Medication Administration:

Interruptions in a Rural Hospital and Evaluation of a Red Light Intervention

Trina Aguirre, PhD, RN [1]

Susan Wilhelm, PhD, RNC [2]

Susan Backer, MSN, APRN-CNS, ACNS-BC [3]

Susan Schoeneman, MSN, APRN-NP, AOCNP [4]

Ann Koehler, MS [5]

[1] College of Nursing, Assistant Professor, taguirre@unmc.edu

[2] College of Nursing, Assistant Professor & Assistant Dean, West Nebraska Division

slwilhel@unmc.edu

[3] Regional West Medical Center, CNS Patient Care Division, susan.backer@rwhs.org

[4] Regional West Medical Center, susan.schoeneman@rwmc.net

[5] University of Nebraska Medical Center, ann.koehler@unmc.edu

Abstract

Purpose: This study was conducted to determine the prevalence and types of interruptions nurses experience during the peak medication administration period (weekdays 7:00 AM-9:00 AM) at a rural regional hospital and to evaluate the effectiveness of a red light intervention to reduce interruptions.

Sample: Participants were a convenience sample of registered nurses who agreed to be observed administering medications. The same nurses were observed during both phases of the study. **Methods:** This study employed a prospective exploratory design. The same observation procedures were used during both phases of the study. During each 2-hour observation period, each participating nurse was accompanied by two observers who recorded all interruptions. During the intervention, a small flashing red light was attached to the medication administration computer. When turned on it served as a signal to avoid interruptions. Educational flyers were distributed to staff, physicians, patients, and visitors to inform them about the meaning of the light.

Findings: Average interruptions per 2-hour medication administration period dropped from an average of 7.2 during baseline to 3.0 during the red light intervention. The top two source of interruptions during both phases were other personnel and not having needed medical supplies/equipment, though the rankings were reversed. The relative prevalence of interruptions caused by other personnel declined from 27.6% (baseline) to 21.8% (intervention).

Conclusions: The major categories of interruptions at this rural regional acute care hospital were similar to those identified in studies in urban settings. The red light intervention effectively reduced the average number of interruptions per 2-hour period and reduced the incidence of interruptions caused by other personnel. The prevalence of interruptions due to missing supplies/equipment remained high and should be addressed by implementing procedures to ensure that carts are appropriately stocked.

***Keywords*:** Medication administration, Interruptions, Rural

Medication Administration:

Interruptions in a Rural Hospital and Evaluation of a Red Light Intervention

Nurses play an essential role in patient safety and the safe administration of medications. Acute care nursing is demanding, unpredictable, fast-paced, and requires the ability to make clinical decisions while managing care for a group of patients. This includes adapting to technological changes and frequent distractions and interruptions while attending to the needs of patients, families, physicians and other staff, admissions/discharges, and patient education, all while administering medications (Jennings, Sandelowski, & Mark, 2011; Kalisch & Aebersold, 2010; Redding & Robinson, 2009; Westbrook, Woods, Rob, Dunsmuir, & Day, 2010).

This work environment creates conditions conducive for errors to occur. There is growing interest in understanding the role of interruptions in medical errors, particularly medication errors which are the third most frequent cause of unintentional harm (Institute of Medicine [IOM], 2006). Interruptions and distractions may be a contributing factor (Kreckler, Catchpole, Bottomley, Handa, & McCulloch, 2008; Thomson et al., 2009) with increased frequency of interruption associated with greater incidence (Scott-Cawiezell et al., 2007; Westbrook et al., 2010) and severity (Westbrook et al., 2010) of errors. Though these relationships are complex and not yet well understood (see reviews in Biron, Loiselle, & Lavoie-Tremblay, 2009; Grundgeiger & Sanderson, 2009; Hopkinson & Mowinski Jennings, 2013; Raban & Westbrook, 2013), reducing interruptions is often suggested as a means of reducing the potential for errors (Biron, Loiselle & Lavoie-Tremblay, 2009; Kliger, Blegen, Gootee, & O'Neil, 2009; McGillis Hall, Ferguson-Pare et al., 2010; McLean, 2006). Efforts to reduce the incidence or effects of interruptions include establishing "no interruption" times or areas during medication administration (Anthony, Wiencek, Bauer, Daly, & Anthony, 2010; Nguyen, Connolly, & Wong,

2010) and use of checklists and/or visual cues (vests, signage, aprons, lights) (Kliger, Singer, Hoffman, & O'Neil, 2012; Pape, 2003; Pape et al., 2005; Relihan, O'Brien, O'Hara, & Silke, 2010).

Purpose

The purpose of this study was to determine the prevalence and types of interruptions nurses experience during the peak medication administration period (weekdays 7:00 AM-9:00 AM) at a rural hospital and to evaluate the effectiveness of a red light intervention to reduce interruptions.

Methods

Setting

This study was conducted in a medical oncology unit of a fully accredited regional acute care hospital that serves the rural Nebraska Panhandle and portions of South Dakota, Wyoming, and Colorado. The Nebraska Panhandle is 14,180 sq. miles in area with a population of 87,000, having an average of 6 people per sq. mile. Scotts Bluff County, where the hospital is located encompasses 739 miles with a population of 36,000 for an average of 50 persons per square mile (United States Census Bureau, 2014). Compared to states averages, people living in Scotts Bluff County tend to be older (17.1% vs 14.1% ≥ age 65), more are Hispanic (22.6% vs 9.9%), and more live below the poverty level (15.1% vs. 12.4%) (United States Census Bureau, 2014).

Experimental Design

This study employed a prospective exploratory design. Baseline observations were conducted (Fall 2011) to determine the frequency and types of interruptions registered nurses experience during the peak medication administration period (weekdays 7:00 AM-9:00 AM). Subsequently (Spring 2012) the same observation procedures were used to evaluate the

effectiveness of using a red light intervention to decrease interruptions during medication administration. IBM® SPSS® Statistics Version 22 was used to determine descriptive statistics.

Participant sample

Participants were a convenience sample of registered nurses who agreed to be observed administering medications. The same nurses were observed during both the baseline and intervention phases of the study. Informed consent was obtained through letters of invitation for the baseline portion of the study and through written consent for the intervention portion of the study. No individually identifying information was collected. Patients receiving medication were not consented because medication administration was part of their normal care and observers did not enter patient rooms. This study was conducted under IRB approval (#459-11-EX) from the University of Nebraska Medical Center and Regional West Medical Center.

Medication Administration

This hospital uses electronic medical records (EMR) and barcoded patient wristbands and medication labels to help ensure that the appropriate medications are administered. Patient records were accessed using a laptop on a cart that was rolled to the patient rooms as needed. The cart also provided storage for non-medicine medical supplies. The pharmacy stocked patient medicines (pill form) in locked medicine boxes attached to the wall outside each patient room. Highly regulated medicines (e.g. opiates) were dispensed using a Pyxis® MedStation system that was kept in a room in the core of the nursing unit behind the nursing desk. IV equipment was also stored in this room. For the purpose of this study, medication administration was defined as beginning when the nurse checked the patient's record on the computer, continuing through the verification and preparation steps, and ending when the nurse finished administering the medicines to the patient.

Interruptions

Interruptions were defined as anything that disrupted the nurse's focus on or caused a break in the task she/he was performing. The principle (PI) and co-principle (Co-PI) investigators categorized the interruptions following the observations.

Observation Period

Observations were conducted weekdays from 7:00 AM to 9:00 AM. Within this period, interruptions were recorded during medication administration for each patient individually as described above. Activities occurring after administering medication to one patient, but before beginning medication administration to the next patient were not included.

Observation Procedures

The PI and Co-PI's provided orientation for the nurses and trained the observers before observations began. Nurses were instructed to conduct business as usual as though the observers were not present. Observers stayed 5-10 feet away from the nurses during observations and did not interact with the nurses or go into patient rooms. During each 2-hour observation period, each participating nurse was accompanied by two observers. Each observer recorded all interruptions, one using an audio recorder and the other recording her/his observations in writing. Both recorded and written observations were transcribed to determine the frequency and type of interruptions. To address inter-rater reliability, only interruptions recorded by both observers were included in the statistical analysis. A possible limitation of this approach is that persons who know they are being observed may behave differently than those who are unaware of observation (the Hawthorne Effect) (McCarney et al., 2007).

Intervention procedures

The intervention consisted of a small inexpensive battery-operated flashing red light that was clipped to the medication administration computer. The nurse turned the light on during medication administration as a signal to avoid interruptions. Educational flyers were distributed to staff, physicians, patients, and visitors to inform them about the meaning of the light. This effort was reinforced through informational meetings and emails for staff and physicians and supportive scripting for nurses and admissions personnel.

Results

Average interruptions per 2-hour medication administration period dropped from an average of 7.2 during baseline to 3.0 during the red light intervention. Table 1 lists the relative prevalence (%) of different types of interruptions in descending order for each phase (baseline and intervention) of the study. The top source of interruptions during the baseline period was other personnel, including technical assistants (TA's), certified nursing assistants (CNA's), and housekeeping and dietary personnel. Though still a substantial source of interruptions, this category dropped to second place during the invention phase (Table 1). The other major source of interruption (second place baseline, first place intervention) was not having needed medical supplies/equipment in the cart (Table 1). During baseline, medication administration was also interrupted fairly often when nurses stopped to stock patient supplies unrelated to the patient's medications, or to respond to questions from student nurses (miscellaneous category) (Table 1). In contrast, the third place source of interruptions during the intervention phase was the administering nurse initiating conversations unrelated to the medications (Table 1).

Table 1

Sources of Interruption at Baseline and During Intervention

Baseline (Fall 2011)		Intervention (Spring 2012)	
Source of interruption	%	Source of interruption	%
Other personnel[1]	27.6	Medical equipment not available	24.8
Medical equipment not available	19.5	Other personnel[1]	21.8
Miscellaneous[2]	12.2	Nurse non-medication conversation	11.2
Patient	8.9	Physician	7.3
Staff nurse	8.1	Staff nurse	7.3
Other patient	5.7	Phone calls	6.3
Physician	4.9	Medication not in box	5.8
Visitor	3.3	Visitor	4.9
Nurse Knowledge	3.3	Patient	3.4
Nurse non-medication conversation	1.6	Other patient	2.9
Equipment failure[3]	1.6	Equipment failure[3]	1.9
Medication not in box	1.6	Miscellaneous[2]	1.0
Phone calls	0.8	Nurse Knowledge	1.0
Emergency (code)	0.8	Emergency (code)	0.5

[1] TA's, CNA's, housekeeping, dietary

[2] stocking non-medication patient supplies, questions from student nurses

[3] laptop, pump, Pyxis®, etc.

http://dx.doi.org/10.14574/ojrnhc.v15i2.327

Discussion

This study demonstrated that a simple visual cue can be used to reduce the number of interruptions during medication administration. Similarly, (Anthony et al., 2010) reported a 40.9% reduction in interruptions using a "no interruption zone" outlined in red. We did not evaluate whether this intervention led to changes in medication error rates. Also unknown is whether this intervention would be sustainable over time or whether people would habituate to the presence of the light.

Similar to the findings of others, personnel (McGillis Hall, Pedersen, & Fairley, 2010; McGillis Hall, Ferguson-Pare et al., 2010; Redding & Robinson, 2009) and missing supplies/equipment (Biron, Lavoie-Tremblay, & Loiselle, 2009; McGillis Hall, Pedersen, et al., 2010; Palese, Sartor, Costaperaria, & Bresadola, 2009; Redding & Robinson, 2009) were the most common sources of interruptions, and at times nurses interrupted medication administration themselves (Biron, Loiselle, et al., 2009; McGillis Hall, Pedersen, et al., 2010; Relihan et al., 2010). As expected, the impact of this visual intervention was primarily observed in sources of interruptions involving face-to-face interactions. For example, the percentage of interruptions attributed to other personnel declined during the intervention, whereas the percentage attributed to missing supplies/equipment increased. The latter can be reduced by implementing procedures to ensure that the carts are properly stocked.

The rural setting may have contributed to the prevalence of interruptions due to personnel, colleagues, and the nurses themselves observed in this study. Rural culture encourages being friendly and personable. In addition, in rural communities it is not uncommon for people to know each other outside of the workplace and/or to be related to each other (Bradley, Werth & Hastings, 2012). These attributes make it easy to initiate or become involved in conversations.

Educational efforts may be needed to increase awareness of the importance of avoiding unnecessary conversations during medication administration.

Interruptions will never be eliminated from healthcare, and some are necessary. Though infrequent during this study, there were instances where a nurse needed to stop to get additional information to properly administer a medication (nurse knowledge) or to respond to an emergency code.

Understanding the relationship between interruptions and medical errors continues to evolve. There is still much to learn about the contexts where interruptions are likely to have adverse consequences, the mechanisms involved, the effectiveness of coping strategies, etc. (Biron, Loiselle, et al., 2009; Grundgeiger & Sanderson, 2009; Hopkinson & Jennings, 2013; Raban & Westbrook, 2013).

Conclusions

We explored the frequency and types of interruptions during medication administration at a regional acute care hospital in rural western Nebraska and evaluated the efficacy of a red light intervention. The major categories of interruptions were similar to those identified in studies in urban settings. The red light intervention effectively reduced the average number of interruptions per 2-hour period from 7.2 to 3.0. In addition, the relative prevalence of interruptions caused by other personnel declined from 27.6% to 21.8%. The prevalence of interruptions due to missing supplies/equipment remained high and should be addressed by implementing procedures to ensure that carts are appropriately stocked.

Supporting Agencies

Regional West Medical Center

References

Anthony, K., Wiencek, C., Bauer, C., Daly, B., & Anthony, M. K. (2010). No interruptions please: Impact of a no interruption zone on medication safety in intensive care units. *Critical Care Nurse, 30*(3), 21-29. http://dx.doi.org/10.4037/ccn2010473

Biron, A. D., Lavoie-Tremblay, M., & Loiselle, C. G. (2009). Characteristics of work interruptions during medication administration. *Journal of Nursing Scholarship, 41*(4), 330-336. http://dx.doi.org/10.1111/j.1547-5069.2009.01300.x

Biron, A. D., Loiselle, C. G., & Lavoie-Tremblay, M. (2009). Work interruptions and their contribution to medication administration errors: An evidence review. *Worldviews on Evidence-Based Nursing, 6*(2), 70-86. http://dx.doi.org/10.1111/j.1741-6787.2009.00151.x

Bradley, J., Werth, Jr. J., & Hastings, S. (2012). Social justice advocacy in rural communities: Practical implications and issues. *The Counseling Psychologist, 40* (3), 363-384. http://dx.doi.org/10.1177/0011000011415697

Grundgeiger, T., & Sanderson, P. (2009). Interruptions in healthcare: Theoretical views. *International Journal of Medical Informatics, 78*(5), 293-307. http://dx.doi.org/10.1016/j.ijmedinf.2008.10.001

Hopkinson, S. G., & Jennings, B. M. (2013). Interruptions during nurses' work: A state-of-the-science review. *Research in Nursing & Health, 36*(1), 38-53. http://dx.doi/org/10.1002/nur.21515

Hopkinson, S. G., & Mowinski Jennings, B. (2013). Authors' response to the letter to RINAH editor: Interruptions are significantly associated with the frequency and severity of medication errors. *Research in Nursing & Health, 36*(2), 117-119.

Institute of Medicine. (2006). IOM report: The future of emergency care in the United States health system. *Academic Emergency Medicine, 13*(10), 1081-1085. http://dx.doi.org/10.1197/j.aem.2006.07.011

Jennings, B. M., Sandelowski, M., & Mark, B. (2011). The nurse's medication day. *Qualitative Health Research, 21*(10), 1441-1451. http://dx.doi.org/10.1177/1049732311411927

Kalisch, B. J., & Aebersold, M. (2010). Interruptions and multitasking in nursing care. *Joint Commission Journal on Quality and Patient Safety / Joint Commission Resources, 36*(3), 126-132.

Kliger, J., Blegen, M. A., Gootee, D., & O'Neil, E. (2009). Empowering frontline nurses: A structured intervention enables nurses to improve medication administration accuracy. *Joint Commission Journal on Quality and Patient Safety / Joint Commission Resources, 35*(12), 604-612.

Kliger, J., Singer, S., Hoffman, F., & O'Neil, E. (2012). Spreading a medication administration intervention organization wide in six hospitals. *Joint Commission Journal on Quality and Patient Safety / Joint Commission Resources*, 38(2), 51-60.

Kreckler, S., Catchpole, K., Bottomley, M., Handa, A., & McCulloch, P. (2008). Interruptions during drug rounds: An observational study. *British Journal of Nursing, 17*(21), 1326-1330. http://dx.doi.org/10.12968/bjon.2008.17.21.31732

McCarney R, Warner J, Iliffe S, van Haselen R, Griffin M, Fisher P; Warner; Iliffe; Van Haselen; Griffin; Fisher (2007). "The Hawthorne Effect: A randomised, controlled trial". *BioMedCentral Medical Research Methodologies 7*(30). http://dx.doi.org/10.1186/1471-2288-7-30

McGillis Hall, L., Ferguson-Pare, M., Peter, E., White, D., Besner, J., Chisholm, A., . . . Hemingway, A. (2010). Going blank: Factors contributing to interruptions to nurses' work and related outcomes. *Journal of Nursing Management, 18*(8), 1040-1047. http://dx.doi.org/10.1111/j.1365-2834.2010.01166.x

McGillis Hall, L., Pedersen, C., & Fairley, L. (2010). Losing the moment: Understanding interruptions to nurses' work. *The Journal of Nursing Administration, 40*(4), 169-176. http://dx.doi.org/10.1097/NNA.0b013e3181d41162

McLean, D. (2006). Medicines administration rounds can be led by pharmacy technicians. *Pharmacy in Practice, 16*(1), 19-23.

Nguyen, E. E., Connolly, P. M., & Wong, V. (2010). Medication safety initiative in reducing medication errors. *Journal of Nursing Care Quality, 25*(3), 224-230. http://dx.doi.org/10.1097/NCQ.0b013e3181ce3ae4

Palese, A., Sartor, A., Costaperaria, G., & Bresadola, V. (2009). Interruptions during nurses' drug rounds in surgical wards: Observation goal study. *Journal of Nursing Management, 17*(2), 185-192. http://dx.doi.org10.1111/j.1365-2834.2007.00835.x

Pape, T. M. (2003). Applying airline safety practices to medication administration. *Medsurg Nursing, 12*(2), 77-93; quiz 94.

Pape, T. M., Guerra, D. M., Muzquiz, M., Bryant, J. B., Ingram, M., Schranner, B., . . . Welker, J. (2005). Innovative approaches to reducing nurses' distractions during medication administration. *Journal of Continuing Education in Nursing, 36*(3), 108-16; quiz 141-2.

Raban, M. Z., & Westbrook, J. I. (2013). Are interventions to reduce interruptions and errors during medication administration effective?: A systematic review. *BMJ Quality & Safety*, http://dx.doi.org/10.1136/bmjqs-2013-002118

Redding, D. A., & Robinson, S. (2009). Interruptions and geographic challenges to nurses' cognitive workload. *Journal of Nursing Care Quality, 24*(3), 194-200; quiz 201-202. http://dx.doi.org/10.1097/01.NCQ.0000356907.95076.31

Relihan, E., O'Brien, V., O'Hara, S., & Silke, B. (2010). The impact of a set of interventions to reduce interruptions and distractions to nurses during medication administration. *Quality & Safety in Health Care, 19*(5), e52. http://dx.doi/org/10.1136/qshc.2009.036871

Scott-Cawiezell, J., Pepper, G. A., Madsen, R. W., Petroski, G., Vogelsmeier, A., & Zellmer, D. (2007). Nursing home error and level of staff credentials. *Clinical Nursing Research, 16*(1), 72-78. http://dx.doi.org/10.1177/1054773806295241

Thomson, M. S., Gruneir, A., Lee, M., Baril, J., Field, T. S., Gurwitz, J. H., & Rochon, P. A. (2009). Nursing time devoted to medication administration in long-term care: Clinical, safety, and resource implications. *Journal of the American Geriatrics Society, 57*(2), 266-272. http://dx.doi/org/10.1111/j.1532-5415.2008.02101.x

United States Census Bureau (2014). Quick facts. Retrieved from http://quickfacts.census.gov/qfd/states/31/31157.html .

Westbrook, J. I., Woods, A., Rob, M. I., Dunsmuir, W. T., & Day, R. O. (2010). Association of interruptions with an increased risk and severity of medication administration errors. *Archives of Internal Medicine, 170*(8), 683-690. http:dx.doi.org/10.1001/archinternmed.2010.65