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ARTICLE *in* JOURNAL OF NURSING CARE QUALITY · OCTOBER 2012

Impact Factor: 1.39 · DOI: 10.1097/NCQ.0b013e318275ac3e · Source: PubMed

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# Reducing Interruptions to Improve Medication Safety

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In the fast-paced environment of a cardiac and thoracic surgery telemetry unit, nurses are interrupted hundreds of times per day. These interruptions can have a detrimental effect on patient safety during medication administration. This article describes a bundle of safety interventions that reduced the average number of interruptions during medication administration by 2.11 interruptions per encounter and decreased reported medication errors by a total of 28 incidents over a 3-month period. **Key words:** *interruptions, medication errors, medication safety, No Interruption Zone, quality improvement, safety interventions*

**M**EDICATION SAFETY, and the reduction of medication errors, is a high priority for hospitals, health care providers, and patients. It is also a focus for the Centers for Medicare & Medicaid Services, The Joint Commission, and the Institute for Safe Medication Practices, among others.<sup>1,2</sup> Kliger<sup>3</sup> estimated that 450 000 medication errors occur annually, leading to costs between \$3.5 billion and \$29 billion each year for hospitals. Medication errors not only impact outcomes financially but may also lead to patient dissatisfaction, adverse patient outcomes, and death.<sup>1</sup> Kliger et al<sup>4</sup> estimated medication errors cause approximately 7000 preventable deaths in the

United States each year. The process from the act of the medical provider ordering medications, to the pharmacy filling doses, to the delivery of the dose to the hospital unit, and the preparation of the medication for administration to a patient entails a multitude of steps, of which any mistake could lead to potentially deadly outcomes for a patient.<sup>2,3</sup>

Current literature describes significant adverse effects of medication errors in hospitals. Although a multitude of situations can lead to medication errors, the more common classification of sources contributing to medication errors include the following: (1) interruptions, (2) environmental distractions, (3) nurse workload, (4) alarms, (5) cognitive function and education, (6) look-alike and sound-alike medications and packages, and (7) communication.<sup>1,3-11</sup> Nguyen et al<sup>1</sup> reported that the leading contributing factors associated with medication errors were interruptions, distractions, and communication. In line with interruptions being a leading cause of errors, Trbovich et al<sup>9</sup> found that nurses were "interrupted, on average, 22% of their time and were frequently interrupted while performing safety-critical tasks."<sup>(p211)</sup> Anecdotal research suggests that many nurses take pride in their ability to multitask and handle interruptions while administering medications and performing other nursing tasks.<sup>2</sup>

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Accepted for publication: September 24, 2012

Published online before print:

DOI: 10.1097/NCQ.0b013e318275ac3e

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With interruptions having a significant impact on medication administration, this article focuses on interruptions occurring during the medication administration process and a bundle of interventions that were used to reduce interruptions. The impact of these interventions on the number of reported medication errors is also discussed.

**PROBLEM**

On a cardiac and thoracic surgery step-down unit, a review of the patient safety reporting system indicated that medication events were an area for improvement. The safety reporting system is a voluntary reporting system that allows safety issues such as falls, medication errors, near misses, pressure ulcers, and other items that affect outcomes to be reported. With voluntary reporting systems, it is widely known that many errors are underreported because of concerns of discipline, lack of knowledge of an error, and time commitments, among other reasons.<sup>4</sup> In July 2010, 22 medication events were reported on the unit (Figure). This increase in reported medication events led the unit leadership to analyze the errors that had occurred during that month. Multiple incidents reported indicated that interruptions contributed to the potential unsafe medication events and errors.

**INTENDED IMPROVEMENT**

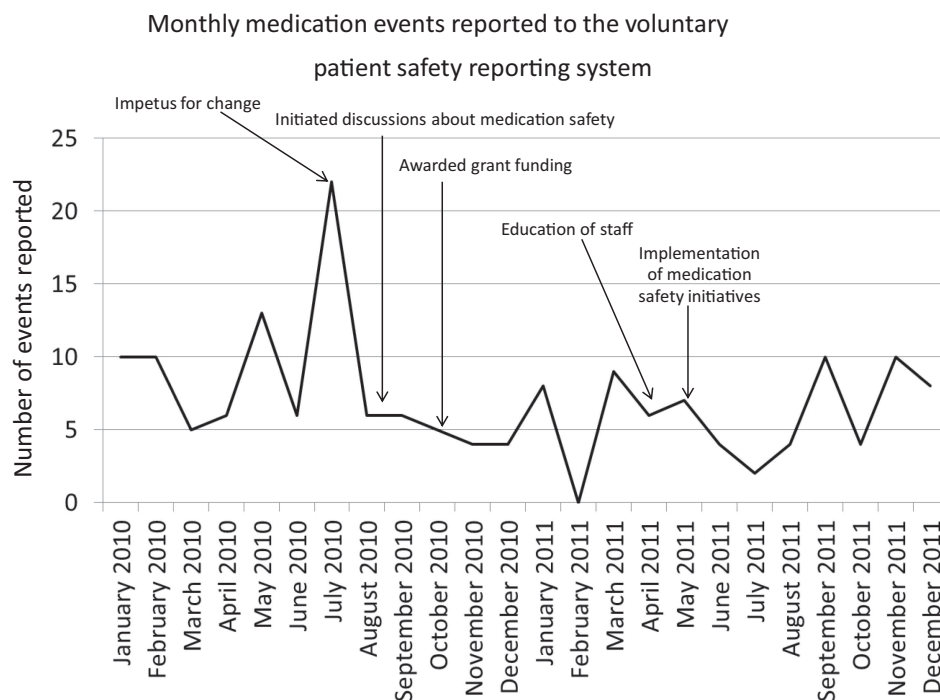
Unit nursing leadership, consisting of the manager, supervisor, clinical nurse specialist (CNS), and educational nurse coordinator, determined that a unit-focused initiative should center on medication safety. At each monthly staff meeting, unit leadership shared the number of reported medication events, types of errors, and contributing factors of the errors. Leadership sought input from staff nurses about ways to reduce interruptions to assist in decreasing the number of medication errors. The CNS reviewed the current literature to determine evidence-based practices to reduce interruptions during the medication administration process.

**Review of literature**

A current review of the literature focusing on medication errors, interruptions, distractions, and medication safety produced multiple concepts that have been implemented in studies to reduce interruptions during medication administration. Several studies indicated the importance of a vest, apron, sash, button, or other clothing item to indicate that the nurse was administering medications and should not be interrupted.<sup>5,6,8,10,12</sup> These studies found a reduction in interruptions after implementation of a selected item to indicate the nurse was administering medications.

In many hospital units, it is common to find the medication room used as the unit "water cooler" and the nurses treating it as a place to have casual conversation about their family, upcoming plans, or other personal information. Jennings et al<sup>2</sup> described medication rooms as "places of turbulence because of the high demand to use them."<sup>(p1447)</sup> Several articles described the concept of a "No Interruption Zone" used in the medication dispensing area. This is consistent with the sterile cockpit rule followed by the airline industry.<sup>10</sup> During the critical times of flight safety, such as taxi, takeoff, and landing, crew members do not engage in conversation unless it is focused on or required for the safety of the activity at hand.<sup>5,6,10</sup> Anthony et al<sup>10</sup> described the implementation of a No Interruption Zone leading to a reduction in interruptions when preparing medications in their study.

Conrad et al<sup>13</sup> described the layout and environment of the medication room and multiple interruptions and distractions that occurred during the retrieval of medications leading to errors. The goal of the study by Conrad et al was to modify the environment in the medication room to reduce harm and improve safety with medication administration. This was accomplished through medication room redesign and education of nursing staff about reducing interruptions.<sup>13</sup> This study also used the 7 rights of medication administration including patient, medication, route, dose, time, reason, and documentation.

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**Figure.** Medication event reports on the cardiac and thoracic surgery step-down unit.

Conrad et al<sup>13</sup> also included “double checks” of high-risk medications such as insulin, warfarin, and heparin. The outcomes of that study indicated a reduction in interruptions, decreased time to administer medications, and reduced errors.<sup>13</sup>

While the overall goal in many studies reviewed was to reduce interruptions, realistically in the hospital setting, there are many interruptions that cannot be eliminated. Jennings et al<sup>2</sup> referred to these as positive interruptions such as cardiac monitors, select pages and phone calls, emergency alarms, intravenous pumps, bed alarms, and ventricular assist device (VAD) alarms, among others.<sup>2</sup> Eliminating those interruptions or alarms could lead to adverse patient outcomes.

On the basis of the need to improve safety during medication administration and the findings from a review of the literature, a plan to reduce interruptions was created, which included the implementation of a bundle of

interventions. McCarron<sup>14</sup> defined a bundle of interventions as a group of interventions used in combination to enhance outcomes. With the overall goal to reduce medication errors by reducing interruptions during medication administration, the plan to implement a bundle of interventions included the following: (1) lighted lanyards worn by nursing staff during medication administration to indicate they should not be interrupted, (2) transitioning the medication room into a No Interruption Zone, (3) phone scripts for unit clerks to triage calls during peak medication administration times, (4) patient and family educational brochures provided on admission, (5) signs placed on each bedside table regarding medication safety, (6) electronic medication administration record (eMAR) review during nurse-to-nurse handoff, (7) a scripting card to encourage dialogue between nursing staff and patients and families to discuss medication safety and the purpose of the lighted lanyard, (8) letters to stakeholders, and (9)

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education of unlicensed assistive personnel (UAP) to round, answer call lights, and respond to alarms during peak medication administration times.<sup>8</sup>

**Study purpose**

The purpose of this quality project was to determine whether the implementation of a bundle of interventions would reduce interruptions during the medication administration process. The number of interruptions was determined through direct observation of medication administration both before and after the implementation of interventions. A secondary goal was to reduce the number of medication errors reported. The extent of medication errors was determined on the basis of the number of medication events reported to the patient safety reporting system each month.

**METHODS****Setting**

This project took place in a large academic medical center on a cardiac and thoracic step-down unit comprised of 36 beds with telemetry monitoring. The unit patient population consists of patients following open-heart, lung, and esophageal surgical procedures. Other patient populations include patients with heart and lung transplants and VADs. The unit has both private and semiprivate rooms. The semiprivate rooms are reserved for individuals with less invasive surgical procedures and those who do not require contact precautions or have a newly transplanted organ. The semiprivate rooms lend an opportunity for more interruptions due to the layout and need for multiple providers, family members, and visitors to enter and exit the room throughout each shift.

Nurses care for 3 patients during the day and evening shifts and 4 patients during the night shift with the assistance of 4 UAP during the day and evening shift and 2 on the night shift. Many of the patients with transplants and VADs require considerable amounts of

medications, at times up to 20 or more medications, to be administered at multiple intervals throughout the day. Hospital data indicate that this unit had the highest number of medication doses dispensed of all 35 adult and pediatric inpatient units in this institution. During a 1-month time period, more than 25 000 medication doses were dispensed to the cardiac and thoracic surgery unit. Unit leadership, physician colleagues, and other members of the health care team were notified of the plan to focus on improving quality measures during medication administration and rationale for this project prior to initiation.

**Planning the intervention**

The Plan, Do, Check, Act (PDCA) method was used to construct and implement this quality improvement project. The PDCA model includes 4 distinct phases.<sup>15</sup> After identification of the problem, the "plan" phase was used to review the current literature to determine potential interventions that could be used. As stated previously, the problem identified by nursing leadership was the increased number of monthly medication errors reported (Figure). Further analysis showed that interruptions contributed to many medication errors, and the plan needed to include ways to reduce interruptions during medication administration. For this project, interruptions were defined as an event that occurred in the surrounding area that averted the nurses' concentration away from the primary focus of safely administering medication.<sup>8,9</sup> As noted previously, the research indicated a bundle of safety interventions that could be used to reduce interruptions and medication errors. To provide a better understanding of each part of the bundle of interventions, each component is discussed in more detail.

***Lighted lanyards***

The concept of a lighted lanyard to be worn at all times, but lighted when administering medications, was taken in part from previous quality improvement studies. The lighted lanyard was effective in indicating that

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the nurse was administering medications and should not be interrupted. The nursing staff were queried via e-mail, staff meetings, and interviews about different items that could be used to indicate that the nurse should not be interrupted while administering medications. Suggestions given to staff for discussion included vest, hat, sash, lighted lanyard, and lighted armband. Staff indicated that the least intrusive item was the lighted lanyard.

The lanyard was a red, lighted "necklace" with a badge holder clip that was activated by pressing a button. When nurses entered the medication room to prepare medications, they turned on their lanyard, indicating that they were in the process of administering medication and should not be interrupted. The nurses obtained the medications and completed verification with the eMAR in the medication room. They then proceeded from the medication room to the patient room with their lanyard lighted. The nurses then logged on to the eMAR in the patient's room and identified the patient using 2 identifiers, for example, name and birth date, according to policy.<sup>16</sup> The nurse completed a double check of the 5 rights of medication administration including right patient, medication, dose, route, and time; provided the patient with the medications as well as education about them; documented the medications administered on the eMAR; and then turned off the lanyard as the medication administration process was completed.

***No Interruption Zone***

Nursing leadership acknowledged the need to include a No Interruption Zone in the medication room. Transitioning the medication room into a No Interruption Zone was a cultural change for the nursing staff on the unit, as this was many times a place of casual conversation.<sup>6,10</sup> Signs were hung in the medication room, and staff were educated about the importance of focusing on the process of medication administration and removing the casual conversation from the medication room.<sup>8,10</sup> Questions related to the medication administration process were considered

necessary conversation, but other discussions were to be avoided while in the medication room. Leadership observed staff while in the medication room and provided real-time feedback to ensure that there was compliance with the No Interruption Zone.

***Clerk triage of phone calls and pages during peak medication times***

One continued interruption observed during medication administration was pages and phone calls to the nursing staff. The clerks were educated about this quality improvement process and were provided phone scripts to assist in triaging calls during peak medication administration times of 8:00 to 10:00 in the morning and evening.<sup>1,3,4,10</sup> During this time, if the call was routine, the clerk would take a message or ask for the call to be returned after peak hours. If it was an emergency, the clerk would then page the nurse.<sup>1</sup>

***Patient and family education***

The unit admission brochure was updated by the unit Patient and Family Centered Care Committee. An insert was placed in the brochure to provide the patient and family with information about the goals of improving safety and the impact interruptions have on the medication administration process.<sup>12</sup> Signs were placed on each bedside tray table by environmental services staff after they had finished cleaning the discharged rooms. The signs described the peak medication times and use of the lighted lanyards on the unit.

***eMAR review***

eMAR review was included during nurse-to-nurse handoff. The oncoming nurses would pull up the eMAR for each of their patients and review it with the off-going nurse to ensure that all medications had been administered and charted. This review of the eMAR allowed for communication and a process for questions and resolution of medication discrepancies. This review also assisted in reducing the need to stop during the medication administration process to rectify discrepancies



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of prior medications that were or should have been administered.

### ***Scripting cards***

A scripting card to encourage dialogue between nursing staff and patients and families to discuss medication safety and the purpose of the lighted lanyard was created and provided to each nursing staff member.<sup>1,6</sup> The nurses started the conversation with an explanation about medication safety being a priority and that the lighted lanyard was worn to indicate they should not be interrupted, if at all possible, while administering medications. The nurses would then explain that they would address the individual's concerns once they had completed the process of medication administration unless it was an emergency.

### ***Multidisciplinary communication/education***

Discussion with the primary teams including the cardiac and thoracic physician assistants ensued before finalizing plans for implementation. This discussion helped to determine whether there were concerns or suggestions from the multidisciplinary team members who were present on the unit at all times. Letters were sent to all stakeholders describing the interventions that would be implemented on the unit to improve medication safety. The letter included statistics related to the outcomes of medication errors including death and financial implications. Also included were ways to assist the unit with improving medication safety such as supporting the nurses while they were administering medications, not interrupting them, holding off on paging the nurses during peak medication administration times, and advocating for safety on the unit. The stakeholder group was large in this case. When determining all providers and health care employees who interacted with a patient during a typical day, it was decided that a multitude of disciplines would need to be included. The informational letter went to nursing and physician leadership and staff, UAP, nutritionists, physical and occupational therapists, transporters,

discharge planners, social workers, VAD coordinators, clerical staff, and others.<sup>10</sup>

### ***UAP rounding and responding to alarms***

Acknowledging that some interruptions are considered positive interruptions, a plan was created to provide education to the UAP to ensure that they were available on the unit to answer call lights, respond to alarms, and assist patients and families during peak medication administration times. The UAP also rounded on the unit while the nursing staff were administering medications. This collaboration from the UAP and fellow nursing colleagues also helped to promote a culture of teamwork and safety on the unit.<sup>7</sup>

### ***Planning the study***

In October 2010, a Fostering Innovation Grant was awarded to the unit to assist in funding the planned interventions. A Fostering Innovation Grant is a facility-sponsored source to promote innovative improvements in the health care system. This grant helped to purchase the lighted lanyards, patient and family brochures, and bedside signs used for the project.

A data collection tool similar to the Medication Administration Distraction Observation Sheet used by Pape<sup>5</sup> in her study was created to tabulate the number and types of interruptions and to track whether the nurse followed the 5 rights of medication administration. The data collection tool questions included the following: (1) Was the nurse interrupted during medication administration process? and (2) What was the source of the interruption and the number of interruptions? Selections included physician, physician assistant, nurse, UAP, call light, monitor, phone, pager, patient or family, and other. Intravenous push medication interruptions were separated from oral and tube-administered medications, as a previous study by Trbovich et al<sup>9</sup> indicated that nurses were interrupted a minimum of once every time they administered this type of medication, but many times they were interrupted more often.

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Direct observations were conducted by the CNS and the supervisor during preparation and administration of medications prior to the implementation of the bundle of interventions. These observations were conducted during the day, evening, and night shifts on weekdays and weekends to provide a baseline for the average number of interruptions during the medication administration process. The process of medication preparation and administration entailed monitoring the nurse from entry into the medication room, during the process of obtaining medications, traveling to the patient's room, performing the rights of medication administration, administering the medications, providing education, and documenting the administration. Interrater reliability was determined by completing several observations using the data collection tool simultaneously and discussing the outcomes. Interruptions were documented via a slash mark on the tool indicating what or who caused the interruption.<sup>5</sup>

**“Do” phase of PDCA**

Once interventions to reduce interruptions were determined in the planning phase, staff were then educated and the interventions were implemented in the “do” phase of the PDCA cycle. In May 2011, the bundle of interventions to reduce interruptions during medication administration was implemented. Education of the nursing staff consisted of the rationale for change including information about the increased number of medication errors related to interruptions. Information about when and how to use the lighted lanyards as well as education about all the other interventions was also provided to the staff. “Super users” were selected on both shifts. The unit leadership and nursing unit practice council, as well as advanced level nurses on the unit, educated the nursing staff.<sup>4</sup>

**“Check” phase of PDCA**

To determine whether the interventions were successful in reducing interruptions, “checks” were completed by observing the number of interruptions during the medica-

tion preparation and administration process before and after the implementation of the bundle of interventions. After education and implementation, the nursing staff were given 1 month to integrate the new process into their workflow. After this period, the same data collection tool was used again by the CNS and the supervisor to conduct direct observations to identify the number and types of interruptions. These observations were completed on all shifts, during different days of the week, observing varied staff to collect the number of interruptions that occurred. Who or what caused the interruption was also collected post implementation. Data were also abstracted from the voluntary patient safety reporting system to determine the number of reported medication errors during the postimplementation period.

**Analysis**

Descriptive frequencies were used to analyze the impact of the interventions on interruptions during medication preparation and administration. No additional variables were analyzed or controlled for during this project's analysis. Based on the number of direct observations, the sample size was not large enough to determine statistical significance.

**RESULTS**

Over a 1-month period prior to the initiation of this quality improvement project, 59 direct observations of medication preparation and administration were conducted. Of the 59 observations, 194 interruptions occurred, with an average of 3.29 interruptions occurring during a medication administration encounter (Table 1). The number of interruptions ranged from 0 to 11 during these medication administration observations. The leading causes of interruptions that were observed during medication administration prior to the initiation of interventions were (1) patients ( $n = 64$ ), (2) nurses ( $n = 56$ ), and (3) family members ( $n = 40$ ) (Table 2).

After implementation of the bundle of interventions to reduce interruptions, there were



**Table 1.** Interruptions Pre- and Postimplementation of Bundle of Interventions

Time of Observations	No. Obs	Total No. Int <sup>a</sup>	Average No. Int <sup>a</sup>	No. IVP Meds <sup>a</sup>	No. Int During IVP Med Adm	Average No. Int During IVP Med Adm
Preinterventions	59	194	3.29	14	19	1.36
Postinterventions	40	47	1.18	4	5	1.25

Abbreviation: IVP, intravenous push. Obs, observations. Int, interruptions. Meds, medications. Adm, administration.

<sup>a</sup>During observed medication administration.

40 direct observations of medication preparation and administration conducted. Of the 40 observations, 47 interruptions occurred. There was an average of 1.18 interruptions during a medication administration encounter (Table 1). The number of interruptions ranged from 0 to 7 during these postintervention medication administration observations. After the implementation of the bundle of interventions to reduce interruptions, the top 3 causes of interruptions were (1) patients ( $n = 17$ ), (2) nurses ( $n = 15$ ), and (3) pagers ( $n = 6$ ) (Table 2). One interesting finding was that no family interruptions occurred during any of the 40 observations after implementation of the bundle of interventions. Prior to the project, family members had been the third leading cause of interruptions.

Monthly data of reported medication errors indicated a decrease in the number of reported events during the months after implementation of the bundle of interventions. Over a 3-month period postimplementation, reported medication errors were reduced by 28 events when compared with the same time period in the previous year. Before implementing the bundle of interventions, 41 medication errors were reported; only 13 medication errors were reported postimplementation (Figure).

## DISCUSSION

### “Act” phase of PDCA

This quality improvement project found that interventions such as lighted lanyards,

limiting pages and phone calls during peak medication administration times, a No Interruption Zone, patient and family education and information, multidisciplinary collaboration, and education can reduce interruptions during medication administration. In the “act” phase, this bundle of interventions, used in successfully reducing interruptions, was shared with other stakeholders in the health care system through poster and oral presentations as well as locally at multiple conferences. Other units in the health care system are working toward incorporating these interventions into their medication administration practices.

Following implementation of this bundle of interventions, the number of interruptions decreased and the number of medication errors reported also declined. Although interruptions were decreased in the overall process of medication administration, only a minimal reduction was noted during the administration of intravenous push medications. This could be in part due to the small number of observations of IVP medication administrations.

Success of this quality improvement project was strengthened by cohesive leadership teamwork and multidisciplinary support. The use of the PDCA process provided a standardized foundation to plan and implement the process. Anecdotal reports based on unsolicited feedback indicated that the medication room was much quieter than before implementing the No Interruption Zone. Staff stated that they placed more importance on the process of medication administration and keyed into observing when others were

*Reducing Interruptions to Improve Medication Safety* 9**Table 2.** Leading Causes of Interruptions Observed During Medication Administration

Cause of Interruptions	Patients	Nurses	Family	Pagers
Preinterventions	64	56	40	12
Postinterventions	17	15	0	6

administering medications, which assisted to reduce interruptions. Other reports from nurses indicated how patients assisted in protecting the process of medication administration. Several patients asked other staff members including physicians and transporters not to interrupt the nurses when they were administering medications.

Nguyen et al<sup>1</sup> studied a “medication pass time-out” that included similar interventions as this quality improvement project. They found that medication errors were reduced by 50% and doses of medication administered without interruptions increased from 81% to 99% after a medication pass time-out was implemented. Pape<sup>5</sup> found that nurses wearing medication safety vests had fewer interruptions and distractions than other groups observed. The results of both of these studies are consistent with what was found in this quality improvement project.

Other studies have found that nursing colleagues were the primary source of interruptions during medication administration, followed by patients, alarms, and family members.<sup>6,9,12</sup> These findings are similar to the observations in this project. Pape et al<sup>8</sup> found physicians, nurse practitioners, physician assistants, visitors, and other personnel, as well as external conversations, led to higher mean scores of distractions than other nursing staff prior to their intervention. Relihan et al<sup>12</sup> found that physician interruptions were low both pre- and postintervention, which is consistent with our findings.

### Limitations

The setting in which this project was conducted limits the generalizability of the findings to other settings. Implementing these interventions in other units and health systems

would assist in determining whether the interventions are effective across settings. Differences in staffing ratios may also limit the ability to generalize these results to other settings. The use of a convenience sample of nursing staff administering medications is also a limitation. The nurses selected happened to be administering medications at the time when observations were conducted. The act of being observed during medication administration could cause a Hawthorne effect and thus be a limitation of this project. Observers attempted to limit interactions with the nurse and the patient who were being observed until after the medication administration process was completed to minimize the Hawthorne effect.<sup>5,12</sup>

As with many quality improvement projects, the change process begins with great enthusiasm. Nursing staff started out with buy-in and adherence to the new process. Over time, though, sustaining the use of lighted lanyards decreased, leading to another potential limitation of this project. Other interventions were considered less intrusive than the use of the lanyard and were more readily adhered to than it was. Over time, the No Interruption Zone has also gradually transitioned back to the “water cooler” of the unit, but continued reminders assist to keep the focus on medication safety. Unit leadership encouraged staff by providing data about interruptions and medication errors during staff meetings. The unit plans to continue education, reminders, and auditing to ensure continued medication safety.

### CONCLUSIONS

Medication safety and the reduction of errors are at the forefront of many initiatives

nationally. Implementing interventions to reduce interruptions can improve medication safety in the hospital setting. This project's outcomes indicated that implementing a bundle of interventions directed at reducing interruptions was successful in decreasing interruptions. This reduction may also have contributed to the decline in reported medication errors. While this study's design and sample size were inappropriate to determine statistical significance, we believe that the findings are clinically significant and provide relevance to implementation in other settings.

Funding and staff buy-in are 2 barriers to continued use of some of these interventions. With the cost of the lighted lanyards more than US \$5 each, the inability to change the batteries, and the short life span of these lanyards, the funded supply was quickly used, and funding could not be obtained to secure more. Nursing staff provided unsolicited feedback about having to wear the lanyards, in-

cluding concerns of waking patients during the night shift and not feeling comfortable with the lanyard lighted; some nurses refused to continue to wear the lanyards.

Other interventions such as decreasing patient-to-nurse ratios, electronic medication order entry, smart pumps technology, bar coding, computerized order entry, and automated medication dispensing cabinets have also been found to reduce errors and improve safety during medication administration.<sup>6,10</sup> The importance of using the 5 rights of medication administration and critical thinking are essential to the medication administration process. Further research on other measures to reduce interruptions during medication administration and application of these interventions to other settings are needed to expand the available evidence. Multiple studies in the literature focus on the causes of interruptions, but more research is needed to determine the usefulness of interventions to reduce interruptions.

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