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Nurses' responses to interruptions during medication tasks: A time and motion study

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ABSTRACT

Background: The majority of interruption research has focused on the undesirable effects of interruptions, especially related to errors during medication tasks. However, there may be times when interruptions result in positive effects by providing new information to a situation or preventing an error. The study of nurses' responses to interruptions is limited. Since interruptions cannot (and possibly should not) be avoided, a reasonable method for handling interruptions might be to learn how best to prepare for and manage interruption-prone situations.

Objectives: The purpose of this study was to examine nurses' responses to interruptions and explore contextual factors that influence interruption management during medication tasks. This is a secondary analysis of an original study aimed at describing interruptions and nurses' responses to interruptions during routine nursing work on medical-surgical units.

Design and setting: This descriptive study was conducted in 5 medical and/or surgical units at 2 acute care facilities in the southern United States, during weekday shifts.

Participants: Twenty registered nurses participated in the study.

Methods: The researcher observed nurse participants for at least 4.5 h during routine nursing work. Observation data were collected using time and motion software. Questionnaires were used to collect organizational, unit, and nurse level data. Interruptions during medication tasks were isolated and described as a secondary analysis.

Results: Approximately 39% of medication tasks were interrupted. Following an interruption, nurses were more likely to suspend the medication task to attend to the interruption task (51.1%) or multitask (40.3%) than delay responding to the interruption until the medication task was complete (12.6%). Several characteristics of the interruption task, including task type, source, method, and communication intent were associated with nurses' responses at the level of statistical significance.

Conclusions: The findings of this study reveal that nurses are interrupted frequently during medication tasks. The range of nurses' responses to interruptions was surprising in relation to the frequency with which nurses accepted the interruption task and the infrequency of delay responses. Additional study of nurses' responses to interruptions during medication tasks and the effect of different responses on patient safety outcomes is indicated.

What is already known about the topic?

- Interruptions are pervasive in the nursing work environment and patient care requires a great amount of cognitive resources.
- Interruption research in healthcare has primarily focused on the undesirable effects of interruptions, especially related to errors during medication tasks.

What this paper adds

- Nurses were 2.2 times more likely to be interrupted during a medication task than any other observed routine task.
- Nurses responded to 94.6% of interruptions during medication tasks immediately by either switching tasks (47.9%) or multitasking (46.7%).
- The characteristics of the interruption were associated with the nurse's response to the interruption, including the interruption task,

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source, and method of interruption.

1. Introduction and review of literature

Interruptions are multidimensional events that occur at varying frequencies and durations in different social contexts and task environments. Given that interruptions are believed to be pervasive in the nursing work environment (Hopkinson and Jennings, 2013; Walter et al., 2014) and patient care requires a great amount of cognitive resources (Potter et al., 2008), it is important to describe nurses' responses to interruptions in the direct care work environment. Of major concern is the potential link between interruptions and errors. Until types of interruptions and responses are described, it is not possible to study this potential link.

Interruption is a complex phenomenon made up of several variables including multiple characteristics of the primary task, interruption, and the environment. Most interruption research is focused on determining the undesirable effects of interruptions on task performance and patient outcomes; however, there may be times when interruptions result in positive effects by providing new information to a situation or preventing an error (Walji et al., 2004b; Grundgeiger and Sanderson, 2009; Sasangohar et al., 2014).

Interruption research suffers from the lack of consistent conceptual definitions and frameworks (Grundgeiger and Sanderson, 2009; Sasangohar et al., 2014). The absence of conceptual and operational definitions of variables of interest prevents the development of instruments and consistent measurements of variables across studies. For example, the following studies in healthcare examine the interruptee's response to interruptions, yet are inconsistent in defining and measuring responses. In some cases, the variable described in the abstract as *response to interruption* was described as the interrupted individual either accepting or rejecting the secondary/interruption task or action (Brixey et al., 2007) or the impact of interruptions on nurse responsiveness (Manias et al., 2002). Two studies reported that nurses either responded directly, delayed, or delegated an interruption task or demonstrated an immediate or scheduled response (Palese et al., 2009; Biron et al., 2009, respectively). In contrast, two studies considered multitasking as a response to interruption and categorized clinician responses as: 1) Interruption, Deferred task, or Continued multitasking (Collins et al., 2007) and 2) Engaging, Multitasking, Deferring, or Blocking (Liu et al., 2009). Drews (2007) categorized the nurse's response to an interruption based on the behavior that resulted from the interruption. An individual's response to an interruption during a work task has been studied in cognitive psychology and human-computer interaction (Li et al., 2012; Grandhi and Jones, 2009; Sarter, 2013). In these studies, the terminology used to describe the choices made when an interruption occurs included interruption-handling strategies and interruption management.

The Interruptibility and Interpersonal Interruption Response Management framework presented by Grandhi and Jones (2009, 2010) examines the interruptibility of an individual emphasizing the influence of the cognitive, social and relational contexts rather than exclusively the task characteristics. *Interruptibility* is a conscious choice that an individual makes about willingness to be interrupted based on whom the interrupter is and what the interruption is thought to be about. This framework originated in the discipline of human-computer interaction which has been actively working over the last decade or so to manage technological advances in the workplace and deploy systems that assist in reducing unwanted interruptions (Grandhi and Jones, 2009).

The Cognitive Theory of Persuasive Interruptions was developed to explain and capitalize on the beneficial effects of interruptions in the healthcare setting (Walji et al., 2004a). Historically interruptions have been viewed as undesirable, distracting events that need to be minimized or eliminated. However, this theory suggests that the appropriate use of interruptions may improve efficiency and productivity, prevent errors and influence behavior. Interruptions that serve as warnings and/or reminders can assist in directing the attention of individuals in a complex, multitasking environment.

Walji et al. (2004a) describe the interruption situation in terms of user and task properties, presentation of the interruption, the interruptee's goal-directed action sequence, and the outcome of the interruption. User properties are critical factors in determining the most opportune moment to interrupt an individual, resulting in the least possible detrimental effects. These characteristics include location, environment, time of day, or schedule. The properties of the interrupted and interrupting tasks are important in determining which tasks are susceptible to the detrimental effects of interruptions. Similar to user properties, task properties include location and timing while also incorporating the interruptee's workload (Walji et al., 2004b). User and task properties may be related to the concept of interruptibility, as described by Grandhi and Jones (2010). According to the theory of persuasive interruptions, the presentation of an interruption may be the most important influence on the response of the nurse (Walji et al., 2004a).

Since interruptions cannot and possibly should not be avoided, a reasonable method for handling interruptions might be to learn how best to prepare for and manage interruption-prone situations. For this reason, nurses' responses to interruptions during certain tasks (Westbrook et al., 2010; Sitterding et al., 2014) or in specific environments (Sasangohar et al., 2014; Walter et al., 2014) are a growing area of study. The purpose of this study was to examine nurses' responses to interruptions and explore contextual factors (i.e., unit characteristics, nurse characteristics, task and interruption characteristics) that influence responses during medication tasks. This examination was part of an original study, Nursing Work and Responses to Interruptions (NWRI), aimed at describing interruptions and nurses' responses to interruptions during routine nursing work on medical-surgical units (Reed, 2015). Interruptions during medication tasks have been isolated and described as a secondary analysis.

2. Theoretical frameworks

Two theoretical frameworks were used to guide the study. The Interruptibility and Interpersonal Interruption Response Management framework by Grandhi and Jones (2009, 2010), guided the exploration of registered nurses' responses to interruptions and the contextual factors and/or cues used to make response decisions. The Cognitive Theory of Persuasive Interruptions (Walji et al., 2004a) was used to illuminate the potential relationships between interruptions, contextual factors, registered nurse characteristics and nurse responses.

Responses to interruptions were identified and defined according to Sarter's (2013) process of interruption management (Fig. 1). This process combines concepts from theoretical frameworks and findings from empirical studies of interruption management (as cited in Sarter, 2013).

3. Materials and methods

The original study employed a descriptive design with multiple data collection methods. Questionnaires were used to collect organizational and unit level data, fatigue and subjective workload levels, as well as nurse characteristics. Data collected from the questionnaires were input to the REDCap electronic data capture tools hosted at Vanderbilt University (Harris et al., 2009). Results from the secondary analysis of medication tasks are presented along with some findings from the original study to provide context for the exploration of interruptions and nurses' responses to interruptions during medication tasks. The secondary analysis of interruptions during medication tasks did not include organizational or unit level data, nor the measures of fatigue or subjective workload employed in the original study.