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Interruptions During Medication Administration: An Integrative Review of Their Attributes and Implications for Registered Nurses

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Abstract

Background: Interruptions during nurses' medication administration (MA) are a major contributor to medication administration errors (MAEs), threatening patient safety and increasing healthcare costs. Objective: This integrative review examined the characteristics of interruptions during MA and evaluated the effectiveness of interventions to reduce these interruptions and related MAEs.

Methods: A comprehensive search of MEDLINE, CINAHL, and PsycINFO identified studies (2018–2024) reporting on interruptions during MA among hospital nurses. Ten studies met inclusion criteria and were appraised for methodological quality. Data were synthesized regarding frequency, sources, duration of interruptions, and the impact of interventions.

Results: Interruptions were common, occurring in 53–63% of MA passes, with an average of 1.2–1.5 interruptions per patient or 2.6 per medication round. The most frequent sources were other nurses and healthcare staff, as well as self-interruptions. The mean duration ranged from 68 to 92 seconds. Bundled interventions (e.g., "Do Not Disturb" vests, staff training, standardized protocols) demonstrated some reduction in interruption rates and MAEs, but evidence of long-term effectiveness remained limited. Several studies highlighted the need to distinguish necessary from unnecessary interruptions and to assess unintended consequences of interventions.

Conclusions: Interruptions during MA are prevalent and significantly associated with MAEs. While targeted strategies can mitigate risk, sustained improvements require multifaceted interventions, continuous education, and a safety culture that supports interruption management. Further research should explore the cognitive mechanisms of interruptions and balance the reduction of unnecessary interruptions with the preservation of essential clinical communication.

Keywords: Interruptions; Medication administration; Medication administration errors; Patient safety; Nursing practice; Hospital nursing; Interruption management strategies.

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Introduction

Adverse events are a widely researched phenomenon in health care. Three factors characterize adverse events in healthcare: the patient suffers harm, an injury, disability or complication; the event is unintended; and the incident is associated with healthcare management rather than the patient's illness or health-impairing condition itself (Vincent et al , 2024)

Interruptions and distractions include all things that draw away, divert or disturb attention from the task at hand by forcing attention on a new assignment, at least temporarily. Attending to the new task increases the chance of error with either of the tasks because of the interruption, which causes cognitive fatigue and leads to mistakes, mental slips, and omissions. Nurses' interruptions are common, and they have negative consequences on the safety and health outcomes of patients, nurses' performance and the national health resources as a whole (Anthony et al, 2019). Nurses' interruptions during medication administration are highly linked with medical errors such as repeating a dose, omitting some medications, re-administration or administering the wrong drugs to patients (Anthony et al, 2019). The medical errors caused by interruption may lead to the worsening of the patients' conditions which consequently leads to increased length of stay at the hospital, poor satisfaction rates, injury and in the worst-case scenario, death (Anthony et al, 2019).. Therefore, it is evident that the interruption of nurses during medical administration (MA) leads to errors that negatively affect the health

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outcomes of the patients and the healthcare resources as a whole since the deterioration of patients' conditions is associated with extra financial needs.

The costs in both human and financial terms are high: one estimate infers that adverse events affect up to one-third of all hospitalized patients and these, 20% will die, and another 13% will suffer permanent disability as a result (Baker et al., 2024; De Vries, Ramrattan, Smorenburg, Gouma, & Boermeester, 2018). Further, and tragically, up to 80% of all adverse events are thought to be preventable (Sharek et al., 2006; Sinopoli et al., 2020). The financial costs are also burdensome. A recent Australian study on patients undergoing cardiac surgery determined that 36% of patients suffered at least one adverse event at a total cost of $42.5 million (Ehsani, Duckett, & Jackson, 2023). With specific regard to medication administration errors, the average hospital patient can expect to experience one or more medication errors per day. As a result, at least 1.5 million preventable medication errors occur in hospital systems yearly. Thus, an estimated 3.5 billion dollars annually are a direct result of preventable medication errors (IOM, 2024). Is there more current data?

Prevalence of the Problem

According to the World Health Organization (WHO), medication errors lead to at least one death daily and injury to about 1.3 million people yearly in America (2018). The global cost associated with medication errors in about US $42 billion yearly or approximately 1% of the total global health expenditure (World Health Organization, 2019). WHO further identifies that most of the medication errors associated with nurses are caused by staff shortages, exhaustion or interruptions,

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and there is a need to improve the medication process to reduce the prevalence of errors and their negative impact on health care (2023) . The U.S. Food and Drug Administration (FDA) also indicates that medication errors are highly prevalent with about 100,000 reports annually (2019). To reduce the prevalence of medication errors, FDA has identified the need to work collaboratively with other organizations such as the Institute for Safe Medication Practices (ISMP) to identify causes of errors and come up with strategies to prevent them (U.S. Food and Drug Administration, 2019). Given that nurses interruptions during medical administration are one of the leading causes of errors, there is a need to identify strategies to reduce interruption and as a result the associated errors and consequently improve the safety and quality of care that service users receive.

Interruption during medication administration

Reed, Minnick and Dietrich (2018) revealed frequent interruptions during medication tasks. The range of nurses' responses to interruptions was surprising in relation to the frequency with which nurses accepted the disruption to the task and the infrequency of delayed responses. An additional study of nurses' responses to interruptions during medication tasks and the effect of different reactions on patient safety outcomes was conducted by Duruk, Zencir, and Eşer (2020). This study found a very high interruption rate while preparing medications. The researcher recommended that in-service teaching should be provided to raise awareness of this important issue. Alteren, Hermstad, White and Jordan's (2018) study showed that nurses were frequently interrupted and distracted, mainly by

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nurses and other healthcare professionals. The researchers recommended that management and education providers recognize this could be a threat to patient safety. Did they recommend interventions?

Hopkinson et al.2017 and Reed et al. (2018) both assert that the majority of the interruption study focuses on the unfavorable effects of nurse interruptions more so linked to errors that occur in the course of medical tasks. However, they also state that there may exist numerous occurrences when interruptions lead to positive impacts by offering new kinds of information to a given scenario or even preventing the occurrence of a more significant error.

According to Reed et al. (2018), medical personnel's' response to various interruptions states that since the interruptions cannot be completely avoided, a viable approach for handling the said interruptions could be to realize how they could be prepared for best as well as manage interruption-prone scenarios. Debra L Wiegand goes a step further and states that reasonably little is known about how the culture that is prevalent in the nursing workplace environment contributes to such interruptions.

Sitterding, Ebright, Broome, Patterson & Wuchner (2021) criticizes current studies by stating that there exists a significant gap when it comes to internalizing attentional dynamics like nurse-situational forms of awareness while at the same time managing interruptions in the course of medication administration.

On the other hand, Johnson et al. (2018) argue that although not all the interruptions have an adverse effect for nursing, interruptions in the course of medication rounds have long been linked with medication errors. Johnson et al.

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(2018) and Huckels-Baumgart et al. (2021) strike a similar tone when it comes to medication errors, with asserting that errors and interruptions in the course of the medication process are common and a critical issue when it comes to the safety of patients within a hospital setting.

Anthony (2020) goes one step further by exploring some causes of medical errors, which include the nurse's overall workload, level of experience, and time of day, as well as systemic deficiencies. Also, the impact of interruptions on the nurses' cognitive duties, which is medical administration, ended up taking up seventeen percent of the nurses' time with every single one of the nurses averaging thirty interruptions per shift.

Intervention to reduce interruption during medication administration

Palese (2021) and Dall'Oglio (2018) examined the effectiveness of a particular improvement program that is geared at an improvement program to cut down on the number of interruptions that occur in the course of the medical administration. Dall'Oglio (2023) highlights the effectiveness of any bundled interventions to cut down on interruption in the course of the medication administration process within a pediatric hospital. Similar to the Palese (2020), the Westbrook (2023) evaluates the effectiveness of non-interruption interventions in a bid to cut down on non-medical-related interruption to nurses in the course of medication administration. Duruk (2019) asserts that such kinds of disruption in the course of the medication preparation process could cause the medication preparation process could lead to medication errors due to the nurses' lack of attention on the part of the nurses.

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A bulk of the studies included interventions to discover their effectiveness in decreasing MAEs and interruption rates. The researchers, however, found weak and limited evidence of the efficacy in reducing interruption rates and MAEs, respectively. Research conducted by Westbrook et al. (2018) showed that a significant majority of nurses who wore 'Do not disturb' vests would refrain from offering their support if the intervention were to become hospital policy. Their lack of support stemmed from the difficulties they experienced when using the garments. It was tedious to put on and take off the vests and uncomfortable wearing them. According to Beyea (2021), it is impossible to eradicate all interruptions, even if pragmatic interventions are employed during medical administrations. Hayes et al. (2018) suggest that improving patient safety is reliant on the application of interruption management strategies. Colligan and Brass (2020) and Johnson et al. (2021) identified and explored various interruption management strategies.

Interruption management strategies

Four interruption management strategies applied during MA and identified by Colligan and Brass (2012) included the following:

a) Engaging the source of the interruption.
b) Multitasking between the MA and the interruption.
c) Mediation, i.e. engaging in activities that resume the MA.
d) Blocking the interruption.

Colligan and Brass's work was built upon by Johnson et al. (2019) who identified a fifth behavioral management strategy that nurses can use to prevent

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interruptions. Further research is needed in discovering which interruption management strategies lessen the risk of MAEs and increase work efficiency.

Education Changes Practice

From the literature, it is clear that medication errors pose a severe risk to the patients, and education and standardization of processes can reduce these risks. Kozub and Fields (2020) found during the administration phase of continuous intravenous medications, the number of errors decreased by 54% from 13 before an education project to 7 after it. Wrong medication errors also fell from 9 to 1, an 89% decrease. In addition, a study by Huckels et al. (2021) evaluated the impact of staff training and wearing safety vests as a combined intervention on interruptions during medication preparation and double-checking, and found that the frequency of interruptions decreased after the intervention.

Drach-Zahavy et al. (2021) recommended attention in the ward should shift from preventing medication administration errors to managing them. They tested the effectiveness of four types of learning practices, namely, non-integrated, integrated, supervisory and patchy learning in limiting medication administration errors. Results indicated that integrated and patchy learning were significantly linked to higher levels of medication administration errors, while non-integrated learning was not. They claimed a head nurse could facilitate learning from errors by circulating and monitoring nurses' medication administration behaviors.

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Aims

This integrated review aims to: (1) assess the quality of the literature about interruptions during medication administration by evaluating and reporting on the quality of the research designs and methods applied in terms of the application of clear definitions for 'interruptions',' and Medication Administration errors 'MAEs'; and (2) assess evidence of the effectiveness of interventions aimed at reducing interruptions during medication administration on interruption and medication administration error rates.

Review Questions:

- What is the state of the science regarding interruptions during nurses' medication administration (MA)?
- What is the quality of the literature evidence regarding interruption?
- What are the characteristics of interruptions during MA, such as their source, frequency and duration?
- What measures were used to decrease interruptions during medication administration?

Design

An integrative review of interruptions during the medication administration process.

Search Methods

Database

The databases MEDLINE, CINAHL and PsycINFO, were searched using a combination of subject headings and free text. The free text terms were limited to

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the title and abstract fields. The search terms used were related to nursing, medication, communication and interruptions, and intervention studies.

Search Limits

The search was limited to academic journals with a full text published in English and between the years 2018 and 2024

Search Terms

Combinations of the following search terms were selected: “interruptions” and “medication administration” OR “interruption” and “medication preparation” OR “distraction” and “medication administration “

Inclusion Criteria .

Articles were selected based on the language of the article, setting, participants and description of interruptions in relation to MA. Only articles that were written in English and were conducted in a hospital setting and in which the participants being observed were nurses were considered for inclusion. Studies reporting on the effects of an intervention which included the aim of reducing interruptions or distractions to nurses during medication administration in hospital settings were included. Inclusion criteria required single studies with either quantitative data or qualitative data based on interruptions or MAEs. Studies which used both direct observation and other methods were included. All types of study designs were eligible for inclusion. Data reported in the article must have included a minimum of one of the following characteristics: (a) frequency of occurrence of interruptions during MA; (b) source of interruptions during MA; and (c) duration of the interruptions during MA.

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Exclusion Criteria.

Articles with reported data on interruptions of general nursing tasks without separating data on MA were excluded. Studies that were implemented in a simulation lab instead of health care settings were excluded. Articles that examined interruption from patients' perspectives were excluded, along with systematic reviews and reviews to the literature.

Search Outcome

The search and selection process is provided in Figure 1. A total of 1060 articles were originally identified, with 1040 identified in database searches and 20 identified in other searches. All were screened for relevance by reviewing the title and abstract, a process that reduced the number of suitable articles to 1008 and then to 52 articles. A total of 52 articles were considered for use. After an extensive full-text review of the articles ,42 articles were excluded based on the focus on only one aspect of MA (interruptions were observed only during patient identification prior to MA), and twelve articles were excluded due to the inclusion of participants other than nurses in the samples with no separation of data based on participant population. In the end, ten articles were eligible to be critically appraised for this review and met the inclusion criteria. Seven studies included in quantitative synthesis and three of them included in a qualitative synthesis.

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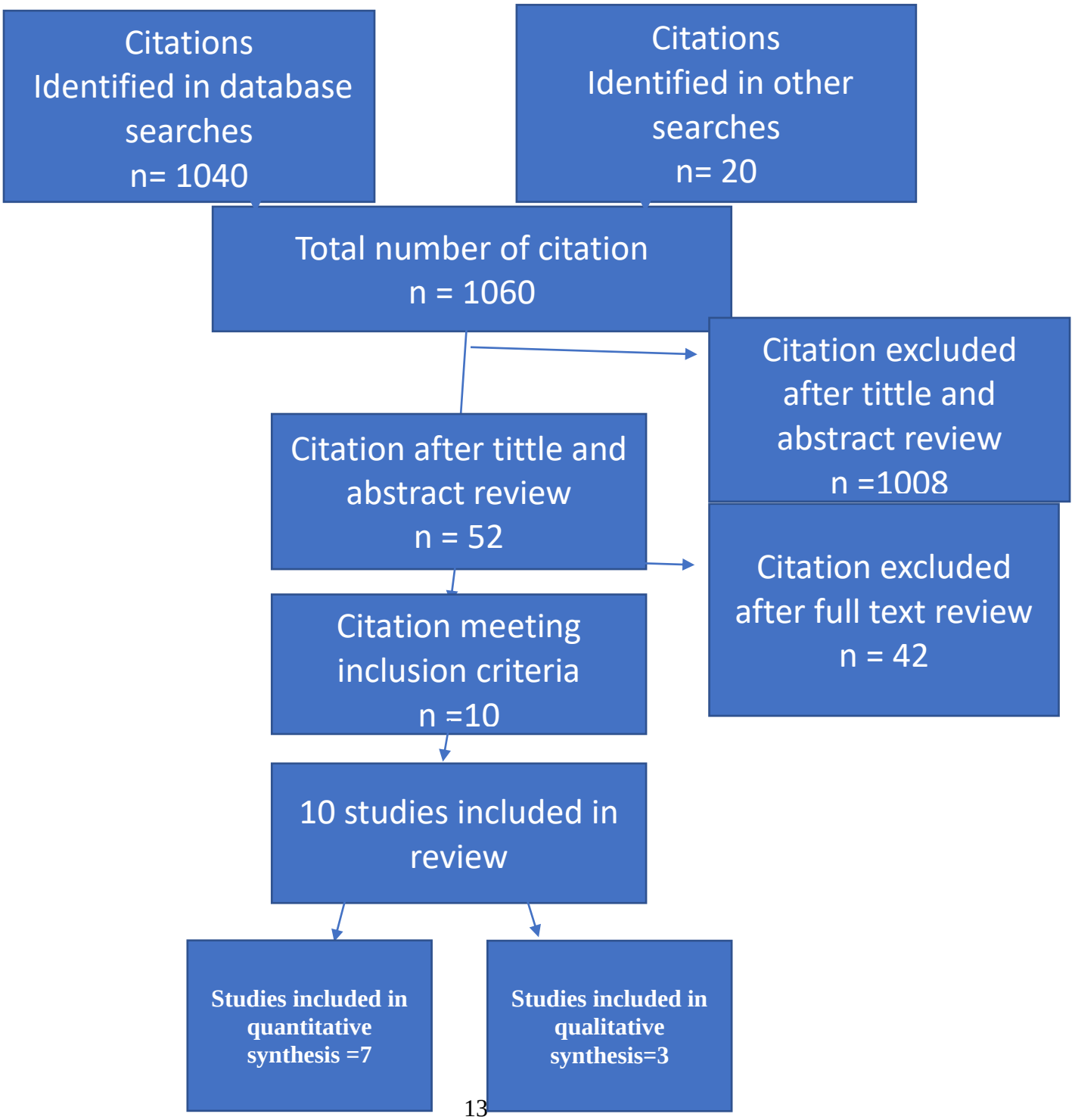
Extraction Result



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Quality Appraisal.

Sirryeh, Lawton, Gardner, and Armitage (2018) presented techniques to assess the quality of literature. They introduced a tool with 16 criteria to be assessed during article reviews using a four-point scale from 0 (not at all) to 3 (complete). This tool can be used to evaluate a study's internal validity and results in a grade of either good, fair or poor. For the current review, the ten articles were assessed using the tool. Each article was ranked, and only articles that received a good and fair ranking were included. Seven of the ten received a good ranking, with three only receiving fair because they did not include specific information about the study population.

Data Abstraction

A matrix was used to present the relevant data from the ten articles about quality appraisal. The data included the design of the study, the location and setting, relevant definitions, implemented interventions, measured outcomes, and effects of the intervention. For the setting, country, the number of hospitals and wards, and types of wards were included. Furthermore, the application of appropriate and clear definitions for 'interruptions', 'distractions', and 'MAEs' was examined. Further aspects examined were the sample sizes, any attempts to evaluate observers' inter-rater reliability, significance testing to determine differences between compared groups, and data collectors' independence at different sites. The data were also extracted regarding overall rates of interruption, then broken down into rates according to sources of interruption, rates at different stages of MA, and the time required to finish MA and MAE rates. The details

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about the sample sizes were examined related to the number of observed administered medications, patients administered mediations, medication rounds, and observation hours and nurses observed.

Results

The reviewed studies all included data for interruptions occurring during nurse MA in general or private hospitals. The countries where the studies were conducted were Australia (n=1), the United Kingdom (n=2) and the United States (n=7). The most common setting was medical-surgical units (n=7), with other settings being a cardiac unit (n=1), an elective surgery unit (n=1) and intensive care units (n=1). Even though the regions, hospital types and units varied, similar interruption characteristics were found across the ten studies.

Frequency of Interruptions

Seven of the ten studies reported on the frequency of interruptions; however, the data presentation differed. In three cases, results were provided on the frequency of interruptions by each patient (or per MA pass), but one reported on the frequency for a medication round where medication was prepared and delivered to a number of patients. On average, there were 1.21-1.5 interruptions per patient for each MA pass (Anthony et al., 20110; Dall'Oglio et al., 2019) while 2.61 interruptions occurred during each MA round (Kreckler et al., 218). Westbrook and collegues (2017) found that interruptions ranged from zero to 16 for one MA round. Of the articles that reported frequency, five provided the data as a percentage of the total MA processes that were observed. During 53.1%-63% of MA passes at least one interruption happened (Reed, Minnick, & Dietrich, 2018,

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Westbrook et al., 2020). Furthermore, at least one was found in 66.7% of medication rounds (Kreckler et al., 2018). This shows an increase in frequency from Hayes and colleagues (2015) study, which only reported frequencies ranging from 25%–55%.

Effect of intervention on MAE rates

The interventions included the targeting of interruptions while medication was being administered and the general improvement of safety during medication administration.

A reduction of MAE rates over the long-term as a result of the interventions was reported in three studies. The reduction of the errors was found to be statistically significant in only two of the studies (Dall'Oglio et al., 2017; Westbrook et al., 2023).

Sources of Interruptions

There were multiple sources of interruptions reported in eight studies. The sources observed most frequently were other nurses, other staff, and self. Such findings remain consistent with other reports on interruptions that occur in healthcare environments (Huckels-Baumgart, Niederberger, Manser, Meier, & Meyer-Massetti, 2023). In some articles, specific reasons for self-interruptions were reported such as collecting supplies (Reed, Minnick, & Dietrich, 2018) and initiating conversations not related to MA (Johnson et al., 2019). However, it should be noted that other interruptions have also been reported in previous studies. A qualitative study by Fry and Dacey (2020) found that in a self-

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administered questionnaire of 139 nurses at a London teaching hospital, nurses believed interruptions by patients and calls during MA caused the most problems.

Duration of interruptions

The duration of observed interruptions was reported in two studies. Anthony, Wiencek, Bauer, Daly, & Anthony, (2019) reported that the average duration of an interruption was 68.2 seconds and Dall'Oglio et al. (2019) reported an average of 92 seconds. Such findings are consistent with other studies of interruptions in healthcare settings where reported durations range from 45 seconds to 82 seconds (Dall'Oglio et al., 2021). From the reported results, it can be concluded that interruptions generally last an average of over a minute in healthcare settings.

Discussion

The review discovered that during the administration of medication, interruptions would occur at least once because of interventions initiated by nurses and staff members. Most nurses report that interruptions are a significant cause of administration errors. Some studies attribute the severity and frequency of administration errors to the interruption of the medication administration process.

Medication administration errors during interruption have been reduced in a myriad of healthcare facilities through interventions. However, the interventions have flaws. For instance, most of the articles fall short in providing sufficient details on their sample sizes. They rely on subjects from the same health facilities as observers who provide information on medication administration. It causes bias in the findings. Some studies also had unclear outcomes.

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Furthermore, only a handful of studies focused on interruptions as the primary issue of the article (Anthony,2024). It would be prudent to unearth the root of the interruptions to gain a better comprehension of the effect of interventions. It is also advisable to focus on the categories of medication administration that existed when the interruptions occurred. The research neglected to examine the unplanned ramifications of different interventions. One study examined the perception of patients about the 'Do not disturb' intervention. It focused on how limiting patient-to-nurse communications posed a threat to the patient's life. Therefore, the researcher must endeavor to measure patient behavior regarding such intervention before they can apply it to nurses.

The challenges posed by medication administration errors are significant, particularly to patients and professionals, since they are costly. An identified and significant contributor to the magnitude of the problem is an interruption. For instance, research conducted by Dean, Schachter, Vincent & Barber, (2020) discovered that human and system factors such as fatigue and skill mix account for 70-80% of the adverse effects or healthcare accidents. However, the numbers connected to adverse events are unproven because these factors are amenable, mainly to change and improvement.

A majority of the studies failed to report enough detail on the sample size observed (Westbrook et al., 2023). They also failed to engage in assessments of inter-rater reliability, relied on the workforce from the same healthcare institutions to act as observers and provide data on interruptions, and failed to gauge the statistical relevance of the intercession or interaction effects (Westbrook et al.,

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2018). The use of staff from the same hospitals contributed to biasness in the studies. The distinctions in the outcomes are also unclear for most studies. For instance, while interuptions were the chief concern of the studies, only 3 were provided and varied across the sources (Anthony et al, 2024).

Some studies emphasized their endeavor to measure changes in interruptions they considered unnecessary. Thus, they elucidated mandatory interruptions as those that added utility to the quality of medical care received by a patient. Anthony et al. (2021) excluded some interruptions by assuming that they were important ones. For instance, interruptions between a nurse preceptor and an orientee. The exclusion was conduction even though the study failed to identify other types of necessary interruptions systematically. One unprecedented adversity of interventions could be the lowering in the number of mandatory interruptions .None of the studies reported the problem of a reduced number of interruptions, determined whether the rate changed post-intervention. The assessment of such unintended consequences proves daunting. For example, as maintained by Anthony et al. (2018), an interruption may be considered prudent by one faction but unnecessaryby the other. The problem has been noted in several studies conducted on pager calls, where the recipients were asked to judge whether some pager texts were necessary or unnecessary. The ones who initiated the messages perceived them as necessary for the execution of patient care. The studies fell short in investigating the unprecedented adversities of their interventions. One study reported that patients fail to raise the necessary interruptions as having the potential to bring negative consequences. The issue should be catered to in future

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studies because of the expanding literature that covers the unpredictable consequences of interventions done on a wide range.

Coraggio (1990) states that the interruptions conducted in the context of a worker's knowledge are generated externally, occur randomly and are discrete events that break the continuity of one's cognitive focus on a task (p. 19). Such an interruption can negatively influence a person's performance on a task because it arrests the individual's attention. Baron (1986) suggests that since tasks and distractions can occur concurrently, the pressure to attend to both events is equal. Cohen (1980) suggest that the diversion of cognitive resources and attention accounts for intentional overload, which causes the person to attend to some cues at the expense of others.

Interruptions require immediate attention, according to Covey (1989, p. 152). , even though an individual may choose to either ignore or delay their attention to distractions. The processing of primary tasks is often mistaken for cognitive processing because both occupy a person's memory concurrently. Thus, they may disrupt cognitive performance more substantially than distractions (Speier, 1996). Minimal research has examined the psychological ramifications of interruptions. The findings indicate that studying interruptions is problematic, particularly the implications and the outcomes. In clinical settings, controlled experiments that are highly structured, such as those used in cognitive and experimental psychology, are not feasible. Even though observations have been relied upon to describe the frequency and types of interruptions, a substantial part

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of cognitive processing is not feasible. In studying the positive and negative effects of interruptions, cognitive processing, and decision making are critical factors.

According to Li et al. (2021), decision-making tasks involve conscious mental processing of several options in a specific situation. The effect of interruption can vary based on the task type. A mitigating factor of the consequences of interruption is the content of the message within it. For instance, when the content of the interruption adds information that assists in the performance of a task. The US Department of Health identified the need for reform in the nation's healthcare system. One of the objectives was to foster safe and improved quality healthcare that could be accessed by all citizens (U.S. Department of Health and Human Services, 2019). Thus, providing ways to reduce interruptions experienced by nurses during the administration of medication is timely and supports the strategic plan of the USD department of health and human services.

Nurses must identify which strategies can be relied upon to reduce interruptions during the administration of medication. Nurses are critical stakeholders in the health sector because their role is to improve the effectiveness of service delivery and supplement the role of doctors. Thus, it is prudent to improve their performance. The policy of improving the quality of healthcare for Americans by obliterating interruptions and errors will elevate the quality of care nurses offer, since they play a significant role in the patient's treatment course. Patients are also key stakeholders since the policies aim to improve their

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satisfaction with the healthcare they receive. Other medical staff are significant stakeholders because they collaborate with nurses to offer healthcare services.

The literature reveals that positive patient outcomes stem from ongoing educational support coupled with delivery methods. The review created a foundation of knowledge revolving around interruptions and their impact on nursing teams. It is also essential in providing nurses with the most effective approaches to apply to prevent interruptions and reduce inaccuracies in medication administration. The desire is to improve the working experience of nurses by imparting knowledge that empowers them to satisfy clientele needs.

Implications for Nursing

The Saudi Arabian healthcare system is currently involved in implementing different policies which focus on elimination of different healthcare-related issues that affect the patients; medication errors is one of the issues being examined. The only problem that can be associated with such policies is that they are focused on generally addressing the different healthcare issues. There are limited policies and educational programs which are mainly developed to help in the prevention, elimination and limitation of the occurrence of interruption during the medication administration process to prevent medication errors in the hospitals.

Conclusion

If staff awareness about common sources of interruptions increases, changes may occur that lead to a decline in the number of interruptions. Furthermore, leaders in nursing can use a heightened understanding of what

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•Study	•Frequency	•source	•Factors	•Interruption	PRIMARY	INTER		

common characteristics interruptions have to inform research as well as policies and training regarding managing interruptions. Although observations have often been used to determine the frequency and types of interruptions, the cognitive processes that happen are not observable. Studies looking at cognitive processes and decision making could be important to better understand the impact of interruptions.

Table 1

Comparing Attributes Findings on outcomes

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				handling strategies	TASK SECONDARY TASK	- RATER RELIABILITY	MAE rate	Duration
•Kyle Anthony 2010	x	x						
•ImmacolataDall'Oglio 2016	x	x				x		
•Johanna I Westbrook 2017	x	x	x					x
•NAZIKE DURUK 2015	x	x	x					x
•ClintaChé Reed 2018			x		x			
•SASKIA HUCKELS 2017	x							x
•Susan G		x						

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Hopkinson 2017								
•Mary Cathryn Sitterding 2014		x	x	x				
•MAREE JOHNSON 2017	x	x						
•AlvisaPalese Nursing/ Patients 2019								

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