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Workflow Interruptions: Risk Factors and Outcomes in Nursing

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Workflow Interruptions: Risk Factors and Outcomes in Nursing

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Workflow Interruptions: Risk Factors and Outcomes in Nursing

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Abstract

**Introduction:** Workflow interruptions in nursing are defined as the disruption of a nursing task. Workflow interruptions are a common stressor in nurses’ work, leading to deviations in their focus that can result in medication errors and missed nursing tasks. Thus, they can compromise patient safety, health outcomes, and satisfaction. Moreover, interruptions can cause stress, burnout, and reduce job satisfaction among nurses. It is important to recognize that there are solutions that would prepare nurses for reducing workflow interruptions and improving their work patterns. The purpose of this literature review was to identify the causes of interruptions, their effects on patients and nurses, and existing evidence-based strategies to prevent workflow interruptions among registered nurses. **Methods:** A search was conducted to identify research on the characteristics of interruptions, their effects on nurses as well as patients, and evidence-based interventions. The inclusion criteria included articles published in academic journals in English within the past ten years. The search was conducted through the Northern Illinois University library databases and Google Scholar with the key terms workflow, interruption, nursing, disruption, and evidence-based practice. **Results:** The literature showed that interruptions can be categorized as internal (e.g., self-induced conversations during nursing tasks) and external (e.g., care- and technology-related interruptions). Positive and negative outcomes related to flow disruptions were also identified. Interventions, such as implementing no interruption zones or adopting positive work beliefs, were found to be effective in significantly reducing interruptions as well as decreasing their negative effects. **Conclusion:** Workflow interruptions can be significantly reduced by implementing evidence-based practices. Nurses should be informed that positive work beliefs can decrease the amount of stress experienced as a result of the complex
nature of their work. However, more research is needed to find the effects of such initiatives related to patient outcomes.

*Keywords:* workflow, interruption, nursing, disruption
Workflow Interruptions: Risk Factors and Outcomes in Nursing

Nurse workflows are very complex adaptive processes and can be complicated by the number of patients assigned to the nurse, the condition of the patients, and the constant requirement to coordinate with other team members’ needs (Cornell, Riordan, Townsend-Gervis, & Mobley, 2011; Vardaman, Cornell, & Clancy, 2012). Nurses have to perform many different tasks that demand critical thinking (Cornell et al., 2011). In order to fulfill patients’ demands, to complete doctors’ orders, and to stay within the scope of nursing practice, nurses switch tasks frequently to manage their dynamic patient load. Research has shown that such task switching increases the amount of time needed to perform tasks as well as the number of errors related to nurse performance (Brixey, Robinson, Turley, & Jiajie, 2010; Elfering, Grebner, & Ebener, 2015). Frequent task switching depends on the number of patients assigned to the nurse, changes in the dynamics of patients’ conditions, and the amount of communication required of interdisciplinary healthcare team members. These factors, along with unpredictable situations, can interrupt nurses’ workflow. Such interruptions occur frequently across all healthcare settings (Rivera & Karsh, 2010). However, an increased workload with such demanding job duties can yield negative outcomes in terms of patient mortality (Joshi, Po-Huang, Tirmizi, & Gross, 2016).

Workflow in nursing is defined as the pattern of carrying out a number of tasks for patient care. Workflow interruptions in nursing are defined as disruptions to a nursing task which can compromise patient safety and health outcomes (Baethge & Rigotti, 2013). According to Anthony, Wiencek, Bauer, Daly, and Anthony (2010), a nurse experiences an average of 30 interruptions during each shift. An alternative study found that nurses were interrupted around 12 times per hour (Brixey et al., 2010). Interruptions can distract nurses from patient care, causing delayed or missed tasks. This sometimes worsens or exacerbates a patient’s condition.
Because the nurse forgets the initial task after task-switching, such workflow interruptions demand extra effort and time. In health care, these interruptions can lead to medical errors, which has detrimental effects for patients (Elfering et al., 2015). When nurses work in high-risk environments, there is a higher occurrence of preventable medical errors because memory and attention are compromised due to the multitasking and task-switching required (Brixey et al., 2010; Flynn, Evanish, Fernald, Hutchinson, & Lefaiver, 2016). Additionally, workflow interruptions have adverse outcomes for nurses as well as patients. For example, according to Relihan, O’Brien, O’Hara, and Silke (2010), interruptions can increase the stress level of healthcare workers because of attention splitting and time constraints. However, the outcomes of workflow interruptions are not always negative. The critical thinking constantly required of nurses helps them to learn from interruptions. Nurses can thus adapt to the mental demands placed on them, which gradually reduces the stress associated with flow disruptions.

**Objectives**

This paper will analyze the causes and outcomes of workflow interruptions in different areas of nursing (e.g., the operating room, intensive care unit), highlighting the effects of workflow disruptions in medication administration. Potential solutions to improve workflow consistency and mitigate the negative effects of workflow interruptions will be considered as well.

**Methods**

This literature review was conducted via an electronic database search of the Northern Illinois University (NIU) online library databases and Google Scholar. This process took place over a two-week period and was completed on September 3, 2018. CINAHL Complete, Science Direct, Academic Search Complete, PubMed, and ProQuest were used to select articles. The
keywords used in the beginning were workflow, interruption, and nursing. Over the course of the research process, it was found that keywords like disruptions, task-switching, barriers, and evidence-based practice were also helpful in finding relevant articles. Inclusion criteria were as follows:

- Full-text available
- Published from 2009 to 2018
- English language
- Both qualitative and quantitative studies
- Original study designs
- Peer-reviewed

Articles about workflow interruptions in professions other than nursing were reviewed and chosen if they provided information about nursing workflow. A couple of literature review articles were used for the discussion section. The abstracts of all articles were reviewed before 25 main articles were selected. The researcher then met with a faculty advisor to approve the articles. A literature review of the final 17 articles was conducted. Most of the articles focused on general nursing care with the exception of critical care unit (CCU) and neonatal intensive care unit (NICU). The studies were conducted in a variety of clinical settings, such as the intensive care unit (ICU), CCU, NICU, and operating room (OR). The majority of studies featured quantitative research, with some qualitative studies, a few literature reviews, and one grounded theory study also included. The articles were read thoroughly, and main ideas were highlighted. The articles which mentioned interventions to avoid interruptions were marked differently and discussed in the intervention section of the paper. Different categories were decided based on different causes of workflow interruptions.
Results

Causes of Workflow Interruptions

There are mainly two types of flow interruptions: (1) external and (2) internal. According to Rivera and Karsh (2010), external interruptions are actions performed by an agent other than the nurse. This includes technological tools, other healthcare providers, system failures, patient and family needs, and administrative requirements. Internal interruptions are self-induced by the nurse (e.g., cognitive stress, negative work beliefs, taking a break).

**External interruptions.** Different nurses experience external interruptions in different ways. Some nurses feel that other healthcare providers are a major source of external interruptions, while some believe that constant beeping from patient safety alarms significantly disrupts flow. Additionally, interruptions related to nursing care, such as responding to an emergency condition, are unavoidable and necessary to provide equal care for all patients.

**Interruptions induced by others.** Numerous researchers have found that nurses are most frequently interrupted by physicians, other nurses, clinical technicians, therapists, patients, and patients’ family members (Anthony et al., 2010; Cooper, Tupper, & Holm, 2016; Craker et al., 2017; Flynn et al., 2016). For example, a patient’s family may need a significant amount of time from nurses to understand their loved one’s care process (Vardaman et al., 2012). This demands additional time from nurses’ predefined workflow, creating interruptions.

Other nurses and healthcare providers interrupt nurses for time-sensitive information as well (Rivera & Karsh, 2010). For example, doctors page nurses to cancel medicines that nurses are about to give their patients. Such interruptions are beneficial in nature rather than destructive as they keep patients from unnecessary treatments, which can sometimes be harmful or invasive.
The most common source of interruptions is interactions with other nursing staff involved seeking information or assistance with patient care (Flynn et al., 2016).

**Technological and administrative interruptions.** New systems and technologies are implemented in healthcare to optimize the standard of care provided, streamline nurses’ workflow, and avoid medical errors (Vardaman et al., 2012). However, the transition from paper-based documentation to computer-based systems, or from one software to another, can increase the workload of the nurse and cause workflow interruptions (Lee & McElmurry, 2010). Such changes often create confusion and lead to ineffective care practice in the early phase of implementation. For example, when a nurse learns to use a new electronic system, he or she must search to determine where to document necessary information as there may be hundreds of tabs available. This places an additional task on heavily burdened nurses. Further, poorly designed computer systems can lead to a delay in patient care. For example, when medication orders are delayed due to the implementation of a new system, patients’ care get delayed and negatively affected.

The implementation of novel technological tools can also be significantly disruptive for nurses and other staff. Joshi et al. (2016) studied the use of web cameras in NICU settings to involve the family in the care process and enhance family bonding. The results indicated that nurses spent a substantial amount of time adjusting and focusing cameras and addressing family concerns. Nurses in this particular unit felt a higher amount of disruptions as a result of the web cameras. Moreover, nurses with multiple infants under their care had increased stress and more tasks to complete, which negatively affected the quality of care provided to the infants. However, new nurses felt less stress handling this situation compared to highly experienced nurses. This could be because more experienced nurses had a defined workflow pattern and were less willing
to accept major changes, whereas new nurses did not have a predefined pattern and were more familiar with contemporary digital technology, allowing them to adjust to the new system easily.

Frequent alarms and constant alerts from personal digital assistants, such as mobile phones or Voceras provided by the organization, are one of the external interruptions nurses most frequently report (Brixey et al., 2010; Cohen et al., 2016; Cooper et al., 2016; Flynn et al., 2016; Relihan et al., 2010; Rivera & Karsh, 2010; Zoupanou & Rydstedt, 2017). Nurses often perceive stress from constant calls from other providers, particularly while working directly with patients (Craker et al., 2017). They thus sometimes ignore the calls and, in doing so, miss an important call related to their patients’ conditions. This is a concern for patient safety. According to Zoupanou and Rydstedt (2017), when a person uses a smart phone at work, their attention is disrupted, and this may impede their recovery from work-related stress. Moreover, technological breakdowns, including errors in scanning tools and difficulty accessing equipment and supplies, can result in increased interruptions (Flynn et al., 2016).

**Care-related interruptions.** Interruptions during high risk activities, such as medication administration or sterile procedures, increase the risk of patient harm (Flynn et al., 2016). For example, when a nurse is distracted during sterile dressing change, they have a high chance of forgetting important safety steps (e.g., breaking the sterile field). Moreover, nurses get interrupted unknowingly when unplanned events or unexpected patient reactions occur. Routine nursing tasks, such as IV insertion, can become difficult with patients who are dehydrated, elderly, or critically ill (Vardaman et al., 2012).

Nurses play a vital role in the critical task of administration of medications, which is highly related to patients’ safety (Anthony et al., 2010; Relihan et al., 2010). Interruptions are particularly common during medication administration, with interruptions occurring in more than
half of the medication passes in medical-surgical (med-surg) units (Cooper et al., 2016). Further, interruptions are more likely to occur during day shifts than night shifts. Interruptions during medication administration can lead to errors that result in harm or injury.

Nurses are a central part of communication related to patient’s condition, which causes them to experience a higher number of interruptions compared to other healthcare providers. For example, circulating nurses experienced a high amount of flow disruptions compared to anaesthesia and perfusion specialists (Cohen et al., 2016). Flow interruptions in such a highly critical environment can create coordination issues, which poses a significant threat to the discipline. This can also lead to major surgical errors during operations.

**Interruptions related to implementation of evidence-based practice.** In order to improve the quality and standards of care, evidence-based practices are integrated in nursing. However, research has shown that nurses often experience a lack of readiness and are unable to implement these practices in their care. Constraining factors for implementation are lack of skills, knowledge, and time (Renolen et al., 2018). The main concern for nurses in this study was the risk of losing workflow and experiencing heavy workload while implementing new practice in their predefined workflow. It was also found that leaders in implementation provided support in the initiation phase before nurses were given the responsibility to move the practice further. Thus, lack of support or enough time were factors that increased nurses’ detachment from using new evidence-based practices (Renolen et al, 2018).

**Internal (self-induced) interruptions.** According to Relihan et al. (2010), one of the most common sources of interruptions are nurses themselves. This includes nurses initiating conversations with other healthcare members during medication administration. Nurses sometimes initiate interruptions for self-care, such as taking breaks to eat or use the restroom.
However, these interruptions are necessary to reduce nurses’ fatigue level. Further, nurses who adopted positive work beliefs interpreted work interruptions more positively and experienced lower cognitive and emotional stress than those who did not (Zoupanou & Rydstedt, 2017).

Outcomes

Negative Outcomes

Interruptions are associated with documentation and medication errors, negative health outcomes for patients, additional expenses for patients and healthcare organizations, and patient dissatisfaction (Craker et al., 2017; Rivera & Karsh, 2010). These outcomes lead to poor nursing performance and can negatively affect the quality of care provided. When there are more interruptions, nurses hardly get time to recover from the negative effects of stress caused by an increased workload, which threatens the accomplishment of daily required tasks. For nurses who have a defined work sequence, interruptions may necessitate reorganization of their workflow. In doing this, there is the possibility that some tasks may be skipped, which may reduce the quality of performance. As a result, nurses may feel frustrated and experience a loss of control over their work environment.

Patient safety is also impacted by workflow interruptions. A large number of tasks in a small amount of time and a long delay between the initiation and completion of an interrupted task increases the risk of forgetting necessary steps in the nursing process. Interruptions can result in occupational injuries, near-miss errors, or actual errors in clinical settings (Baethge & Rigotti, 2013; Elfering et al., 2015). Errors during administration of potent or lifesaving medication pose a great risk to patient’s life (Anthony et al., 2010).

The more interruptions a nurse experienced throughout their shift, the higher the likelihood of forgetting intentions, being less satisfied with their performance, and feeling
irritated at the end of the shift (Baethge & Rigotti, 2013). Moreover, high switching between nonrepetitive tasks was associated with high cognitive strain and limited uninterrupted time. This leads to nurses having inadequate time for recovery. Interruptions may thus necessitate the reorganization of their workflow for nurses who have a defined work sequence.

**Positive Outcomes**

Nurses constantly communicate with other staff members in order to confirm information, ask questions regarding policies and standards, and get help troubleshooting devices (Craker et al., 2017). Healthcare workers should interrupt each other in the event that time-sensitive information needs to be communicated (Cooper et al., 2016; Rivera & Karsh, 2010). Interruptions in such cases can have positive outcomes as they can provide necessary information to nurses and ensure that organizational standards regarding the patient care process are followed. Additionally, some alerts from vital sign monitors, IV pumps, and ventilators create necessary interruptions to inform nurses about changes in patients’ condition (Cooper et al., 2016; Rivera & Karsh, 2010). This will reduce the likelihood of patients’ lives being put at risk. Interruptions can also result in quicker task accomplishment and increased attention to the interrupted task (Baethge & Rigotti, 2013). Further, some nurses regarded task switching as a method to improve job satisfaction and keep control of nursing tasks (Renolen et al., 2018).

**Interventions**

Reducing negative interruptions is comprised of eliminating unnecessary communication, optimizing collaboration, and ensuring nurses maintain undisturbed focus (Flynn et al., 2016). In order to reduce the amount of interruptions, it is necessary to recognize the sources of and reasons for their occurrence (Craker et al., 2017). Understanding the root causes of interruptions will facilitate effective interventions. The prevalence of interruptions should also be measured to
determine the frequency of interruptions experienced by each healthcare professional in an institution. It is also necessary to acknowledge the non-linear, adaptive nature of nurses’ workflow (Vardaman et al., 2012). According to Cornell et al. (2011), delegating routine and repetitive nursing tasks to non-nursing personnel can improve nurses’ workflow.

In order to minimize interruptions, nurses should gather necessary vital signs and information about medication at the beginning of their shifts and for new admissions (Cooper et al., 2016). According to Baethge and Rigotti (2013), nurses should record notes regarding patient information as well as interrupted tasks in order to prevent skipping tasks. Checklists can also be provided to assist nurses in organizing their workflow (Relihan et al., 2010; Rivera & Karsh, 2010). During medication administration, vests or signs indicating “do not interrupt” have been found to significantly decrease interruptions from other healthcare providers (Anthony et al., 2010; Flynn et al., 2016; Relihan et al., 2010; Rivera & Karsh, 2010). Moreover, multidisciplinary rounding can reduce interruptions related to follow-up care (Craker at al., 2017). For example, with rounding, the nurse does not need to follow up with the doctor or pharmacy to obtain necessary data when a doctor orders the discontinuation of a medication.

In a quasi-experimental pilot study conducted by Anthony et al. (2010), No Interruption Zones (NIZs) were implemented in two ICU units to reduce interruptions while preparing medications. Signs on the walls and red borders on the floor of the work area were used to designate the NIZ. The results of this study found a significant reduction in interruptions within three weeks of implementing the NIZ. With additional research, this could be implemented as an evidence-based practice to reduce errors resulting from interruptions. In a similar observational study conducted by Relihan et al. (2010), a set of evidence-based interventions was used to reduce interruptions during medication rounds in an acute medical admissions unit. The methods
used in the study were red aprons and signs on the ward indicating a quiet zone. Patient education regarding the outcomes of interruptions was also used. Patients can be informed using educational leaflets encouraging them not to interrupt nurses during medication administration. The results indicated that such interventions yielded a significant decrease in interruptions induced by other healthcare providers and patients.

Joshi et al. (2016) stated that a positive perspective toward changes in practice can help nurses have more positive feelings about interruptions. When implementing a change in practice or technology, appropriate training and education must be provided. The introduction and use of the technology need to be critically evaluated so that physicians and nurses do not initiate unnecessary interruptions (Brixey et al., 2010). Furthermore, new nurses can be role models during technological changes, and administrators should be more actively engaged in decreasing common interruptions experienced by nurses (Joshi et al., 2016; Relihan et al., 2010; Renolen et al., 2018). This can be accomplished by implementing new technologies that are designed to reduce task switching, unnecessary tasks, and interruptions as well as optimize the time needed to communicate information.

According to a study by Zoupanou and Rydstedt (2017), a belief in hard work and ethical standards positively mediated the positive interpretation of interruptions, leading to better overall health and wellbeing. Thus, nurses’ work beliefs should be investigated as it could yield practical suggestions on ways to improve their motivation and performance. Moreover, healthcare organizations should introduce work philosophies or practices focused on positive work values.

Nurses tackle interruptions in a way that is convenient to them and use the task schemas developed for such interruptions in the future (Vardaman et al., 2012). For example, if a nurse knows that a particular patient is more demanding and wants a significant amount of attention
from the nurse, the nurse can educate other future patients that nurses have other patient
assignments too and will try their best to provide best care. The layout of the setting where
nurses work is also a mediating factor that affects nurses’ workflow. A study conducted by
Bayramzadeh et al. (2018) mentioned that the layout of an operating room can cause circulating
nurses to have excessively long travel paths between their workstation and other areas of the
operating room, such as the storage area. This caused fatigue, delayed accomplishment of tasks,
and decreased efficiency. It can also lead to serious work-related injuries, such as falls, back
pain, and sprains.

**Discussion**

Over the course of the past two decades, nurses’ work has become more complex and
required more critical thinking. This has not only resulted in an additional amount of work duties
but has increased nurses’ stress level. Moreover, as the central point of communication between
patients and other healthcare professionals, nurses experience unnecessary interruptions while
performing their nursing tasks. According to the results of this literature review, interruptions
have more negative outcomes than positive. Negative outcomes can lead to poor patient
prognosis as well as lower job satisfaction among nurses. Interruptions can be considered
stressors that are positively related to irritation, depression, and psychosomatic complaints. In
order to provide safe and quality care, it is important to reduce or eliminate such interruptions.

While self-induced interruptions can be positive in nature and are difficult to manage,
external interruptions can be influenced by the different interventions presented. Factors that can
mediate interruptions are time pressure, mental demands, and patient acuity (Baethge & Rigotti,
2013; Elfering et al., 2015). Completion of interrupted and interrupting tasks requires nurses’
undivided attention as well as additional time to complete. This prevents nurses from being able
to think critically. Patients in critical condition require constant vigilance on the part of nurses while they are taking care of other assigned patients. Measures can be taken to provide nurses with additional time or fewer patient assignments, which can yield better outcomes for nurses as well as patients. More research is needed to find the relationship between nurse staffing and the occurrence of interruptions.

The duration of nurses’ work experience also affects their perspective toward handling interruptions. Nurses with experience in the same unit for multiple years better know how to handle unexpected tasks as well as keep control over the flow of their work during high-stress situations. However, new nurses have an advantage in having been educated with the most recent technology and practices, which are representative of actual work environments. Thus, they are better prepared to address technological interruptions. This confirms the findings of Joshi et al. (2016), who found that newly graduated nurses felt less stress adopting a new technology in their practice.

**Limitations**

One of the limitations of this literature review is limited access to research through the NIU library databases and Google Scholar. Some valuable studies may also have been excluded because of the publication restrictions. Moreover, this literature review was conducted over the course of a semester; with additional time, more relevant research may be identified.

Regarding the existing literature, more research is needed to identify the outcomes of nursing interruptions on patient safety. Further, even though implementation of some interventions provided improved workflow, the sample sizes were generally small, the types of study setting were limited, and only specific shifts were observed. Direct observation, as the method implemented in multiple studies, may also have affected the participants’ behavior;
therefore, the study results may have been affected by observer bias. Finally, the high drop-out rates in some studies may have led to skewed results due to the differences in characteristics between participants and nonparticipants in the study.

**Future Considerations**

Administration, managers, and staff nurses should be willing to participate in interventions designed to decrease interruptions as well as research on such interventions (Baethge & Rigotti, 2013). Future studies focused on the implementation of interventions designed to reduce interruptions should include control groups for comparison to avoid observational bias and the placebo effect. Further, the implementation of NIZs during all shifts and in med-surg units is necessary to collect results that can be generalized (Anthony et al., 2010). More studies are also needed to determine the relationship between interruptions and nurses’ positive work beliefs. Additional research is needed to identify the association between interruptions and occupational safety.

**Nursing Implications**

Evidence-based practices must be implemented in clinical settings to reduce interruptions and improve patient outcomes, which can be accomplished through organizational changes. This includes introducing the latest technological tools that can prevent repetition of similar tasks. Delegating guidelines can also be reviewed and reformatted to reduce nurses’ workload. A pilot study implementing different initiatives in different settings is needed to compare the effectiveness of such interventions. In addition, administrators, nurse managers, and staff nurses should be interested in furthering knowledge of coping strategies for dealing with stress caused by workflow interruptions.
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