the association of the model with project concepts, measures, and the Safe Zone intervention.

PROJECT DESIGN

The project was planned, implemented, and evaluated from September 2010 through July 2011. Before implementation of the Safe Zone, the project team was selected, a checklist for medication administration was developed, Safe Zone areas were established, education was provided regarding the protocol, and vests were distributed to participants. Professional-appearing floor and eye-level signs were designed by university art students. Disposable orange vests with the words "Medication Rounds in Progress: Do Not Disturb" were worn by participants.

Twelve sources of distractions and interruptions were measured pre- and postintervention, using an established survey tool, the Medication Administration Distraction Observation Sheet. The tool, which was adapted with permission (Table 3), was validated on the basis of the expert opinions of 26 nurses who used a survey rating scale based on Fehring's[61] diagnostic

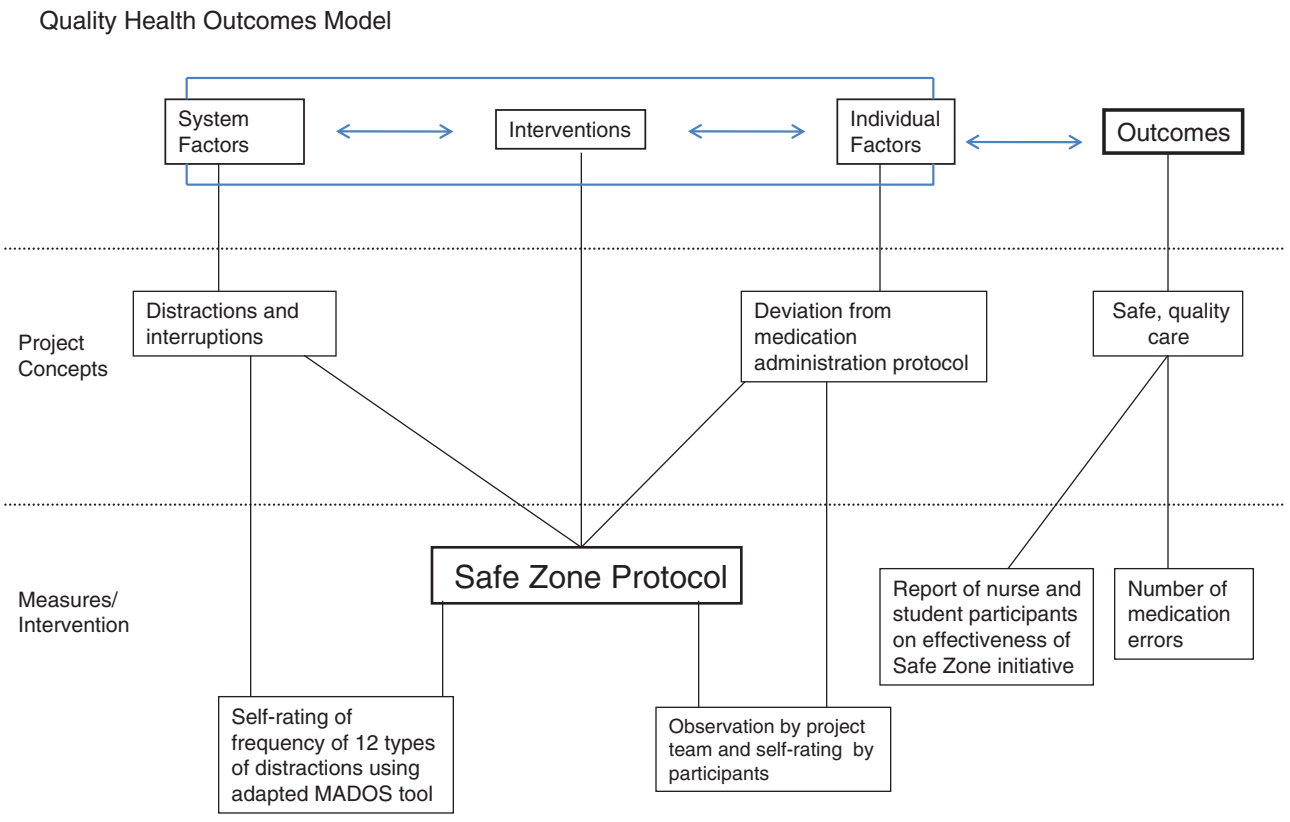

Figure 2 Application of the quality health outcomes model to the Safe Zone project. *Abbreviation: MADOS, medication administration distraction observation sheet.*

content validity model.[10,11] Pape[11] reports establishing "a high interrater reliability of .90 by comparing observations of a trained research assistant and the project manager."[61(p85)] MAEs were compared pre- and postintervention using hospital event reports. The route of administration for the medication was not differentiated—whether oral or intravenous (IV)—for the purposes of this project. All medications administered, regardless of route, were included in the Safe Zone protocol.

Event reports were the established method for reporting medication errors at the project site. Three months of data from hospital event reports submitted by personnel on the selected unit were compared pre- and postintervention. Coincidentally, the project site was obtaining measurement of patient satisfaction and patient perception of safety and quality of care over the course of the pilot.

PARTICIPANTS

Participants included individuals who administer medications on 1 hospital medical unit, which included all nurses who routinely gave medications on the unit and senior-level BSN student nurses from 1 university who had a clinical rotation on the unit from January 2011 through April 2011. Out of 56 nurses and 24 student nurses, 20 nurses (36%) and 11 students (46%) completed both pre- and postsurveys. The majority of nurse respondents were younger than 25 years of age (45%), Caucasian (95%), and female (90%). The majority of student respondents were younger than 25 years old (91%), Caucasian (100%), and female (91%). Approximately half (45%) of nurse respondents were bachelor's-prepared registered nurses; the remainder were associate-prepared registered nurses (50%) or licensed practical nurses (5%). The majority also reported 0 to 5 years of employment on the medical unit (80%) and 0 to 5 years of total nursing experience (75%). Seventy percent rated themselves as competent or proficient. Eighty-two percent of students rated themselves as novices.

RESULTS AND INTERPRETATION

Participants followed the Safe Zone protocol an estimated 50% to 80% of medication passes, based on self-report. Students (75%-80%) adhered more frequently than nurses (50%-70%). Reported barriers included forgetfulness; negative feedback from nonunit staff, visitors, or patients; and personal beliefs.

Participants rated the frequency of the distraction or interruption on a Likert scale from 0 (never) to 10 (very

TABLE 3

Medication Administration Checklist

Original Checklist[60]	Adapted Checklist for Project Site
1. Place vest on self. 2. Check for new orders that may have been written since the end-of-shift order review occurred. 3. Do not engage in conversation not pertaining to medications. 4. Do not allow interruptions or distractions. • If someone interrupts, state "Safe Zone protocol is being followed at present." • Other staff members field phone calls and interruptions for nurse. 5. Use 7 rights: right drug, right patient, right dose, right time, right route, right reason, right documentation. 6. Obtain medication from Pyxis, go to a Safe Zone, and verify with MAR: right drug, right dose, right time, right route, right reason. a. Take EMR and unit dose packets to bedside. b. Administer medications to 1 patient at a time. 7. Verify patient armband—name, DOB, and MD with MAR. Right patient. a. Ask patient to state name and DOB. 8. Scan each medication and verify accuracy in EMR. 9. Scan patient armband. 10. Read medication name aloud to patient, while opening unit dose packet. 11. Correctly document medications given. 12. Continue with second patient, etc.	**S**ecure vest **A**ccess the medical record, ✓ for new orders **F**ocus: no conversation or interruptions **E**xecute the 7 rights: patient, drug, dose, time, route, reason, and documentation Be **Z**ealous about standing in marked Safe Zones during med prep **O**pen patient door with AIDET, observe patient armband, and ask patient to state name and DOB **N**ext, scan each medication, verify accuracy with MAR, and scan the patient's armband **E**xplain medications to patient; enter documentation regarding medications and education given to patient

Adapted with permission for use from Dr T. Pape © 2002.

Abbreviations: MAR, Medication Administration Record; DOB, date of birth; EMR, Electronic Medical Record; AIDET, (fundamentals of patient communication) Acknowledge, Introduce, Duration, Explanation, Thank You.

often). Mean scores of nurse and student participants completing both pre- and postsurveys are compared in Table 4, and mean scores and standard deviations for all participants are compared in Table 5. Nurses reported a higher frequency of interruptions than students. The sources most frequently distracting or interrupting nurses were patient call lights and conversation or people talking in the area. Students reported conversation or people talking, nursing faculty, missing or wrong dose of medication, other nursing students, and visitor/family as the most frequent sources of distraction or interruption.

Overall, nurses and students reported an increase in distractions and interruptions from pre- to postintervention. Conversation or people talking, patient call lights, and staff members were the most frequent sources of distraction or interruption preintervention. Postintervention, conversation or people talking and staff members continued to be the most frequent sources. However, visitor/family was among the top 3 most frequent sources of distraction or interruption. Paired differences using a 2-tailed t test displayed in Table 6 demonstrate a statistically significant increase in distractions and interruptions caused by physicians, NPs, or PAs ($P = .003$); loud noises in the area ($P = .018$); and visitor/family ($P = .025$). Potential factors contributing to increases in distractions and interruptions based on written participant comments during the pilot, feedback from project team members, written survey comments, and debriefing sessions with participants were categorized into 3 themes:

1. Education and discussion about interruptions and distractions during medication administration may have increased awareness about the problem.
2. Wearing the vest may have increased interruptions from staff, patients, family, and visitors who wanted to talk with nurses about the vest.
3. The Safe Zone protocol was not followed consistently among all participants, which may have had a negative impact on the anticipated effect of the protocol.

Reported errors for every 1000 patient days increased from 1.74 to 2.88. Results are summarized in Table 7. Of the 10 errors reported during the time of the intervention, all were preventable if the nurse was following a checklist for administration and avoiding interruptions. Of the errors, 4 were failures to press the start button on the pump for infusion of IV medication, 4 were wrong drug or dose compared with what was ordered, 1 was wrong time, and 1 was a medication reconciliation failure. Contributing factors to the increase in reported errors may have been an increased awareness of distractions and the need to report errors by participants; staff and visitors initiating conversation about the new protocol; and lack of consistency in following the protocol among participants. Despite the fact that no decrease in reported MAEs was realized, participants perceived a reduced risk of MAEs when following the Safe Zone protocol on the postintervention survey. An unexpected finding that needs further exploration was the dramatic

TABLE 4

Frequency of Distractions and Interruptions Pre- and Postintervention by Groups

Type of Distraction or Interruption During the Medication Administration Process[a]	Participant Mean Scores			
	Student (N = 11)		Nurse (N = 20)	
	Pre	Post	Pre	Post
Physicians, NPs, or PAs interrupt or talk to me	1.91	2.73	4.75	7.00
Staff members interrupt or talk to me	4.09	5.00	6.45	7.25
Nursing students interrupt or talk to me	3.27	5.18	3.65	4.65
Nursing faculty interrupt or talk to me	5.27	5.55	4.55	5.35
I start a conversation or talk to someone	3.18	4.45	4.85	4.90
There is conversation or people talking in the area	4.73	5.82	6.85	7.55
A missing or wrong medication(s) causes interruption	4.18	5.18	5.25	6.45
There are loud noises in the area during medication administration	4.36	4.82	4.60	6.85
An emergency (eg, code blue) interrupts me	1.36	1.36	2.85	3.25
Phone call(s) interrupts the medication administration process	1.45	.91	6.65	7.40
Visitor/family interrupts or talks to me	3.73	5.18	6.40	7.45
Patient call light interrupts me	3.45	3.27	6.95	7.75

[a] *Reported on a scale of 0 to 10, with 0 being never and 10 being always. Abbreviations: NP, nurse practitioner; PA, physician assistant.*

TABLE 5

Frequency of Distractions and Interruptions Pre- and Postintervention: All Respondents

Type of Distraction or Interruption During the Medication Administration Process[a]	Respondents (N = 31)			
	Pre-Intervention		Postintervention	
	Mean	Standard Deviation	Mean	Standard Deviation
Physicians, NPs, or PAs interrupt or talk to me	3.74	2.98	5.48	3.10
Staff members interrupt or talk to me	5.61	2.90	6.45	2.64
Nursing students interrupt or talk to me	3.52	3.08	4.84	2.81
Nursing faculty interrupt or talk to me	4.81	3.54	5.42	2.87
I start a conversation or talk to someone	4.26	3.39	4.74	2.80
There is conversation or people talking in the area	6.10	3.02	6.94	2.85
A missing or wrong medication(s) causes interruption	4.87	3.48	6.00	3.22
There are loud noises in the area	4.52	2.94	6.13	2.75
An emergency (eg, code blue) interrupts me	2.32	2.56	2.58	2.60
Phone call(s) interrupts the medication administration process	4.81	3.71	5.10	3.67
Visitor/family interrupts or talks to me	5.45	3.08	6.65	2.44
Patient call light interrupts me	5.71	3.43	6.16	3.37

[a] *Reported on a scale of 0 to 10, with 0 being never and 10 being always.*
Abbreviations: NP, nurse practitioner; PA, physician assistant.

TABLE 6

Frequency of Distractions and Interruptions Pre- and Postintervention: Paired Differences

	Paired Differences					
			95% Confidence Interval of the Difference			
	Mean	Standard Deviation	Lower	Upper	*t*	Significance (2 Tailed)
Physicians, NPs, or PAs	−1.74	3.02	−2.85	−0.63	−3.21	.003
Staff members	−0.84	3.44	−2.10	0.42	−1.36	.184
Nursing students	−1.32	3.82	−2.72	0.08	−1.93	.063
Nursing faculty	−0.61	4.30	−2.19	0.96	−0.80	.433
I start a conversation	−0.48	3.48	−1.76	0.79	−0.77	.445
Other conversation/people talking	−0.84	3.55	−2.14	0.46	−1.32	.198
A missing or wrong medication(s)	−1.13	3.27	−2.33	0.07	−1.92	.064
Loud noises in the area	−1.61	3.58	−2.92	−0.30	−2.51	.018
An emergency situation (eg, code blue)	−0.26	1.98	−0.99	0.47	−0.73	.474
Phone call(s)	−0.29	2.80	−1.32	0.74	−0.58	.567
Visitor/family	−1.19	2.82	−2.23	−0.16	−2.36	.025
Patient call light	−0.45	3.10	−1.59	0.68	−0.81	.423

Abbreviations: NP, nurse practitioner; PA, physician assistant.

increase in patient satisfaction scores. Patient satisfaction with nursing care has not yet been reported in previous studies where interventions to reduced MAEs have been trialed, nor was measurement of patient satisfaction originally included in the evaluation plan for this study. Nevertheless, scores related to patient perceptions of safety and quality increased approximately 40% during project implementation over a 12-month period, according to project site administration.

TABLE 7

Medication Administration Errors per 1000 Patient Days

	Pre-intervention		
	March-May 2010	November 2010-January 2011	Postintervention March-May 2011
Number of errors	7	6	10
Number of patient days	4,167	3,442	3,476
Error rate	1.68	1.74	2.88

Feedback from the project implementation team and participants in the pilot offer some insights. Members of the project team noted the potentially positive impact to nurse efficiency and patient safety. The unit manager indicated that the patient satisfaction survey results were enough evidence to continue the Safe Zone protocol and to expand implementation to all medical units throughout the hospital. Key project team observations were:

1. Nursing has traditionally been all about multitasking 100% of the time. Multitasking or "being fast" does not equate to efficiency or quality of care. Practicing the discipline of focusing on 1 critical task (eg, passing medication) will take time to develop, as will changing overall thinking.
2. Setting priorities is still a skill needed to provide safe, quality, efficient care. At times, 1 challenge was balancing doctor rounds and medication administration.
3. Role modeling by respected peers was crucial to the success of the project.
4. When nurses worked well as a team, following the protocol was a smooth process.
5. Having rewards (candy and a monthly contest) made the project fun and generated energy around the project.

6. Some nurses wore the vests beyond the medication pass to avoid being interrupted during other tasks. This delayed medication administration for other nurses.
7. New nurses being interviewed and hired on the unit voiced excitement about the Safe Zone because they felt they needed time to concentrate on medication passes.
8. Patients/visitors stopped walking into the staff medication preparation areas once the floor signs were posted.
9. During high census, some staff voiced relief over having the vests, because it provided a sense of peace and calm during a stressful, busy time.
10. Students took leadership roles offering vests to nurses, and nurses responded positively to the suggestion.
11. The protocol was a helpful reminder to faculty not to interrupt students and to the manager not to interrupt nursing staff with nonmedication questions.

After the pilot was completed, dialog sessions were held with participants. All students and approximately 40% of nurses participated. The nurse sessions were held during 2 unit staff meetings. The student session was conducted during class time at the university. In these sessions, participants relayed positive and negative stories about using the Safe Zone protocol. Student and nurse comments were summarized by 3 themes. Student themes were:

1. Remembering to put on the vest and incorporate a new process for medication administration was difficult, especially because giving medications was a newly learned skill.
2. Dealing with their own or others' negative feelings was a challenge. One student remarked, "Not being able to have conversations made me feel unfriendly at times." Another student confessed, "It was hard when the nurses talked negatively about the project."
3. Experiences while following the protocol had positive undertones. For example, one student recounted, "A doctor actually read the vest and apologized for interrupting me."

Nurse themes were:

1. The overall theory behind the Safe Zone concept was accepted.
2. Vests were reminders of the importance of focusing and concentrating during medication administration.
3. Challenges included (a) communication and coordination among team members to ensure that all medications were given in a timely manner, (b) personal belief that good service was not being provided if other patients or staff were waiting while medications were being given, and (c) vests being worn by some nurses for tasks other than medication administration.

LIMITATIONS OF MEDICATION ERROR LITERATURE

Understanding the limitations of medication error literature is important because strategies to reduce errors stem from the assessment of when errors occur, error types, at-risk populations, associated medications, and contributing factors. Confusion exists regarding what constitutes a medication error both in the literature and in practice settings.[7,14,24,30,34,37] Varied definitions of adverse events are also evident.[2] Second, error data may be lacking as a result of underreporting because nurses do not understand the value of error reporting, are confused as to what errors should be reported, and fear punitive repercussions.[14,62] Third, comparing results from multiple studies is difficult because multiple types of data sources (eg, clinical records, observations, self-reports, computer systems, case studies) have been used to study medication errors and adverse events,[2] making meta-analysis on this topic difficult. Fourth, most studies completed to date have involved small or convenience samples, which limits the generalizability of findings.[30] Finally, most of the published studies are observational or based on nurse perceptions and/or report of errors, which limits the researcher in showing causality or statistical significance.

CONCLUSION

Applying interventions that reduce medication errors can save lives and reduce costs to our health care system. In addition, it may also have a positive impact on customer satisfaction with care. Interventions, such as the MedSafe protocol, which targets both individual and system factors contributing to MAEs, have demonstrated the potential for reducing errors from 22% to 52%.[8,10,51-53,55] However, this quality improvement project offered evidence that interventions to reduce MAEs may not be equally effective in all health care settings. Although it was not reflected in measurement outcomes, an overall reduced risk of making errors when following the Safe Zone protocol was perceived by project participants. In addition, nurses' awareness increased related to the extent of distractions and interruptions that they experienced during medication administration and the related risk of medication error.

Based on evidence from the literature, the following practice recommendations should be considered:

1. Redesign the workplace environment and practices to reduce nurses' distractions and interruptions during medication preparation and administration.
2. Adapt the following principles of a safety zone in acute care, inpatient settings:
    a. Clearly mark the quiet areas to retrieve/prepare medications.
    b. Follow a standard protocol for the medication administration process.
    c. Educate nurses about the importance of following the protocol and eliminating unnecessary distractions/interruptions, especially conversation.
    d. Educate all health care personnel about the need for no conversation and not distracting or interrupting nurses during medication administration.
    e. Have nurses wear a visible sign (such as a vest, bib, sash, or light) during the medication preparation and administration process.

To determine the long-term impact of the intervention, continuing the Safe Zone protocol for 12 to 18 months at the project site was recommended. Expanding implementation to all medical/surgical units may be beneficial to increase the sample size. Much opportunity exists for future research related to medication safety. More research is needed to continue exploring strategies to decrease interruptions in varied health care settings. Research has not applied these strategies to nursing students during clinical rotations, and other researchers may also wish to use Pape's MedSafe concepts with nursing student participation, as described and implemented for this project. Measurement of patients' perceptions of these interventions would also be important.

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