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NCPD Nursing Continuing Professional Development

Effects of the Interruption Management Strategy "Stay S.A.F.E." During Medication Administration

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Abstract

Purpose: This study measured the impact of the Stay S.A.F.E. intervention on nursing students' management of and response to interruptions during medication administration. Time to return to the primary task, performance (procedural failures and error rate), and perceived task load were evaluated.

Design: This experimental study used a randomized prospective trial.

Methods: Nursing students were randomized into two groups. Group 1 (the experimental group) received two educational PowerPoints: the Stay S.A.F.E. strategy and medication safety practices. Group 2 (the control group) received educational PowerPoint on medication safety practices. Nursing students participated in three simulations where they were interrupted during a simulated medication administration. Eye tracking of students' eye movements determined focus, time to return to the primary task, performance including procedural failures and errors, and fixation time on the interrupter. The perceived task load was measured using the NASA Task Load Index.

Results: The intervention group, which was the Stay S.A.F.E. group, demonstrated a significant reduction in time away from task. There was a significant difference in perceived task load across the three simulations, including decreased frustration scores for this group as well. The control group members reported a higher mental demand, increased effort, and frustration.

Clinical Relevance: Rehabilitation units often hire new nursing graduates or individuals with little experience. For new graduates they have typically practiced their skills without interruptions. However, interruptions in performing care, particularly in medication management, occur frequently in real-world situations. Improving the education of nursing students related to interruption management has the potential to improve their transition to practice and patient care.

Conclusion: Students who received the Stay S.A.F.E. training, a strategy to manage interruptions in care, had decreasing frustration over time and spent more time on the task of medication administration.

Keywords: Interruptions; medication errors; interruption management; simulation; nursing students.

Introduction

Every year in the United States, an estimated 98,000 patient deaths and 440,000 preventable adverse events occur (James, 2013) because of medical errors (Institute of Medicine [IOM] et al., 2000; now the National Academy of Medicine). That number continues to rise. The IOM asserts that medication errors are the most common, and these errors can occur in any stage of the medication administration process. Medication administration, one of the six phases of the medication process, is the phase associated with the most errors (Leape et al., 1993). The IOM reports that interruptions in the healthcare environment could lead to medical errors and decrease patient safety (IOM et al., 2000).

An interruption occurs when there is "a break in the performance of a human activity initiated by a source internal or external to the recipient…within the context of a setting or a location…[resulting] in the suspension of the initial task by initiating the performance of an unplanned task with the assumption that the initial task will be resumed" (Brixey et al., 2007, p. E38). It has been suggested that interruptions cause a cognitive shift, a shift of a nurse's primary attention to a task (Potter et al., 2005). This shift can increase cognitive workload and the amount of mental ability needed to process an activity and manage incoming stimuli (Paas & van Merriënboer, 1994). Cognitive shifts imposed by interruptions can increase the amount of time to complete a task by a loss of focus and attention on the primary task, leading to errors (Campoe & Giuliano 2017; Cole et al., 2016; Cooper et al., 2016; Cottney & Innes, 2015; K. D. Johnson et al., 2021; Potter et al., 2005).

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Nurses who are interrupted during medication administration have 1.5 increased odds of making a medication error (Feleke et al., 2015). In addition, the number of interruptions during medication administration (3 interruptions vs. 12 interruptions) had a dose–response relationship between interruptions and errors (Santomauro et al., 2021). A high number of interruptions during medication administration, including interruptions by technology (mobile devices), discussions (family members or other staff), and alarms, can lead to a break in task and have a negative impact on patient care (Odberg et al., 2017).

The source of interruption (another registered nurse, a phone call, or a family member) and the information an interruption communicates, such as a verbal report about a patient when you are retrieving a medication from the Pyxis machine, are factors that can influence the interruption's outcome on the task at hand (Cole et al., 2016; Sasangohar et al., 2014) and its potential to contribute to error

Nurses in post-acute care report that being interrupted is a significant barrier to safe medication administration, and they identify interruptions as the number one reason for medication errors (Dilles et al., 2011; Mahmood et al., 2012). In one post-acute care setting, a study evaluated 3,101 medication administration events and found an association between interruptions and medication errors (Scott-Cawiezell et al., 2007).

Undergraduate nursing students practice skills uninterrupted in a simulated laboratory setting or on a clinical unit under the direct supervision of their faculty (Aggar & Dawson, 2014; Schroers et al., 2021; Weigl et al., 2012). Students receive education about medication safety practices often during a simulation. However, simulations do not include environmental and system factors, such as interruptions. Schroers et al. (2021) report that nursing students do not receive any formal training on managing interruptions and express that they need education while in school to prepare for the real world.

Management of interruptions is critical as students transition from the role of a nursing student to the role of a graduate nurse. It is unclear how students will manage their responses to interruptions. What is clear is that educators need to assist students in managing interruptions in the school setting. In a simulated setting, this study examines the effect of a specific educational strategy on managing interruptions in nursing students who are performing medication administration.

Methods

Study Design

This experimental study used a randomized prospective trial of the Stay S.A.F.E. intervention, an interruption training program, and standard medication safety education to determine their effectiveness in decreasing the consequences of interruptions during medication administration for nursing students. The control group received standard medication safety education only.

The hypotheses for this study included the following:

1. Determine the impact of the Stay S.A.F.E. intervention on student nurse management of and response to interruptions in simulated clinical scenarios.

a. Student nurses in the experimental group will return to the primary task more quickly in posttest simulations (Simulations 2 and 3) compared to baseline.

b. Student nurses in the experimental group will return to the primary task more quickly in posttest simulations compared to the control group.

c. Student nurses in the experimental group will be more likely to respond appropriately to the interrupter (not take the report) in posttests (Simulations 2 and 3) compared to baseline.

d. Student nurses in the experimental group will be more likely to respond appropriately to the interrupter (not take the report) in posttest compared to student nurses in the control group.

2. What is the impact of the Stay S.A.F.E. intervention on student nurse errors?

a. Student nurses who receive the Stay S.A.F.E. intervention will make fewer errors in posttest simulations compared to baseline.

b. Student nurses who receive the Stay S.A.F.E. intervention will make fewer errors compared to the student nurses in the control group.

3. What is the impact of the Stay S.A.F.E. intervention on student nurses' perceived task load?

a. There will be a significant difference in perceived workload across three simulations for student nurses who receive the Stay S.A.F.E. intervention.

b. Student nurses in the control group will not perceive a significant difference in workload across the three scenarios.

Sample and Setting

The study took place in a simulation laboratory in a nursing school in the eastern United States. A convenience sample of prelicensure nursing students was recruited from the baccalaureate nursing program. Students were either in the traditional track or the second bachelor's track. Participants included junior and senior nursing students who had previous education in physical assessment and had

administered medications. Nursing students who wore glasses had the eye-tracking goggles placed over their glasses and then calibrated. If the participant could not wear their glasses consistently, meaning they had to take them on and off to see either near or far objects, they were excluded from the study. Participants who wore their contacts and/or glasses consistently were included in the study.

The baseline simulation provided a point of reference in understanding nursing student behavior when being interrupted during medication administration. The baseline simulation required participants to administer medications as they normally would in the practice setting. They were provided a medication administration record (MAR) listing the medications to be given to the patient. The medications were labeled with the patient's name, date of birth, medication name, and dose. The patient also had a wrist band with the same information. The students were interrupted at a designated time during the medication administration. The participants were randomized into two groups, after the baseline simulation, using a computer-generated random assignment number generator. Group 1 (the experimental group) received two educational PowerPoints: the Stay S.A.F.E. strategy and medication safety practices. Group 2 (the control group) received the PowerPoint on medication safety practices, which included the six rights of medication administration. Participants were blinded to their respective groups.

Intervention

The Stay S.A.F.E. interruption management strategy was created by Henneman et al. (2018) and was modeled after the Memory for Goals Theory by Altmann and Trafton (2002). Stay S.A.F.E. aids nurses in staying on task following an interruption and provides a mnemonic for students and nurses to remain focused on the task at hand while acknowledging the person interrupting. The Stay S.A.F.E. acronym has been shown to be easy to remember and implement in a simulated setting. Using this strategy, when interrupted, the individual is trained to take the five steps. It includes the following: **Stay** physically in your current location and stay engaged in the task at hand. Physically hold any items you are working with in your hand when possible. **S**ay out loud what you are in the middle of doing, being as specific as possible while still respecting patient privacy. **A**cknowledge the person interrupting you without looking away from your task. **F**ixate on your place in the task for 1–2 seconds. Find a natural break in the task when you can pause. **E**stimate the time until you can attend to the interrupting person. Be reasonable but realistic (Figure 1).

The S.A.F.E. intervention provided nursing students with techniques to keep the primary task of medication administration in their active memory. The intervention aids nursing students to prioritize interruptions during medication administration. Participants in the intervention group learned the Stay S.A.F.E. management strategy with a voice-recorded educational PowerPoint presentation.

Measurement

Eye Tracker

The eye tracker is a lightweight, tetherless system that can be worn by participants who must move freely through a study environment. The device includes a scene camera, optics, and reflecting mirror all mounted on safety glasses. The scene camera records a video of the area in front of the wearer and uses pupil–corneal reflection to measure the position of the eye. The video is recorded by the eye

Stay S.A.F.E. Acronym

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Stay	**Stay** physically in your current location and **stay** engaged in the task at hand. Physically hold any items you are working with in your hand when possible.
S	**S**ay aloud what you are in the middle of doing, being as specific as possible while still respecting patient privacy.
A	**A**cknowledge the person interrupting you without looking away from your task.
F	**F**ixate on your place in the task for 1 to 2 seconds. **F**ind a natural break in the task when you can pause.
E	**E**stimate the time until you can attend to the interrupting person. Be reasonable but realistic.

Figure 1. Stay S.A.F.E. acronym. Adapted from Henneman et al. (2018). Reprinted with permission.

tracker. The device was calibrated for each participant. The points of reference (i.e., cross hairs) were used to identify where the participant was looking, and the eye tracker software measured the time of each event.

Procedural Failure and Error Rate

The two types of errors measured in this study were clinical errors and procedural failures. Both can occur with different tasks, but in the context of this research, clinical errors and procedural failures were focused on medication administration. Clinical errors occur when a person does not follow one of the six rights of medication administration, such as right dose, right drug, right time, right patient, unordered drug administered, and so forth (Westbrook et al., 2010). Procedural failures occur when the person completing a task does not follow proper procedure. During medication administration, procedural failures include not verifying patient identification, not double-checking high-risk medications, and failure to check blood pressure prior to administering an antihypertensive drug (M. Johnson et al., 2017, Westbrook et al., 2010). Procedural failures assessed during the study included failure to verify medication label, failure to verify patient identification, and failure to verify the MAR including documentation. Clinical errors assessed during the study were administration of Tylenol (not indicated based off scenario), medication given in the incorrect site, and wrong dose administration.

NASA Task Load Index

Subjective workload assessment was measured with the NASA Task Load Index (NASA-TLX; Hart & Staveland, 1988), developed by the NASA Ames Research Center for aviation but used increasingly in human factors research (Hart, 2006). Since its development, it has been used in nursing and medicine. The NASA-TLX consists of seven subscales, each of which measures a different component of subjective workload. Possible scores range from 0 to 7 (scaled score) or from 0 to 100 (raw score), with higher scores indicating higher perceived cognitive workload. Raw scores were used in this study. The NASA-TLX has been used in various settings and studies including cockpits, simulation, and laboratory settings and has demonstrated good test–retest reliability (Hart, 2006). Below are the specific questions included in the tool:

Mental demand: How mentally demanding was the task?

Physical demand: How physically demanding was the task?

Temporal demand: How hurried or rushed was the pace of the task?

Performance: How successful were you in accomplishing what you were asked to do?

Effort: How hard did you have to work to accomplish your level of performance?

Frustration: How insecure, discouraged, irritated, stressed, and annoyed were you?

Demographic Data Collection Tool

All participants completed a demographic form, which included age, gender, race, ethnicity, and grade point average. Other covariates to be collected included year in nursing program, amount of prior healthcare experience (e.g., work as patient care assistant or certified nurse's aide), level of comfort with simulation, and how frequently they had taken part in simulation.

Procedure

Participants completed the three simulations over 2–4 weeks. Each simulation (baseline, Simulation 2, and Simulation 3) took approximately 30 minutes each time, for a total of 1.5 hours. All three simulation scenarios included the administration of a medication and an interruption by another nurse looking to report to the participant about a patient admission. For the baseline simulation and Simulation 2, which occurred on the same day, the researcher obtained informed consent and had the participants complete a demographic data collection tool. The researcher then introduced the participants to the simulation environment and briefly described the process of simulation testing. Simulation laboratory training took about 10 minutes. A simulated patient room was set up with a bed, table, and simulation mannequin equipped with intravenous (IV) line, IV tubing, and IV bag. A medication station was also made available for medication preparation and administration.

Participants were informed about the use of an eye-tracking device (goggles) that captured a video of the scene in front of them and placed crosshairs on the video, showing exactly where they were looking as they perform a task (Duchowski, 2007). The device was calibrated for each participant.

At the beginning of each simulation (baseline, Simulation 2, and Simulation 3), participants received a handoff report from the researcher and/or trained research assistant and began care for a simulated patient who required medication administration. The participants were interrupted by the researcher and/or trained research assistant at similar times during the process to give a report on a new admission. After the baseline simulation, each participant completed a paper-and-pencil NASA-TLX and then was randomized into one of two groups. Group 1 received two educational PowerPoints: The Stay S.A.F.E. strategy and medication safety practices. Group 2 received an educational PowerPoint on medication safety practices. Both presentations were similar in length and scripted with

a voice-over. Once the education was given, the participant completed Simulation 2. The NASA-TLX was completed after the baseline simulation, Simulation 2, and Simulation 3. The participants were asked to return in 7–14 days to take part in Simulation 3, where the student administered a medication to a simulated patient. Figure 2 reviews the study protocol steps.

Data Analysis

Prior to analyses, all data were evaluated for skewness and kurtosis, and any necessary transformations were performed. The descriptive statistics were summarized as counts and frequencies for binary or categorical data and as means, standard deviations (*SD*s), medians, and interquartile ranges (the 25th and 75th percentiles) for continuous data.

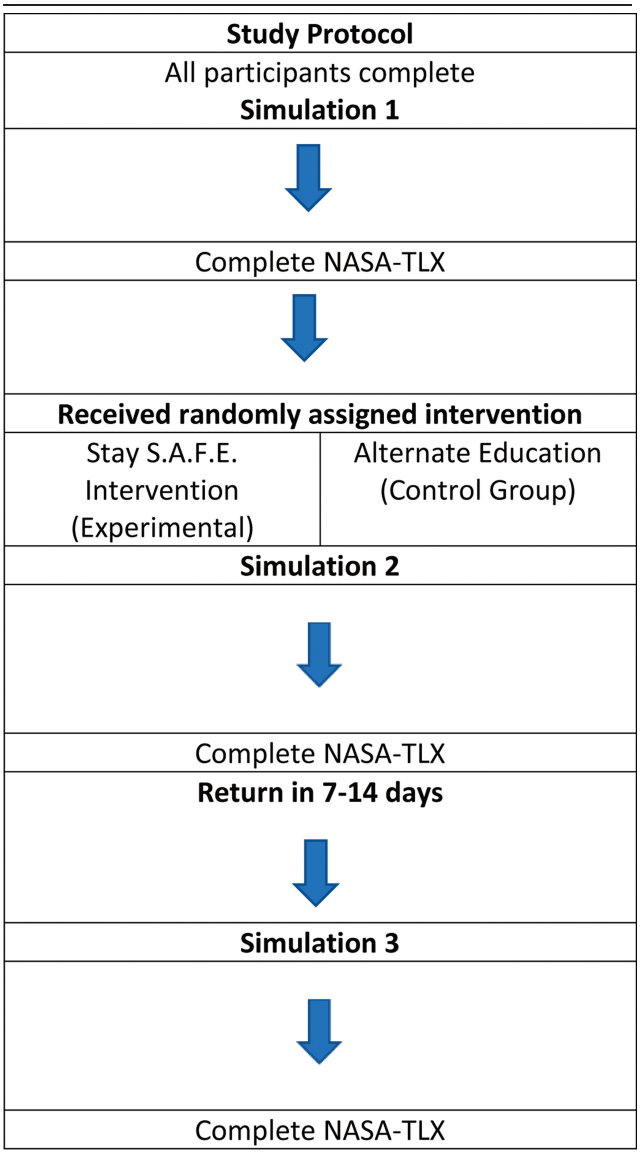

Figure 2. Study protocol. NASA-TLX = NASA Task Load Index.

To compare independent means (e.g., the means between the control and experimental groups for a single simulation), the Student's *t* test was used. To compare medians, the Mann–Whitney test was used. To compare frequencies and proportions between two independent groups, the chi-square test was used unless there was a cell count of <5. In that case, the Fisher's exact test was used. To compare paired frequencies, the McNemar test was used. To compare paired medians, the Wilcoxon matched-pairs signed-ranks test was used.

To determine whether nursing students who received the Stay S.A.F.E. intervention were more likely to respond appropriately to the interruption, we compared the proportion of correct responses between groups with the chi-square test or the Fisher's exact test (mostly the Fisher's exact test because of small cell sizes). To compare repeated means within the control or experimental groups, a simple repeated analysis of variance (ANOVA) model was used with the Box correction to derive the adjusted *p* values. To compare trends across the three simulations, both in all participants and within the control and experimental groups, Cuzick's nonparametric test for trend was used. All *p* values of <.05 were considered statistically significant. All analyses were done with Stata/MP 15.1 for Windows (StataCorp LLC, College Station, TX).

Results

Demographics of Participants

The sample consisted of a convenience sample of 41 nursing students. Two participants were not included in the analysis because of problems calibrating the eye tracker, leaving 20 in the experimental group and 19 in the control group. The participants ranged in age from 18 to 38 years, with most ranging from 18 to 26 years of age (74%). Most nursing students (92%) had experience with simulation during nursing school, hospital orientation, and/or continuing education. More than half of the students had some patient experience (67%). Nineteen students were from the accelerated second bachelor's track, and 20 were from the traditional undergraduate track. All participants had experience with medication administration.

Impact of the Stay S.A.F.E. Strategy on Nursing Student Management of and Response to Interruptions

The Stay S.A.F.E. experimental group had a shorter time to return to the primary task when compared to the control group. In addition, the control group took longer to complete the task of medication administration. There was a significant difference in return to the primary task times in Simulation 2 when comparing the Stay S.A.F.E.

experimental group with the control group. The median [25th percentile, 75th percentile] time from start to finish (in seconds) to return to the primary task was 11.9 [10.0, 13.5] in the experimental group and 18.9 [12.0., 30.0] in the control group (p = .007). In Simulation 3, the difference in return to the primary task was not significant: 12.0 [10.9, 13.9] seconds in the experimental group versus 12.0 [8.9, 38.0] in the control group (p = .543). However, in Simulation 3, the interquartile range was much wider (i.e., more subjects had very long times to return to the primary task), which provides some evidence that the experimental group did better when compared to the control group.

Additional analysis evaluated the three means (time in seconds) using a repeated ANOVA over the three simulations. The three means were significantly different in the experimental group: means (*SD*s) for Simulations 1, 2, and 3 were 30.1 (13.5), 12.4 (6.0), and 13.0 (6.7), respectively (p < .001). Cuzick's test for trend also revealed a significant, decreasing trend in the experimental group (p < .001). Notably, in the control group, the three mean times were not significantly different using a repeated ANOVA for Simulations 1, 2, and 3: means (*SD*s) were 25.2 (13.3), 20.8 (10.4), and 19.3 (14.2), respectively (p = .366). Cuzick's test for trend also showed the means had a nonsignificant trend (p = .071). Figure 3 demonstrates the difference in time to return to the primary task using box plots.

The simulation was designed so that participants needed to prioritize which task was more critical at the time of the interruption. The interruption involved another nurse attempting to give the participant report about an incoming patient admission. Figure 4 demonstrates the percentage of participants either in the Stay S.A.F.E. (the experimental group) or the control group who took the patient report. The percentages of those taking the report in Simulations 1, 2, and 3 in the experimental group were 64.7%, 5.0%, and 5.6% versus 43.8%, 36.8%, and 26.3% in the control group. The experimental group had a significant improvement in appropriate response (not taking the report) in Simulations 2 and 3 compared to Simulation 1 (baseline); p = .002 and p = .008, respectively. In contrast, the control group did not have a significant difference in appropriate response from Simulations 2 and 3 compared to Simulation 1 (baseline), p = 1.000 and p = .625, respectively.

Impact of the Stay S.A.F.E. Intervention on Errors

There was no significant difference between the control and Stay S.A.F.E. groups regarding the number of errors (i.e., procedural failures and clinical errors) committed by participants. However, when reviewing all errors across the three simulations in both groups, the total number of errors decreased significantly: means (*SD*s) for Simulations 1, 2, and 3 were 2.9 (1.7), 2.4 (1.2), and 2.2 (1.1), respectively (p = .037 by Cuzick's test for trend). In addition, a significant difference existed between Simulation 1 and Simulation 2 in failure of the control group to record on the MAR: 15 out of 19 (78.9%) subjects did not record on the medication record in Simulation 1 versus 9 out of 19 (47.4%) in Simulation 2 (p = .031).

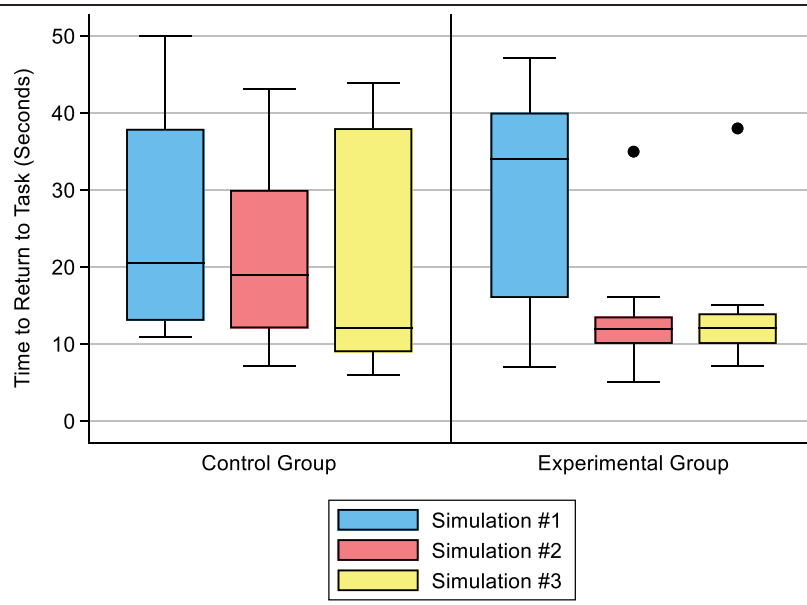

Figure 3. Time to return to the primary task.

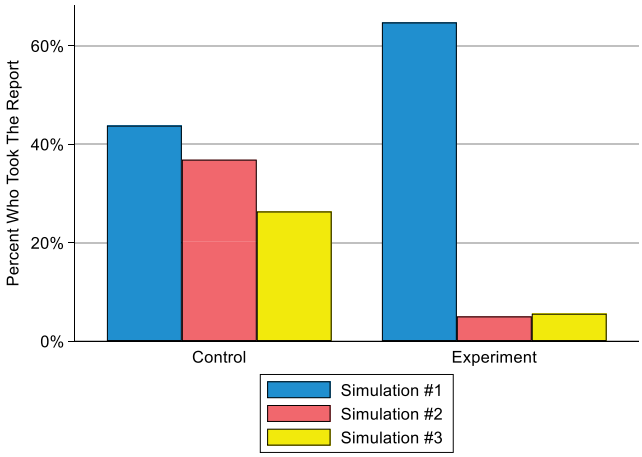

Figure 4. Percentage of participants who took report by groups.

Impact of the Stay S.A.F.E. Intervention on Perceived Task Load

The NASA-TLX, as a measurement of perceived task load, evaluated each participant in both groups postsimulation (baseline, Simulation 1 [baseline], Simulation 2, and Simulation 3). There was a significant difference in perceived workload across three simulation scenarios for the Stay S.A.F.E. experimental group. There was also a significant difference in NASA-TLX scores between the three simulations in the control group.

Each component of the NASA-TLX evaluated mental, physical, temporal, performance, effort, and frustration. The Stay S.A.F.E. group demonstrated a decrease in frustration scores across the three simulations. For Simulations 1 (baseline), 2, and 3, the mean (*SD*) frustration scores for the experimental group were 23.4 (18.6), 19.3 (16.2), and 12.4 (13.3), respectively. For the control group, the mean (*SD*) frustration scores for Simulations 1 (baseline), 2, and 3 were 14.5 (14.1), 24.5 (17.6), and 14.7 (12.4), respectively. The experimental group had a significant trend ($p = .034$ by Cuzick's test), whereas the control group did not ($p = .968$). Figure 5 displays the frustration scores in the Stay S.A.F.E. group and the control group over the three simulations.

The mental demand dimension of the NASA-TLX asked participants, "How mentally demanding was the task?" We observed that the scores varied significantly across the three simulations both in the control ($p = .023$) and experimental ($p = .014$) groups. However, there was no significant difference when the experimental group was compared to the control group on this dimension within each simulation.

Discussion

The major finding of this research was the decreased time to return to the primary task when comparing the Stay S.A.F.E. group to the control group. Consistent with Henneman et al.'s (2018) work, those who received the Stay S.A.F.E. training spent less time distracted from the primary task of medication administration. In contrast, the control group took longer to complete the task of medication administration, confirming that interrupted tasks take longer to complete (Campoe & Giuliano, 2017; Cole et al., 2016; Odukoya & Chui, 2013). In past studies, the presence of interruptions, whether during medication administration or another nursing task, has had a negative impact on the duration of care. In one observational study, it took the nurse 2.5 minutes longer, on average, to complete a task when interrupted (M. Johnson et al., 2017). Findings of the current study suggest that the intervention strategy Stay S.A.F.E. was effective in decreasing interruption time and potentially modifying nursing student behavior.

The NASA-TLX question on frustration asks specifically about "How insecure, discouraged, irritated, stressed, and annoyed were you?" In a prior study by Sørensen and Brahe (2014), nurses reported that interruptions during medication administration are a source of frustration. The decrease in frustration over time within the experimental group demonstrates that the Stay S.A.F.E. intervention had an impact on management of interruptions specifically with insecurity, discouragement, irritation, and annoyance.

The mental demand dimension of the NASA-TLX indicated a significant difference across the three simulations for both groups. In an interdisciplinary study including students, clinicians were assessed on workload associated with identifying burn patient conditions and priority settings. Students experienced higher mental demand scores than clinicians with more than 5 years of experience (McInnis et al., 2017). Tien et al. (2014) found similar results of NASA-TLX scores between experts and novices, and those unfamiliar with a process, such as medication administration,

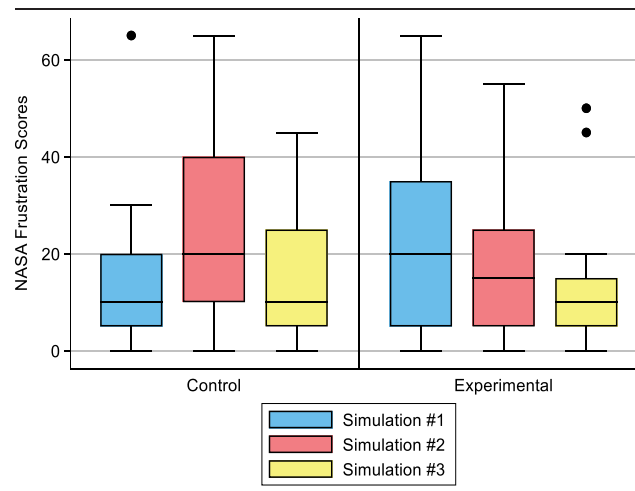

Figure 5. NASA-TLX frustration score.

scored higher in mental demand (Hudson et al., 2015). Not all interruptions are harmful; some communicate critical patient information (Grundgeiger & Sanderson, 2009; McCurdie et al., 2017; Westbrook et al., 2010). At the time of an interruption, the nursing student must determine the relative importance of the interruption and decide whether and how urgently to respond. Most notably, the difference was significant post-intervention (Simulation 2) between the control and experimental groups in responding to the interrupter. The control group was more likely to take the verbal report from the interrupter.

Although we cannot definitively know the thought process of the participants, our findings in this randomized controlled trial suggest that the Stay S.A.F.E. group benefited from this strategy in evaluating the importance of the primary task (medication administration) when compared to that of the secondary task (verbal report of an incoming patient admission). Also, the Stay S.A.F.E. group was less likely to take the report from the interrupter in Simulation 3, which provides evidence that there may have been at least some knowledge retention from the original PowerPoint education. In the similar Schroers et al. (2021) study, most nursing students either engaged with the interrupter or multitasked and answered the interrupter while trying to complete the medication administration process. Engaging and multitasking are not suggested strategies (M. Johnson et al., 2017).

Experts have suggested that the recognition of the nature and impact of interruptions is a first step in preparing clinicians, including nursing students, to work safely in environments at high risk for interruption-related errors (K. D. Johnson et al., 2021; Schroers et al., 2021). Clinicians, like students, should be mindful of the potentially negative consequences of an interruption (Henneman et al., 2018; Schroers et al., 2021). In this study, the Stay S.A.F.E. group was less likely to respond to the interrupter, potentially increasing their time, focus, and concentration on the task of medication administration.

Limitations

Several limitations were identified with this study. Location of the simulations varied as participants were not consistently in the same simulation laboratory potentially decreasing the fidelity of the simulation and adding unnecessary confounders (Cheng et al., 2014). Four percent of the eye-tracking data were lost because of technical issues with the eye-tracking recorder. Also, two participants were unable to continue with the study because of problems calibrating the eye tracker. Though lost eye-tracking data were less than other studies, it was a limitation identified during the sample size estimations (Henneman et al., 2014, 2018). Lastly, the researcher and research assistants were not blinded to the groups during the simulations as well as when coding the data. This could contribute to the observer bias during the simulation and the confirmation bias during data coding.

Implications for Rehabilitation Nursing Practice

Interruptions can lead to an increased risk of making errors in health care, particularly during medication administration, which can result in patient harm. Interruptions that require the nurse to leave the patient result in medication errors (Cottney & Innes, 2015). Though this study did not find a statistically significant number of errors between groups, there was a difference in relation to Simulation 1 (baseline) and Simulation 2 ($p = .031$) in failure to record on the MAR in the control group. There was also a significant decrease in the total number of errors over the three simulations that could demonstrate an effect of simulation as a method of training in both groups.

In the rehabilitation setting, limiting interruptions during high-risk tasks such as medication administration may be beneficial; however, eliminating all interruptions is not recommended because of the complexity of health care and demand for communication and coordination of care (Rivera-Rodriguez & Karsh, 2010). Rather than trying to eliminate interruptions, this research demonstrated that it could be more useful to teach nurses how to manage unnecessary interruptions and minimize the time away from high-risk tasks such as medication administration.

This study, along with research by Henneman et al. (2018), demonstrated a significant reduction in time away from the task/patient following implementation of the Stay S.A.F.E. intervention. Although nursing students are given tools during their didactic education such as medication safety practices, simulations do not include environmental and systems factors, such as interruptions, which could increase the risk of error.

Conclusion

Most research investigating strategies for managing interruptions in health care has focused on reducing interruptions during the medication administration process (Gao et al., 2021). Strategies for managing interruptions have centered on establishing "interruption-free" zones for the nurse administering the medication. Nurses should decide how to manage interruptions, and researchers should identify nurses' decision-making processes in managing interruptions (Gao et al., 2021; Hayes et al., 2017) and characteristics of interruptions that can be successfully overcome (Grundgeiger & Sanderson, 2009). Nursing schools should consider adding a curriculum that incorporates interruption management strategies such as the Stay S.A.F.E. strategy (K. D. Johnson et al., 2021; Schroers et al., 2021).

Key Practice Points

- Interruptions in the healthcare environment are pervasive and have the potential to impact patient safety and quality of care.
- Nursing students, during didactic training, should have education on handling interruptions during care.
- Interruption management strategies, such as Stay S.A.F.E., have the potential to keep nurses' focus on high-risk tasks, such as medication administration.

New registered nurses are responsible for many complex tasks including medication administration, and they are expected to use critical thinking, judgment, and competence (Cloete, 2015; Hayes et al., 2017). This study evaluated an interruption management strategy (Stay S.A.F.E.) on medication administration and errors. Nursing students in the control group reported a higher mental demand, increased effort, and frustration. Those who received the Stay S.A.F.E. training had decreasing frustration over time and spent more time on the task of medication administration. Future studies should build upon this research and further evaluate overall frustration. Larger samples should be considered to evaluate the error potential.

Conflict of Interests

The authors declare no conflict of interest.

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