MEDINFO 2007
HISA Ltd Australia
© 2007 The authors. All rights reserved.

Initiators of Interruption in Workflow: The Role of MDs and RNs

Juliana J. Brixey[a,b], David J. Robinson[b], James P. Turley[b], Jiajie Zhang[b]

[a] *University of Kansas School of Nursing, Kansas City, KS, USA*
[b] *University of Texas Health Science Center at Houston,*
School of Health Information Sciences, Houston, TX, USA

Abstract

The healthcare environment has been characterized as interrupt-driven with medical doctors (MDs) and registered nurses (RNs) receiving many interruptions during a shift. Previous research studies have focused on the recipient because of the negative impact on task performance. It is equally important to understand the initiator of an interruption to help design strategies to lessen the number of interruptions and the possible negatives consequences. The purpose of this instrumental study was to examine MDs and RNs as initiators of interruptions. Results of this study indicate that MDs and RNs initiate interruptions most often through face-to-face situations and use of the telephone. Strategies to successfully manage interruptions must consider both the role of initiator as well as the recipient in an interruption event.

Keywords:

Interruption, workflow, emergency medicine

Introduction

The healthcare environment has been characterized as interrupt-driven. An interruption is defined as a break in the performance of a human activity initiated by a source internal or external to the recipient, with occurrence situated within the context of a setting or a location. This break results in the suspension of the initial task by initiating the performance of an unplanned task with the assumption that the initial task will be resumed. [1] Medical doctors (MDs) and registered nurses (RNs) are the recipients of many interruptions during a shift resulting from face-to-face conversations with co-workers, telephone calls, email messages, and alarms and alerts from medical devices. These examples depict a role-based event between a recipient and an initiator. The recipient takes the role of accepting the interruption. Consequently, the recipient is affected by the interruption event because of the unexpected intrusion of a secondary task. For that reason, research studies in healthcare have examined the role of recipient because of the negative impact on task performance. [2-6] Moreover, the Joint Commission for Accreditation of Healthcare Organizations (JCAHO) [7-9], the Institutes of Medicine (IOM) [10, 11] and Morbidity and Mortality [12] report that interruptions contribute to preventable medical errors. It is equally important to understand the role of the initiator.

The initiator has the role of originating the interruption in workflow. Hence, they play an active role in the event. Moreover, the successful delivery of an interruption entails that the initiator forms the intent to interrupt and that the interruption be announced by some physical signal. That physical signal must pass a threshold test of detection by the recipient's sensory system so that the recipient is stimulated to respond to the initiator. Therefore, a successful interruption depends on the detection and acceptance of the impending interruption task by the recipient. [1]

A review of the literature found a limited number of studies that considered the role of initiator in an interruption event. [3, 4, 13, 14] Coiera and Tombs categorized a communication event as either sent or received for nine different MD and RN clinical roles. Findings from the study showed RNs initiated more paging and telephone calls than they received. In contrast, MDs initiated almost all communication events using the telephone. Medical doctors designated as house officers initiated more telephone calls when compared to consultants, senior registrars, or senior house officers. Specifically in the ED, Spencer and Logan categorized a communication event as sent or received by the MDs and RNs. [3] The MDs were classified as either registrars or junior medical officers. Registered nurses were categorized as either coordinators or having a patient load. [15] This study is limited to attending MDs and staff RNs. Therefore, the purpose of this instrumental study was to examine the role of MDs and RNs working in a level one trauma center as initiators of interruptions. An understanding of the initiator will help in the design of strategies to reduce or mitigate the negative outcomes of interruptions.

Methods

Study Design: The design was an instrumental case study. An instrumental case study is used to gain an in-depth understanding of a phenomenon as well as to generalize from an observational, inductive approach. [16]

Subjects: A convenience sample of MDs and RNs in a level one trauma center. Participation was voluntary and written consent and community consent was obtained.

Setting: All observations were made in the trauma section of a large teaching hospital. The hospital is part of a major medical center located in the Gulf Coast region of the United States of America (USA). The Emergency Department occupies 51,000 square feet (4738 square meters) and contains major trauma and cardiac resuscitation rooms. Annually, the organization provides care to approximately 52,000 patients.

Study Protocol: The MDs and RNs were shadowed with observations being recorded on a minute-by-minute basis using an automated semi-structured field note form.

Data Collection: Observers typically worked in teams of two and recorded their observations using a semi-structured field note form implemented on Tablet PCs. Subjects were shadowed for a minimum of 2 hours but not more than 12 hours. Recording of observations began when the subject had completed the informed consent. Observations were recorded on a minute-by-minute basis.

Data Analysis: Data analysis of the field notes was supported using NVivo© [17] and MacSHAPA [18].
The data was analyzed using the Hybrid Method to Categorize Interruptions and Activities (HyMCIA). [19] HyMCIA was developed through the hybridization of a deductive *a priori* classification framework with the provision of adding new categories discovered inductively in the data using grounded theory [20]. Two coders analyzed the data for agreement of tasks and interruptions. A percent agreement score was calculated.

Results

Demographics: Five attending trauma physicians were observed for a total of 29 hours, 31 minutes. The physicians were pre-selected based on scheduling and a willingness to participate. Observations were made on either the 0700–1500 or the 1500-2300 shift. These shifts were selected because they were known to be periods of time characterized as high activity.

Eight RNs were shadowed for a total of 40 hours 9 minutes. Observations were made on either the 0700–1500 or the 1500-2300 shift. The charge nurse for the shift preselected which subject would participate in the observation and the willingness of the subject to participate.

Roles in the interruption event: The major roles of initiator and recipient of an interruption emerged during categorization of the field notes. The following examples are taken from the coded field notes:

Initiator – RN initiates a telephone call.

Initiator Blocked – RN initiates a telephone call but no answer.

Initiator Delayed – RN initiates a telephone call and put on hold.

Intended Recipient – MD paged for new trauma patient

Indirect Recipient – MD talking with resident when resident is interrupted to speak with the RN.

Unintended Recipient – MD answers telephone but call is for the RN.

Recipient Delayed – Nurse practitioner waits until MD acknowledges her to receive report for a patient.

Recipient Blocked – RN waits to talk with MD but leaves after a few minutes. MD did not acknowledge.

The precise roles that were identified within the categories are shown in Table 1.

Table 1 - A Role-Based Taxonomy of Interruption

Initiator	Recipient
Initiator – a person who initiates an interruption	**Intended Recipient** - the person to be interrupted
Initiator Blocked - the initiator is blocked from initiating an interruption	**Indirect Recipient** – the incidental recipient of an interruption; i.e., talking with another in conversation when the intended recipient suspends the original activity
Initiator Delayed – the initiator is delayed in initiating an interruption	**Unintended Recipient** - not the intended recipient of an interruption; i.e., receiving a phone call that was incorrectly dialed
	Recipient Delayed – the intended recipient postpones an interruption
	Recipient Blocked – the intended recipient does not accept the interruption

As each new category was identified from the field notes, all previously coded data was reviewed. If an instance of the new category was identified the observation was coded

to the new category. This iterative process ensured that all observations recorded in the field notes were accurately coded. These categories formed a role-based taxonomy of interruptions derived from the data.

Medical doctors initiated 2.1 interruptions per hour. However, as the recipient of an interruption, MDs were found to have 25.19% of all activities interrupted. Consequently, MDs received 10.58 interruptions per hours. As shown in Figure 1, MDs were more likely to be the recipient of an interruption compared to the initiator.

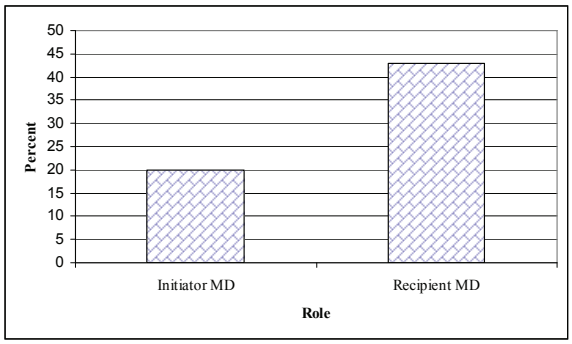

Figure 1 - Role for MDs in the interruption event

Similarly, RNs were more likely to be the recipient of an interruption rather than the initiator as reported in Figure 2.

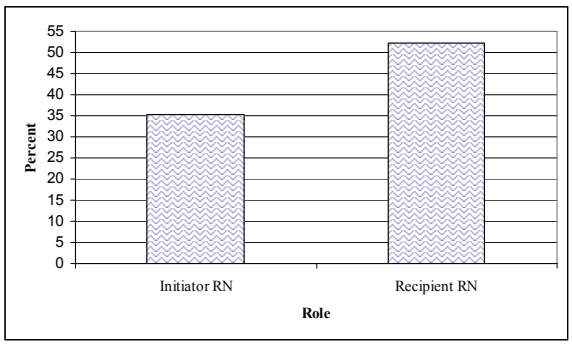

Figure 2 - Role for RNs the interruption event

In contrast, 16.45% of all RN activities were interrupted. What's more, RNs were interrupted at a rate of 11.65 per hour. When compared to MDs, RNs were more likely to initiate an interruption. This could be attributed to difference in role responsibilities. For instance, RNs may initiate an interruption to give report to another nurse when transferring a patient to another unit or when requesting a physician assess a patient because of a change in condition.

Analysis of the field notes indicated that MDs and RNs most often used face-to-face encounters to initiate an interruption. The telephone was also used as a medium to deliver an interruption. Mobile telephones were used by MDs in addition to traditional land-line telephones. Mobile telephones were not available for use by staff RNs. Therefore, RNs used only land-line telephones to initiate an interruption.

Discussion

This study systematically identified and studied the role of initiator for MDs and RNs in an interruption event. Findings from this study indicate that MDs initiated an interruption less often than receiving an interruption. Similarly, RNs took the role as initiator of an interruption less often than that of recipient. However, both MDs and RNs most often initiated an interruption as a communication event in a face-to-face encounter. The telephone was found to be the second most often used medium through which to deliver an interruption. Telephones included both land-line and mobile telephones.

It should be understood that some interruptions are necessary in the ED to deliver critical information to the MD or RN via technology. Moreover, the initiator needs to know when and how to deliver the interruption to lessen the negative impact on task performance for the recipient. This is an emerging challenge as mobile technology such as mobile telephones and personal digital assistants (PDAs) become more common in the ED. In a recent study, mobile telephones were reported as improving patient safety through the rapid delivery of communication between MDs. [21] However, the study did not report how the delivery of information via a mobile telephone interrupted the recipient's workflow.

The initiation of interruptions is not limited to mobile technologies. Real-time clinical notification systems can initiate interruptions for the MD or RN. Delivery of a notification such as a laboratory value is initiated by set of rules. Once a threshold is met the rule fires and the notification is sent regardless of the recipient's workload.

The recipient of an interruption has few choices in how to manage the instant accessibility as mobile technologies may have few features to delay receiving the interruption as opposed to older technologies such as pagers and land-line telephones. The mobile telephone lacks a voice mail feature which would allow the recipient to delay the interrupting telephone call. With a pager, the recipient page did not need to need to immediately attend to the page message as it was stored in memory of the devices. A clerical person is usually designated to answer the land-line telephone. This person could intercept the interruption by taking a message or possibly provide information to the initiator of the call. In this study only MDs had mobile telephones in contrast the RNs did not. However, as mobile technology comes into widespread use in the clini-

cal setting, there will be a need to study the roles of initiator and recipient in the interruption event.

Research is needed to understand how the new types of interruptions change workflow for MDs and RNs. It is imperative that future research studies identify the types and consequences of interruptions introduced by technology. It is suggested the role based taxonomy presented in this paper be used to classify interruptions in future studies. Findings from the studies can be used to design strategies to mitigate or decrease the negative effects of interruptions must consider the role of the initiator.

Conclusion

A role-based taxonomy of interruption was derived from the recorded field notes using grounded theory. The categories within the taxonomy show that MDs and RNs initiate interruptions as well as receive them.

This study suggests the need to develop strategies to decrease or mitigate the negative effects of interruptions and must consider the interaction between the initiator and the recipient of an interruption. Failure to consider why the interruption was initiated will lead to the formulation of ineffective strategies to manage interruptions. The introduction and use of technology in the clinical setting to manage interruptions must be critically evaluated so that MDs and RNs do not initiate unnecessary interruptions.

Acknowledgement

This study is supported by a training fellowship from the Keck Center for Computational and Structural Biology of the Gulf Coast Consortia (NLM Grant No. 5 T15 LM07093).

Grant R01 LM07894 from the National Library of Medicine.

References

[1] Brixey JJ, Robinson DJ, Johnson CW, Johnson TR, Turley JP, Zhang J. A concept analysis of the phenomenon interruption. Advances in Nursing Science. 2007 2006;30(1):E26-E42.

[2] Coiera E. Clinical communication - a new informatics paradigm. p. 17-21.

[3] Coiera E, Tombs V. Communication behaviours in a hospital setting: an observational study. BMJ. 1998 February 28, 1998;316(7132):673-6.

[4] Coiera EW, Jayasuriya RA, Hardy J, Bannan A, Thorpe MEC. Communication loads on clinical staff in the emergency department. MJA. 2002 6 May 2002;176(9):415-8.

[5] Chisholm C, Dornfeld A, Nelson D, Cordell W. Work interrupted: a comparison of workplace interruptions in emergency departments and primary care offices. Annals of Emergency Medicine. 2001;38(2):146-51.

[6] Chisholm CD, Collison EK, Nelson DR, Cordell WH. Emergency department workplace interruptions: are emergency physicians "interrupt-driven" and "multitasking"? Acad Emerg Med. 2000 November 1, 2000;7(11):Acad Emerg Med.

[7] Joint Commission on Accreditation of Healthcare Organizations. Sentinel Event Alert. 2001 [cited 2006 November 29]; Available from: http://www.jointcommission.org/

[8] Joint Commission on Accreditation of Healthcare Organizations. A follow-up review of wrong site surgery. Sentinel Event Alert 2001 [cited 2006 March 8]; Available from: http://www.jointcommission.org/

[9] Joint Commission on Accreditation of Healthcare Organizations. Preventing ventilator-related deaths and injuries. Sentinel Event Alert 2002 [cited 2006 November 29]; Available from: http://www.jointcommission.org/

[10] Aspden P, Wolcott J, Bootman JL, Cronenwett LR, eds. Preventing Medication Errors Washington, D.C.: The National Academies Press 2007.

[11] Kohn LT, Corrigan JM, Donaldson MS, eds. To Err is Human: Building a Safer Health System. Washington, DC: National Academy Press 1999.

[12] Wears RL. Caution interrupted. AHRQ WebM&M [online journal] [Online journal] 2004 [cited 2006 March 8]; Available from: http://www.webmm.ahrqu.gov/case.aspx?caseID=73

[13] Spencer R, Coiera E, Logan P. Variation in communication loads on clinical staff in the emergency department. Ann Emerg Med. 2004 Sep;44(3):268-73.

[14] Alvarez G, Coiera E. Interruptive communication patterns in the intensive care unit ward round. International Journal of Medical Informatics. 2005 Jul 14;74:791-6.

[15] Spencer R, Logan P. Role-based communication patterns within an emergency department setting. Proceedings HIC 2002; Melbourne; 2002.

[16] Stake RE. Qualitative Case Studies. In: Denzen NK, Lincoln YS, eds. *The Sage Handbook of Qualitative Research*. Third ed. Thousand Oaks, CA: Sage Publication, Inc. 2005:443-62.

[17] QRS. NVivo 2.0. Doncaster Victoria, Australia 2002.

[18] Sanderson PM. MacSHAPA. 1.0.3 ed 1994.

[19] Brixey JJ, Robinson DJ, Johnson CW, Johnson TR, Turley JP, Patel V, Zhang J. Towards a hybrid method to categorize interruptions and activities in healthcare International Journal of Medical Informatics. 2006;In press.

[20] Glaser B, Strauss A. The Discovery of Grounded Theory. New York: Aldine Publishing 1967.

[21] Soto RG, Chu LF, Goldman JM, Rampil IJ, Ruskin KJ. Communication in critical environments: Mobile telephones improve patient care. Anesth Analg. 2006;102:535-41.

Address for correspondence

Juliana J. Brixey PhD, MPH, RN
Assistant Professor
University of Kansas School of Nursing
3910 Rainbow Boulevard Mail Stop4043
Kansas City, KS 66160