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## What Is an Interruption? A Concept Analysis of Interruption During Nursing Medication Administration

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# What is an Interruption?

## A Concept Analysis of Interruption During Nursing Medication Administration

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### Abstract

Interruptions are ubiquitous in health care settings, particularly during the medication administration process. Interruptions are associated with negative effects, one of great concern being medication errors. A consistent definition of interruption has not been found in the health care literature which has created challenges in interpreting research findings and conducting further research with generalizable results. A concept analysis using Walker and Avant's (2005) eight-step method was used to distinguish the concept of interruption from related terms, clearly define the concept, and develop a model of interruption during medication administration. The developed operational definition and model give clarity to the term interruption and can be adapted to apply to various settings and disciplines.

**Keywords:** interruption; medication administration; health care; nursing; concept analysis

Interruptions occur with high frequency in health care settings. Researchers have observed doctors in in-patient hospital settings interrupted on average more than five times per hour (Weigl, Müller, Zupanc, Jürgen, & Angerer, 2011), with emergency room physicians as often as once every five minutes (Institute for Safe Medication Practices [ISMP], 2012). Pharmacists and pharmacy technicians have been found to be interrupted as often as once every two minutes while dispensing medication (ISMP, 2012). Nurses have also been observed to be interrupted frequently while performing nursing tasks, particularly during medication administration (MA). Nurses are interrupted an average of 1.21-1.5 times per MA (Cooper, Tupper, & Holm, 2016; Elganzouri, Standish, & Androwich, 2009).

Fields such as psychology, cognitive science, human factors engineering, business, and aviation have studied the effects interruptions have on human performance. Researchers in psychology and cognitive science have found that interrupted tasks are more prone to error (Altmann, Trafton, & Hambrick, 2014; Li, Blandford, Cairns, & Young, 2008; Monsell, 2003) and create longer task completion times, leading to decreased task efficiency (Brumby,

Cox, Back, & Gould, 2013; Monk, Trafton, & Boehm-Davis, 2008; Monsell, 2003). Human factors engineering researchers have concluded the same (Bailey & Konstan, 2006; Loft, Sadler, & Braithwait., 2015), adding that the overall quality of work is also reduced when interruptions occur (Foroughi, Werner, Nelson, & Boehm-Davis, 2014). Human factors engineering researchers (Bailey & Konstan, 2006) have also found that people experience annoyance and anxiety when interrupted during tasks. Business researchers (Speier, Valacich, & Vessey, 1999) found that interruptions lowered performance on complex tasks and the aviation literature reports that interruptions can tax performance and contribute to accidents (Latorella, 1998).

Health care researchers have begun to study the effects interruptions have on clinical performance and patient safety. Cooper et al. (2016) provided evidence that interruptions decreased efficiency of MA and Westbrook, Woods, Rob, Dunsmuir, and Day (2010) found a positive relationship between interruptions and medication administration errors (MAEs). These findings provide support that interruptions are associated with longer task completion times and errors within health care which are consistent with findings from other disciplines (Altmann et al., 2014; Bailey & Konstan, 2006; Brumby et al., 2013; Latorella, 1998; Monk, et al., 2008; Monsell, 2003). However, it is important to note that an increase in patient safety has also been identified as a result of interruptions. Blignaut, Coetzee, Klopper, and Ellis (2017) found a significant association between interruptions and a decrease in wrong-dose medication errors. The authors observed the medication order being rechecked after an interruption occurred and explained that this likely led to a decrease in errors.

The occurrence and effects of interruptions have been studied across various fields, however, a consistent definition of an interruption has not been found in the literature. A clear meaning, or definition, of a concept is essential to formulate operational definitions, develop research instruments, generalize research findings, and replicate studies. A clear operational definition of a concept is a major component of validity of a research instrument (Brink & Wood, 1998). Without a clear definition of a concept, researchers would not know what to measure, nor be able to generalize findings. In addition, readers would not be able to understand the findings presented if a clear definition was not provided. Interruptions are associated with patient safety; thus, it is imperative to have a clear understanding of what an interruption is.

### Methods

A concept analysis using Walker and Avant's (2005) eight-step method was performed with an aim to give understanding and clarity to the concept of an interruption, specifically within the context of nursing MA. The steps included in this method involve: 1) select a concept; 2) determine the aims or purposes of the analysis; 3) identify uses of the concept; 4) determine the defining attributes; 5) identify a model case; 6) identify other cases (borderline, related, contrary, invented, illegitimate); 7) identify antecedents and consequences; 8) define empirical referents (Walker & Avant, 2005, p. 65). This concept analysis included a model, borderline, and contrary case. The author believed the three cases used clarified the concept without the need for additional cases. According to Walker and Avant (2005), not all cases are required if the cases used complete the analysis.

A concept analysis on interruption was performed by nurse researchers (Brixey et al., 2007) over 10 years ago. However, a more current analysis of the term interruption and one placed in the context of MA was deemed necessary. There is a current increase in attention on interruptions in the health care setting partly due to the negative effects observed to be associated with interruptions during MA. Medication administration (MA) involves preparing medication and the act of giving medication to a patient. This process includes checking the "rights of medication": 1) the right patient; 2) the right medication; 3) the right dose; 4) the right route; 5) the right time; 6) and the right documentation (Yoost & Crawford, 2016). If an omission or error occurs during any of the 6 rights, a medication error is more likely to result.

A search of the origin of the term, dictionary definitions, and an examination of the term as described in the nursing literature within the context of MA was performed. In addition, other disciplines (psychology, cognitive science, aviation, human factors engineering, and business) were also searched for the use of the term interruption. The search was conducted using the electronic databases Cumulative Index of Nursing and Allied Health Literature (CINAHL), PubMed, PsycARTICLES, and Google Scholar. The search terms "interruption," "task interruption," "nursing" and "medication administration" were used. All articles included were written in English and examined interruptions of the human experience, as opposed to, for example, an "interrupted computer signal." Nursing articles were limited in year of publication from 2007-2017 to ensure the use of the most current findings from the nursing discipline. Articles other than nursing were not limited to a timeframe. Seven nursing articles and one article from each of the other disciplines were used in the analysis.

### Definitions and Uses of Interruption

The word interruption is derived from the Latin word *interruptionem* which means: a break of continuity; a breaking in upon some action (Interruption in Online Etymology Dictionary, 2018). Merriam-Webster (2018) provides a similar definition of interruption: 1. to stop or hinder by breaking in; 2. to break the uniformity or continuity of. The Cambridge English dictionary (2018) provides the definition of an interruption as: an occasion when someone or something stops something from happening for a short period.

Other uses of the word interruption include describing a hardware signal that breaks the flow of a computer program execution. In pharmacology a planned temporary suspension from taking medication is called a "structured treatment interruption." In the health care setting, one might hear the term "interrupted suture" to describe a suture in which each stitch is separately tied. These definitions and uses of the term interruption all have common elements. They each refer to a break, stop, suspension, or lack of continuity of something. This is consistent with the origin and definitions of the word.

### Related Terms

The terms multi-tasking, disruption, and distraction were frequently used in the interruption research across various disciplines. These terms were at times used synonymously with the word interruption, grouped with interruptions, or may have been used to describe a result of an interruption. Each term is discussed below.

**Multi-tasking.** Dictionary.com (2018) defines the term multi-tasking as: to perform two or more tasks simultaneously. Researchers in the field of psychology describe multi-tasking as "undertaking multiple tasks at the same time; interleaving independent tasks in the same time period and switching among them" (Adler & Benbunan-Fich, 2013, p. 1441). Multi-tasking occurs with high-frequency in health care settings and are many times a result of an interruption.

Nurses may choose to multi-task while in the process of MA. As an example, a nurse may receive a phone call while performing MA and instead of suspending the process of MA for the duration of the phone call, the nurse chooses to engage in the interruption created by the sender of the call, by simultaneously attending to the phone call and continuing the MA process. In this example, imagine that the nurse talks with the sender of the call while continuing to take the medication out of the storage device, looking at the name of the medication, and placing it in a medication cup.

**Disruption.** Disruption is another related term found in the literature when researching the term interruption. A disruption is defined by Merriam-Webster (2018) as: 1. to break apart; 2. to throw into disorder; 3. to interrupt the normal course or unity of. Human factors researchers have described disruptions in relation to interruptions as follows: "... interruption research involves time and errors as measures of disruption, as they are often the most appropriate metrics for determining the effects that interruptions have on task performance" (Foroughi et al., 2014, p. 1262). In this description, the term disruption is an *effect* of an interruption. Like multi-tasking, a disruption can *result* from an interruption.

**Distraction.** Distraction was the most common term related to interruption found in the literature. Distraction is defined as: something that distracts: an object that directs one's attention away from something else (Distraction, 2018). Unlike the definitions of interruption which refer to a break, stop, suspension, or lack of continuity of something, distraction refers only to directing one's attention away from a primary task. In the field of psychology authors have made the distinction between a distraction and interruption clear: "Unlike mere distractions (e.g., the onset of an unexpected sound), which can temporarily draw attention away from a primary task, interruptions require the distinct cessation and resumption of the ongoing task in order to perform a separate intervening activity" (Hodgetts & Jones, 2006, p. 1120).

Distractions and interruptions were grouped together, used synonymously, or defined as the same in articles from various disciplines. Despite the interchangeable literary use, there is a clear distinction between a distraction and an interruption, whereby a distraction only directs attention away from something, and an interruption requires stopping a task. A distraction may precede an interruption, by creating an alert, however this is different than an interruption itself.

### Psychology, Human Factors Engineering and Aviation

Within the field of psychology, researchers have described a definition of an interruption as "...interruptions typically note the unexpected nature of the interruption and the prompt cessation of the task at hand due to the interrupting task" (Weng, Huber, Vilgan, Tobias,

& Sanderson, 2017, p. 77). Human factors engineering (HFE) researchers have described the term interruption as "...refers to the suspension of one stream of work prior to completion, with the intent of returning to and completing the original stream of work" (Loft et al., 2015, p. 1417). In aviation the term was defined as: "...to occur only when an external event (stimulus) caused at least one pilot to stop performing (interrupt) an ongoing task. Furthermore, the event must have had two characteristics. First, it must have been unanticipated... Second, the event must have had a distinct beginning" (Damos & Tabachnick, 2001, p.1).

### Cognitive Science

Altmann and Trafton (2002) provided a definition of an interruption in their Memory for Goals model as "...a situation in which a goal must be suspended before it is completed, and then resumed later" (p. 67). Here the words *suspended* and *resumed* are critical in this description of an interruption. Suspended is similar to the words *stop* or *break* from the dictionary definitions. The word *resumed* is also very important to note. The necessary resumption of a task, or the intent to resume a task, after it has been interrupted is key to this theoretical definition. If the task was not intended to be resumed, then the event of an interruption would change to become a *conclusion* of the task.

Each description in the fields of psychology, cognitive science, HFE, and aviation uses a unique definition of the term, yet they all have commonalities. Each definition refers to a cessation, suspension, break, or stopping of a task. These are critical components of what makes an interruption truly an interruption; the task must be stopped. Some of these definitions also refer to the unexpected nature of the interruption and the necessity to have an intention to resume the task that has been suspended. The unexpected nature of the interruption and the necessity to have an intent to resume the task that has been stopped are also key components of what make up an interruption.

### Business

In contrast to the definitions just described, some business researchers have defined an interruption as "An interruption breaks a decision maker's attention on a primary task and forces the decision maker to turn his or her attention towards the interruption, if only temporarily..." (Speier, et. al, 1999, p. 339). According to the dictionary definition, this description given of an interruption is actually one of a distraction. Nowhere in this description do the authors state that the interruption causes one to stop the task. There is only the mention of one's attention being broken and turned toward the interruption.

### Nursing

Nursing researchers have provided varying operational definitions of the term interruption, and many use the terms distraction and interruption interchangeably. This is incorrect, since as previously discussed the two terms stand alone. Although some similarities in the definitions from the nursing literature were found, such as "break in task," "ceased the preparation," or "break in the activity," there were also many unique descriptors identified in the definitions. One definition referred to a disruption of the nurse's focus, while others included the necessity to "carry out a secondary task" or "attend to an external stimulus". An interruption does not necessarily require engagement in a secondary task; it merely

requires stopping the primary task. Table 1 provides definitions of interruptions from the nursing literature.

Table 1. Definitions of Interruptions Provided in Nursing Articles

Author(s)/Year	Definition of Interruption Provided
Aguirre, Wilhelm, Backer, Schoeneman, & Koehler (2015, p. 54)	"anything that disrupted the nurse's focus on or caused a break in the task he/she was performing"
Beyea (2014, p. 1)	"Distractions and interruptions consist of anything that disrupts and individual from the current task by diverting one's attention"
Biron, Lavoie-Trembley, & Loiselle (2009, p. 330)	"a break in the activity being performed to carry out a secondary task"
Craig, Clanton, and Demeter (2014, p. 252)	"any emergent or non-emergent stimulus that 'halts the activity being performed for monitoring purposes or to carry out a secondary task' (Biron et al., 2009)"
Elganzouri, Standish & Androwich (2009, p. 206)	"An interruption or distraction, for this study, was defined as any event that disrupts the nurse in the medication administration process"
Trbovich, Trip, Prakash, Savage & Stewart (2010, p. 212)	"any externally initiated event (e.g., question from a patient, telephone call, infusion pump alarm) that caused the nurse's attention to be diverted from a primary task... this definition encompasses both interruptions and distractions"
Westbrook et al. (2010, p. 684)	"situations in which a nurse ceased the preparation or administration task in order to attend to an external stimulus"

### Significance for Nursing

Given that interruptions are ubiquitous in health care settings, have a negative effect on productivity, and are associated with patient safety, an increase in knowledge and research of interruptions within the nursing context is warranted. However, the nursing literature has not provided a clear and consistent definition of the term interruption. Without a consistent definition or meaning of the concept interruption in the nursing literature, challenges in understanding results and comparing findings are created.

### Analysis of Interruption of Medication Administration

The structure and function of the concept of interruption as it is used in language among various disciplines and how an interruption is like and unlike related terms has been presented. Using the Walker and Avant (2005) eight-step method for a concept analysis, the defining elements (attributes, antecedents, and consequences) of the concept were determined.

### Attributes

Defining attributes, or characteristics, of a concept are the most frequently seen attributes that cluster together with the concept (Walker & Avant, 2005). These specific characteristics differentiate the concept from others. The defining attributes of an interruption were

determined through this analysis to be: 1) a human experience; 2) suspension of the primary task; 3) engagement or non-engagement in the secondary task; 4) intention to resume or resumption of the primary task.

**Human experience.** Humans, machines, and actions can be interrupted. Even an interruption of weather has been used in an example in the Meriam-Webster dictionary (2018): “a hot spell occasionally interrupted by a period of cool weather.” When discussing machines, a hardware signal that breaks the flow of a computer program execution is termed an interruption. As Brixey et al. (2007) pointed out, human conversations can be interrupted as well as tasks. In this concept analysis it is specifically an interruption of a human task within the context of nursing MA that has been examined.

**Suspension of the primary task.** The nurse must suspend or stop the action of MA. This is crucial for an interruption to occur and aligns with the origin and dictionary definitions of interruption. An interruption requires a cessation, suspension, break, or stopping of an action to be considered an interruption. If a suspension of the task does not occur, it may be that the nurse chose to engage in multi-tasking or was merely distracted.

**Engagement or non-engagement in the secondary task.** The recipient must decide whether to engage in the presented secondary task or not engage in the secondary task. Some authors describe an interruption with the requirement to engage in the presented secondary task (e.g. conversation, answering the phone, involvement in the secondary task), although this is not accurate. If a recipient decides not to engage in the secondary task, but stops the primary task of MA, if even for very briefly, an interruption occurs.

**Intent to resume the primary task/resumption of the task.** The nurse must have an intent to resume the task of MA or return to the task to complete the process. If there is no intent to resume or actual resumption of the task, then the task has been *concluded*, not interrupted.

### **Antecedents**

Antecedents are the elements that must occur prior to the concept (Walker & Avant, 2005). The antecedents of interruption were identified as: 1) external or internal initiator/source 2) unexpected alert; 3) recipient’s cognitive system is stimulated by the alert.

**External or internal initiator/source of the alert.** There must be a source or initiator of the alert prior to an interruption occurring. This source or initiator can be from the environment (external) or self-induced (internal). External alerts involve the different senses. They can be audible (e.g. sounding of an alarm), visual (e.g. colleague entering the room), tactile (e.g. person touching the recipient on the shoulder), or olfactory (e.g. smell of smoke in the air).

An internal alert, which precedes a self-interruption, occurs when a thought suddenly forms in the mind. Self-interruptions have been reported to account for 40-50% of task switches (Adler & Benbunan-Fich, 2013; Katidioti, Borst, vanVugt, & Taatgen, 2016) and result in lower accuracy of tasks (Adler & Benbunan-Fich, 2013). Gathering supplies and initiating conversations with others are common self-interruptions that occur when nurses are in

the MA process (Aguirre, Wilhelm, Backer, Schoeneman, & Koehler, 2015; Craig, Clanton & Demeter, 2014; Kreckler, Catchpole, Bottomley, Handa, & McCulloch, 2008). Although self-interruptions may be at times difficult to identify by an observer, this type of interruption is widespread and should be considered when examining interruptions.

It is important to note that the source may or may not have a planned intention to interrupt the recipient. For example, the audible ring from the phone may have been mistakenly dialed, intended for a different nurse. The person who walks into the room may not have intended to create an alert and divert the nurse’s attention and cause an interruption.

**Unexpected alert.** An unexpected alert can occur at any time during the process of MA. The alert must be unexpected or unplanned, otherwise it would be a planned event.

**Stimulation of the recipient’s cognitive system.** The recipient’s cognitive system must be stimulated to detect the alert. The nurse must be able to hear, see, feel, smell, or become aware of the alert. If the cognitive system is not stimulated, the recipient would not be aware of the alert, which must precede the interruption.

**Diverts attention.** The alert must divert the nurse’s attention. If the nurse ignores the alert, or is unaware of the alert, the attention has not been diverted.

### **Consequences**

Consequences of a concept are those events or incidents that occur as a result of the concept (Walker & Avant, 2005). The consequences of an interruption during MA were found to be primarily negative, although some positive consequences were also found. The consequences found were: 1) decreased efficiency/productivity; 2) perceived cause of errors; 3) decreased patient safety; 4) increased patient safety.

**Decreased efficiency/productivity.** Interruptions inherently create longer task completion times. The interruption event, or interruption proper, creates what is termed resumption lag. Resumption lag is the time taken to re-orient to the original task and resume that task (Brumby et al., 2013) after the break in task has occurred. The amount of time taken if the recipient decides to engage in the secondary task also needs to be accounted for. This time can be quite significant. A study conducted by Thomson and colleagues (2009) found that interruptions accounted for an average of 10 additional minutes during the MA process.

**Perceived cause of medication errors.** Many nurses have reported that they believe MAEs are a consequence of interruptions. Surveys and self-reports from nurses indicate interruptions as a leading cause of MAEs in the health care setting (Hayes, Jackson, & Davidson, 2015; Hewitt, 2010; Mayo & Duncan, 2004). The perceptions that interruptions lead to medication errors has been supported by empirical evidence (Westbrook et al., 2010).

**Decreased patient safety.** Westbrook et al. (2010) found with each interruption a nurse received during MA there was a 12.1% increased chance of a procedural error (e.g. not checking a patient’s identification band prior to administration of medication). In addition,

with each interruption a nurse received, the risk of a clinical medication error (e.g. wrong dose of medication) increased by 12.7%. The more frequent the interruptions, the higher the risk of committing a medication error resulted. The researchers found statistical significance ( $P = <.001$ ) in their study of a positive relationship between interruptions and MAEs.

Westbrook et al. (2010) also classified severity of medication errors in their study and found the severity of errors increased with frequency of interruptions. The more often a nurse was interrupted during the same process of MA, the higher the risk of a severe medication error occurred.

**Increased patient safety.** Blignaut et al. (2017) found through their direct observational study that interruptions lowered the risk of wrong-dose medication errors. It was observed in their study that the medication order was often re-checked after an interruption took place, which the researchers surmised led to a decrease in wrong-dose errors. In addition, Sassangohar, Donmez, Trbovich, and Easty (2012) discuss in their article that interruptions in health care can lead to an overall increase in patient safety. The authors describe how nurses may be involved in a task (such as MA) and hear an overhead page to attend to a patient in critical condition. The authors also give the example that a nurse may be interrupted by a source to convey important information. This may be an alarm on an IV pump warning of an incorrect setting that could lead to an error.

### Model Case

A model case has been provided to illustrate the defining attributes, antecedents, and a potential consequence of an interruption during the process of nursing MA. The defining attributes, antecedents, and a consequence are underlined:

Nurse A is in the hospital unit medication room preparing a patient's ordered medication, hydromorphone. As Nurse A is checking the medication name on the label against the order, Nurse Z enters the medication room and says enthusiastically to Nurse A, "Hi there! I haven't worked with you in almost two weeks. How are you?" Nurse A stops looking at the medication label, turns attention to Nurse Z and replies, "I know, it's been a while since I've seen you." The two nurses continue to converse for over one minute. Nurse A then returns to preparing the medication. Nurse A incorrectly believes that all the medication rights have been checked and leaves the medication room. Nurse A administers hydrochlorothiazide to the patient, instead of the intended hydromorphone, which results in a serious medication error.

The interruption of Nurse A in the model case included the four defining attributes, the four antecedents, and one of the consequences. The attributes in the model case were: 1) a human experience; 2) suspension of the primary task of MA; 3) engagement in the secondary task; 4) resumption of the primary task.

In this model case, the human experience is that of Nurse A preparing medication in the medication room. The source of the interruption is external, initiated by Nurse Z. Nurse A's attention was diverted either by the visual alert of Nurse Z entering the room, or the audible

alert when Nurse Z stated, "Hi there!" Nurse A stops looking at the medication label, which is part of the MA process. Nurse A engages in the secondary task of conversing with Nurse Z. Nurse A resumes the task of MA.

The antecedents in the model case were: 1) external initiator/source; 2) unexpected alert; 3) stimulation of the recipient's cognitive system; 3) diverted attention. The initiator or source of the alert and interruption was Nurse Z. An unexpected alert occurred when Nurse Z entered the medication room and stated, "Hi there!" Nurse A's cognitive system was stimulated, evidenced by Nurse A diverting attention from the MA process and responding to the alert(s).

The consequence in the model case was: 1) decreased patient safety due to a medication administration error. In the model case Nurse A resumed the task of MA after being interrupted, and a medication error ensued.

### Borderline Case

Borderline cases contain most, but not all, of the defining attributes of a concept (Walker & Avant, 2005). A borderline case of an interruption during MA has been provided:

Nurse A is in the hospital unit medication room preparing a patient's ordered medication. As Nurse A is checking the medication name on the label against the order, Nurse Z enters the medication room and says enthusiastically to Nurse A, "Hi there! I haven't worked with you in almost two weeks. How are you?" Nurse A smiles in response but does not stop looking at the medication label. After Nurse A has checked all the rights of medication, Nurse A turns to Nurse Z and says "Sorry, I was just finishing up. I'm doing well. How are you?" Nurse A converses with Nurse Z for over one minute, then leaves the medication room. Nurse A correctly administers the medication to the patient.

The borderline case included one of the defining attributes, three antecedents, and none of the consequences. The attributes and antecedents are underlined. The attribute in the borderline case was: 1) a human experience. In this borderline case a *distraction* occurred. An interruption did not. The attribute of a human experience was evidenced by Nurse A preparing medication in the medication room, however this was the only attribute of an interruption found in this case. Nurse A did not stop the task of MA. The task is continued despite the alerts, or distractions, created by Nurse Z.

The antecedents in the borderline case were: 1) external initiator/source; 2) unexpected alert; 3) stimulation of the recipient's cognitive system. The initiator or source of the alert was Nurse Z. An unexpected alert occurred when Nurse Z entered the medication room and when Nurse Z stated, "Hi there!" Nurse A's cognitive system was stimulated, evidenced by Nurse A responding to the alert(s) with a smile. There were no consequences in the borderline case.

### Contrary Case

A contrary case is a clear depiction of what the concept being analyzed is not (Walker & Avant, 2005). A contrary case of an interruption during MA is below:

Nurse A is alone in the medication room, preparing a patient's ordered medication. The door is closed, signaling to other staff that no one should enter the room while Nurse A is in there. Nurse A has handed off his assigned phone to another nurse prior to entering the medication room. No one enters the room and no distractions or interruptions occur while Nurse A prepares the medication. Nurse A never stops mid-task while preparing the medication. Nurse A leaves the medication room, walks to the patient's room without interruption, and correctly administers the medication to the patient.

In the contrary case presented it appears that the agency has strict policies in place to limit any interruptions during MA. Nurse A follows these policies by handing off his phone prior to beginning the process of MA and closing the door, signaling to others to not enter the room. Nurse A completes the task of medication administration without interruption and no errors occur.

### Empirical Referents

Defining the empirical referents of a concept is the final step in Walker and Avant's eight-step method. Empirical referents are "classes or categories of actual phenomena that by their existence or presence demonstrate the occurrence of the concept itself" (Walker & Avant, 2005, p. 73). The empirical referents for an interruption during MA were found to be 1) suspension of the primary task due to an unexpected alert; and 2) intent to resume or resumption of the primary task.

### Definition of Interruption

Based from the analysis performed, a definition and model (see Figure 1) of interruption were developed. An interruption is defined as: occurs when an unexpected alert diverts the recipient's attention, causing the recipient to suspend the primary task, if only temporarily, with intent to resume the original task.

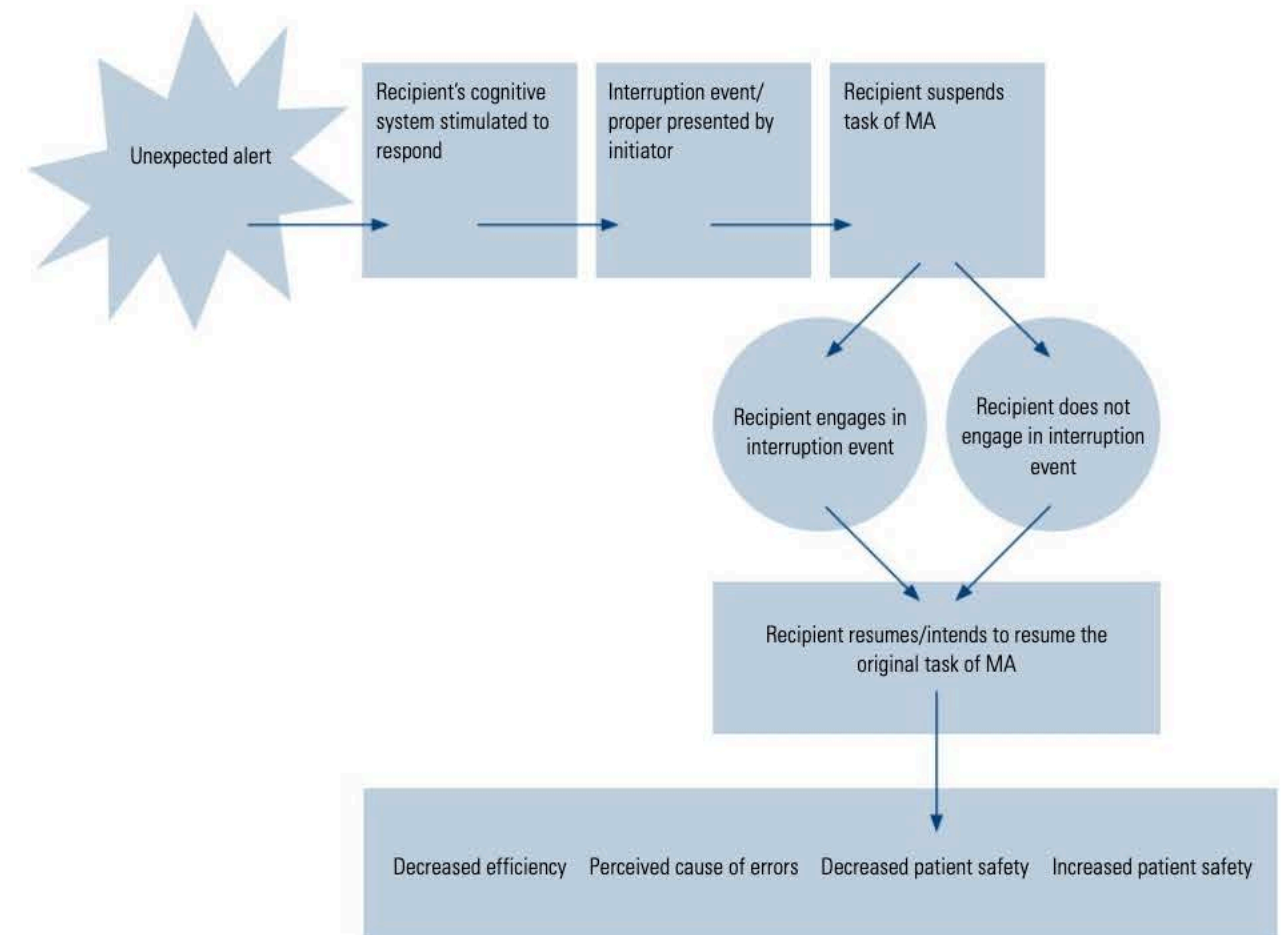
### Discussion

Interruptions have the potential to occur in all human experiences. The concept of interruption has been examined within various disciplines and have been largely shown to have associations with negative effects. As they relate to the discipline of nursing, interruptions can lead to deleterious effects such as harmful, even fatal, medication errors. However, interruptions have also been shown to be associated with positive effects in health care settings and are necessary in certain situations. For example, interruptions of nursing tasks may be needed to mobilize personnel to assist in emergency situations. In addition, interruptions may occur to convey important information such as a critical lab value that leads the nurse to withhold administering a medication to a patient. In these instances, interruptions have the potential to increase patient safety.

Further research on interruptions in nursing contexts is needed. A better understanding of the associations of interruptions and patient safety, as well as evidence to guide the identification of targeted interventions and strategies aimed to best manage interruptions is required. Current interruption management interventions are aimed merely to reduce interruptions during MA due to the interpretation that interruptions have only a negative association with patient safety. Such interventions include "no interruption zones" and

nurses wearing "do not disturb" vests or sashes during MA. Raban and Westbrook (2014) performed a systematic review to explore the effectiveness of such interventions on decreasing interruption rates and MAEs and found weak evidence of the effectiveness of these interventions to significantly reduce interruption rates, and limited evidence of their effectiveness to reduce MAEs (Raban & Westbrook, 2014). An important strategy to improve patient safety is the incorporation of management strategies for interruptions (Beyea, 2014; Hayes et al., 2015; Rafferty & Franklin, 2017; Westbrook et al., 2017) rather than focusing solely on decreasing their occurrence.

Figure 1. Model of Interruption during Medication Administration



Results from well-designed studies can aid researchers in expanding evidence in this topic area, guide the development of health policies, and inform educators and administrators of effective strategies to best manage interruptions. Colligan and Brass (2012) and Johnson and colleagues (2017) have identified how nurses currently manage interruptions during MA. It is recommended to extend this work with an aim to discover which strategies are both practical and effective to mitigate the negative effects of interruptions during MA. However, before we can continue this research, we need a clear definition and understanding of the concept we are examining.

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