Title Page

Title of Project: Development of an Education Intervention for Triage Interruption Management

Principal Investigator: Kimberly D. Johnson PhD, RN, CEN, FAEN

Co-Investigator: Jun Ying, PhD

Organization: University of Cincinnati

Inclusive Dates of Project: 9/1/18 - 8/31/21

Federal Project Officer: DAVID RODRICK

Acknowledgement: This project was supported by grant number R03HS025844 from the Agency for Healthcare Research and Quality. The content is solely the responsibility of the authors and does not necessarily represent the official views of the Agency for Healthcare

Research and Quality Grant Award Number: R03 HS25844-0222

Structured Abstract—Five Elements:

Purpose: The overall objective for this project was to develop a training intervention to prepare triage nurses for effective interruption management.

Scope: Every year, over 130 million people seek emergency care in the United States. Upon arrival at the emergency department (ED), nearly every patient undergoes a triage assessment, which is the critical first interaction between patient and nurse. Triage interruptions cause errors. Learning to manage interruptions may improve patient care.

Methods: In stage 1, a Delphi group of triage, education, and operational management experts was convened to generate consensus recommendations on successful strategies to manage and mitigate the impact of triage interruptions in the emergency department. An educational intervention was developed based on their recommendations. In stage 2, the education was offered to novice triage nurses. Blinded data collectors conducted observations of triage nurses, evaluated triage duration and accuracy, and provided an overall score of how well the nurse conducted the triage interview.

Results: The Delphi group identified eight strategies to mitigate the impact of interruptions and the best teaching modalities for each strategy. The education was provided to 14 triage nurses. This experimental group, along with a control group of 20 nurses, was observed conducting triage. No differences in triage duration, accuracy, or quality were noted based onthe education provided. However, using data mining techniques, differences were noted based on the years of experience of the nurse and the presence of interruptions.

Key Words: triage, interruption, online modified Delphi method

1. **Purpose**

   The overall objective for this project was to develop a training intervention to prepare triage nurses for effective interruption management.

2. **Scope**

   Every year, over 130 million people seek emergency care in the United States (CDC, 2017). Upon arrival at the emergency department (ED), nearly every patient undergoes a triage assessment, which is the critical first interaction between a patient and an emergency healthcare provider, most commonly a registered nurse. Triage is the critical beginning of the treatment cascade (Wolf, 2010), and completion of the assessment requires the nurse to conduct an efficient and accurate assessment of the patient to determine if the patient's condition is emergent, urgent, or non-urgent. Current recommendations by the Emergency Nurses Association (ENA) state that triage should be conducted by a registered nurse who has completed a standardized triage education course as well as training in cardiopulmonary resuscitation, the Trauma Nursing Core Course (TNCC), the Emergency Nurse Pediatrics Course (ENPC), and Geriatric Emergency Nurse Education (ENA, 2010). Unfortunately, none of these courses address how to develop the required skills to manage interruptions.

   Interruptions are common in the ED, are potential obstacles to providing high-quality patient care, and are more common in the unpredictable environment of the ED than other care settings (Burley, 2011; Chisholm et al., 2001). Triage interruptions may lead to errors such as missed symptom identification, incomplete assessment, or unasked questions. In addition, they can potentially delay care, resulting in significant morbidity or mortality (Grossmann et al., 2012).

   Background

   Two decades ago, the IOM reported that healthcare errors and delays were a concern and that they remain problematic today. Interruptions of ED providers have been linked to errors and delays in patient care (Kohn et al., 2000). For example, the results of a prospective time and motion study conducted in Australia showed that emergency physicians were interrupted 6.6 times per hour and that the interruptions were associated with a significant increase in the amount of time required to complete a task, such as writing orders, dictating notes, and assessing patients (Westbrook et al., 2010). Additionally, the providers failed to return to the original task 18.5% of the time (Westbrook et al., 2010). In a similar Swedish study, physicians and nurses failed to return to a task following interruption 13% of the time (Berg et al., 2013). It is difficult to generalize the results of studies such as these due to varied categorization of

interruptions across studies; however, the significance of the impact of interruptions is clear.

Although interruptions have been credited with significant errors and patient harm in healthcare, few solutions have been offered to mitigate the impact of these interruptions (Yoder et al., 2015; Knudsen et al., 2007). Some interventions have been implemented in other healthcare settings outside of the ED and demonstrate significant improvements (e.g., medication timeout, safe zone); however, these interventions are too impractical to effectively implement, given the fast pace of triage (Ming et al., 2016; Nguyen et al., 2010; Raban & Westbrook, 2014; Relihan et al., 2010; Yoder et al., 2015). Additionally, there is no training or education currently available for emergency nurses to learn how to avoid interruptions or mitigate the impact of interruptions on patient care. This means that nurses are required to learn triage interruption management onsite or, alternatively, not at all.

This ‘on-the-job’ learning style of interruption management can be problematic for novice triage nurses. When an error occurs, nurses can experience negative emotions such as guilt, shame, fear and depression (Roberson & Long, 2018). Such adverse emotions can impact the nurse’s confidence in making future decisions, which can adversely affect safety. Because triage requires nurses have to have quick yet efficient assessment skills, insecurity in decision making can cause critical delays in patient care.

Pilot testing of educational intervention: Thirty-four triage nurses participated in this study. Fourteen nurses were provided with training how to cope with interruptions during triage interviews and then successfully completed the interviews in addition to standard triage training. These are the cases. Twenty nurses did not receive the training; they received only the standard 24 hours of triage training for the facility. These are the controls.

3. **Methods**

Delphi Panel: A panel of nine triage, education, and operational management experts were selected based on their publication and presentation history. This panel participated in three Delphi rounds, providing individual responses during each round. All responses were entered into a RedCap database, which allowed research team members to synthesize the results and return summaries to the participants. Final consensus was reached among this panel regarding recommendations for successful strategies to address triage interruptions that can be encompassed in a training module. The experts were then asked to identify the best instructional modality for teaching each of the interruption management strategies.

Pilot testing of educational intervention: We developed and preliminary test a short (2-hour) simulation scenario with an educational component to teach strategies identified for managing interruptions. The trainees will be observed conducting triage interviews by blinded trained observers, who will evaluate the nurses' performance in interruption management in both simulated and actual triage environments. Other outcome measures were triage accuracy, triage speed, and subjects' stress level and sense of control. Additionally, program usefulness and acceptability were evaluated. In testing the effectiveness of training, each nurse was interrupted deliberately for a random length of time. An evaluator assessed how successfully each nurse completed the triage interview on a scale from 0 to 100 (labeled Nurse_Grade).

4. **Results**

Delphi Panel: Eight strategies to mitigate the impact of interruptions were identified: 1) Ensure nurses understand impact of interruptions; 2) Ensure nurses understand consequences of interruptions on cognitive demands of healthcare workers that could influence behavior and lead to errors; 3) Apologize to the current patient before tending to an interruption and give an expectation of when you will return; 4) Triage the interruption and decide to i) ignore interruption, ii) acknowledge but delay servicing interruption, or iii) acknowledge and service interruption, delaying completion of interrupted task; 5) Identify urgent communication as anything clinically significant that impacts the patient immediately or requires immediate intervention; 6) Use focused questions to clarify whether interruption can wait; 7) Redirect non-priority interruptions; and 8) Finish safety-critical task or tasks near completion before tending to an interruption. The Delphi participants, through consensus, recommended the best teaching modality was simulation for six of the strategies. For the two strategies not recommended for simulation, the use of written case studies was recommended by seven of the nine experts to convey the importance of identifying urgent communication. Observing a case study was recommended by six of the experts as the teaching approach best suited for ensuring that nurses understand the impact of interruptions.

Based on these recommendations, the research team worked with three ED educators to design simulation experiences and case studies that addressed the interruption management strategies per the Delphi panelists' recommendations. The two simulation experiences were developed with the assistance of the simulation lab director to address six of the strategies. All scenarios were presented to emergency nurses not enrolled in the study for validation.

The 2-hour educational intervention involved classroom learning with the case studies and the simulation experiences. The ED educators were conducting triage training and agreed to add our interruption management education to the end of their training session. As the nurses were already in the classroom, our education began with a written case study assessment and discussion. The training session was then moved to the simulation lab, where the participants observed a scripted interaction between a nurse and a standardized patient. Following this observed case study, the participants were debriefed and discussion about the case study occurred. Finally, each student participated in their own simulation experience. Two standardized patients were used in each scenario. One was the patient being triaged and one was the interrupter. At the end of each simulation, the participant was debriefed and strategies that they used, or could have used, to manage interruptions was discussed.

Pilot testing of educational intervention:The participants who received the education provided an evaluation of their experience. We had them rate several aspects of the training on a scale from 1 (strongly disagree) to 5 (strongly agree). The results are listed in Table 1.

Table 1. Participant evaluation of education

	Education design element Assessment	Importance of this item
Objectives and Information		
Enough info at beginning	2.71	4.43
I understood the purpose	3.29	4.07
Simulation info was clear	3.5	4
Enough info during sim	3.21	4.43
Appropriate cues	3.21	4.07
Support		
Timely	3.07	4.07
Need for help was recognized	3.21	3.85
Felt supported by educator	3.14	4.21
I was supported	3.14	4.14
Problem solving		
Independent problem solving was supported	3.57	3.86
Encouraged to explore all possibilities	2.71	2.78
Sim was designed for my skill level	3.43	3.85
Sim allowed me to prioritized nursing assessment	3.35	3.64

Sim provided opportunity for goal setting	2.78	3.14
Feedback		
Was constructive	3.43	3.21
Timely feedback	3.57	3.5
Allowed me to analyze my behavior	3.07	3.28
Opportunity to provide feedback	3.21	3.28
Fidelity (realism)		
Scenario resembled real life	4.14	3.85
Real life factors were built into the scenario	4	4.07

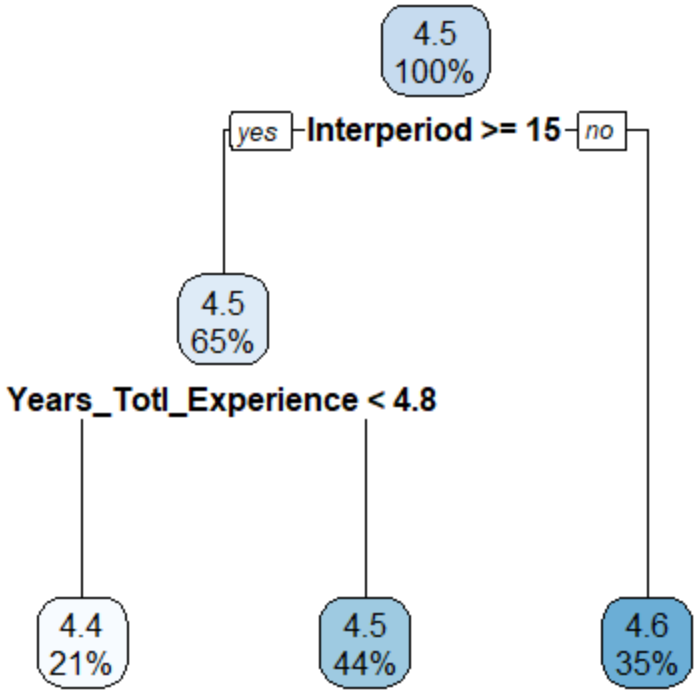
Participants felt that the fidelity and realism of the scenarios were strong. There were areas for improvement identified with providing more information at the beginning and during the simulation, both items that the participants scored high in importance.

After training was completed, a blinded researcher observed nurses conducting triage. The reviewer scored each nurse's triage on a visual analog scale from 0 to 100 on how well the nurse managed interruptions. This variable was named "Nurse_Grade".

Regression analysis was conducted to determine nursing characteristics that might affect the nurse's grade (how well the nurses managed triage interruptions). Logarithms are taken on Nurse_Grade before conducting the two-sample t-test due to its non-normal distribution (Wilk-Shapiro test: P= 1.459e-05). Nursing characteristics included were years of total experience, years of ED experience, gender, highest degree, shift length, hours worked per week, nurse reported stress level, and if they were in the intervention group or not. No variables had a significant impact ($F(11,22)=0.3599$, $p=0.1458$, $R^2=0.1525$).

Data Mining Methods

Because of the lack of significance in our originally planned analysis, we decided to embarked on data mining to detect patterns in the data. We have developed a regression tree for the data on hand. The response variable is log(Nurse_Grade) with mean and variance. The objective of the tree is to find the subgroup of the data with a substantial reduction in the variances of the log(Nurse_Grade)



Interpretation

Through data mining, we found three subgroups:

- Subgroup 1: all nurses who were interrupted for at least 15 seconds and who have total experience less than 4.8 years. There are seven nurses with this characteristic. Their average grade was 81.45, and variance is 0.022.
- Subgroup 2: All nurses who were interrupted at least 15 seconds and who had total experience more than 4.8 years. There were 15 nurses in this subgroup. Their average grade was 90.02, with a variance of 0.0059.
- Subgroup 3: All nurses who were interrupted less than 15 seconds. There were 12 nurses in this subgroup. Their average nursing grade was 99.48, with a variance equal to 0.0034.

This data mining method indicates that the grade remains close to 100% if the nurse is interrupted for fewer than 15 seconds. This means that short interruptions do not affect performance. Nurses having longer interruptions but with more experience manage the job reasonably well, with a grade close to 90%. On the other hand, nurses having longer interruptions but with less experience do not do well in the job, with their grade close to 80%. Other characteristics of the nurses do not have any influence on the final grade.

Conclusion

Delphi Panel: Participants agreed that there are strategies that can be taught to novice triage nurses to mitigate the impact of interruptions. The experts in operations management, emergency nursing, and education agree that creating simulations to teach each of these strategies is an effective way to educate nurses. The citation for this manuscript is below.

Pilot testing of educational intervention: We had planned on holding our last educational session in April 2020. Unfortunately, the increased demand on the emergency nurses during the time of the COVID-19 pandemic limited the opportunity to provide education and conduct research with the ED nurses. Because of this, the last six participants could not receive our training. Although we were about to obtain observations for our 20 control group participants, we were only able to complete training on 14.

Overall, all of the nurses in both the control and experimental groups scored well on managing interruptions in triage. Therefore this was not a significant difference among the two groups. We did find, through datamining, that experience has more impact on triage quality than training and found that less time spent on interruptions was related to higher-scored triage interviews.

The educational intervention had no significant impact on the accuracy of triage or how well the nurses managed triage. The reason for the insignificant findings could be related to the small sample size. However, we have shown that this education is feasible to administer, especially in combination with traditional triage orientation. We believe that, had the global epidemic not impacted the implementation of our intervention, we would not have had difficulty meeting our recruitment numbers. The participants felt that the education was realistic, but we learned that we need to provide more guidance at the beginning of simulations for future simulations.

We have shown the feasibility of using these simulation experiences to teach strategies to manage interruptions. Nursing administration and the ED educators were enthusiastic about the education, so the next step is to supplement the information provided at the start of the simulations to provide more guidance to participants. We plan to use this education in a larger scale throughout the hospital system. Depending

intervention on a larger scale using multiple sites and hospital systems.

5. **List of Publications and Products**

Johnson KD, Schumacher D, Lee RC. Identifying Strategies for the Management of Interruptions for Novice Triage Nurses Using an Online Modified Delphi Method. J Nurs Scholarsh. 2021 Jun 2. doi: 10.1111/jnu.12683. Epub ahead of print. PMID: 34075688.

REFERENCES

1. Berg, L. M., Källberg, A. S., Göransson, K. E., Östergren, J., Florin, J., & Ehrenberg, A. (2013). Interruptions in emergency department work: An observational and interview study. BMJ Quality & Safety, 22(8), 656–663. https://doi.org/10.1136/bmjqs-2013-001967
2. Burley, D. (2011). Better communication in the emergency department. Emergency Nurse: The Journal of the RCN Accident and Emergency Nursing Association, 19(2), 32–36. https://doi.org/10.7748/en2011.05.19.2.32.c8509
3. Centers for Disease Control and Prevention (CDC). [Accessed May 7, 2017] National Hospital Ambulatory Medical Care Survey: 2013 Emergency Department Summary Tables. https://www.cdc.gov/nchs/fastats/emergency-department.htm
4. Chisholm, C. D., Dornfeld, A. M., Nelson, D. R., & Cordell, W. H. (2001). Work interrupted: a comparison of workplace interruptions in emergency departments and primary care offices. Annals of Emergency Medicine, 38(2), 146–151. https://doi.org/10.1067/mem.2001.115440
5. Committee on Quality of Health Care in America. (2000). To Err Is Human: Building a Safer Health System.
6. ENA (2010). Triage Qualifications and Competency [Position Statement]. https://www.ena.org/docs/default-source/resource-library/practice-resources/position-statements/triagequalificationscompetency.pdf?sfvrsn=a0bbc268_12
7. Grossmann, F. F., Zumbrunn, T., Frauchiger, A., Delport, K., Bingisser, R., & Nickel, C. H. (2012). At risk of undertriage? Testing the performance and accuracy of the emergency severity index in older emergency department patients. Annals of Emergency Medicine, 60(3), 317-325.e3. https://doi.org/10.1016/j.annemergmed.2011.12.013
8. Knudsen, P., Herborg, H., Mortensen, A. R., Knudsen, M., & Hellebek, A. (2007). Preventing medication errors in community pharmacy: frequency and seriousness of medication errors. Quality & Safety in Health Care, 16(4), 291–296. https://doi.org/10.1136/qshc.2006.018770
9. Kohn, L. T., Corrigan, J., & Donaldson, M. S. (2000). To err is human: Building a safer health system. Washington, D.C.: National Academy Press.
10. Ming, T., Lai, A., & Lau, P.-M. (2016). Can Team Triage Improve Patient Flow in the Emergency Department? A Systematic Review and Meta-Analysis. Advanced Emergency Nursing Journal, 38(3), 233–250. https://doi.org/10.1097/TME.0000000000000113

11. Nguyen, E. E., Connolly, P. M., & Wong, V. (2010). Medication safety initiative in reducing medication errors. Journal of Nursing Care Quality, 25(3), 224–230. https://doi.org/10.1097/ncq.0b013e3181ce3ae4
12. Raban, M. Z., & Westbrook, J. I. (2014). Are interventions to reduce interruptions and errors during medication administration effective?: A systematic review. BMJ Quality & Safety, 23(5), 414–421. https://doi.org/10.1136/bmjqs-2013-002118
13. Relihan, E., O'Brien, V., O'Hara, S., & Silke, B. (2010). The impact of a set of interventions to reduce interruptions and distractions to nurses during medication administration. Quality & Safety in Health Care, 19(5), e52. https://doi.org/10.1136/qshc.2009.036871
14. Westbrook, J. I., Woods, A., Rob, M. I., Dunsmuir, W. T. M., & Day, R. O. (2010). Association of interruptions with an increased risk and severity of medication administration errors. Archives of Internal Medicine, 170(8), 683–690. https://doi.org/10.1001/archinternmed.2010.65
15. Wolf L. Does your staff really "get" initial patient assessment? Assessing competency in triage using simulated patient encounters. Journal of Emergency Nursing. 2010 Jul;36(4):370-4. doi: 10.1016/j.jen.2010.04.016. Epub 2010 May 31. PMID: 20624578.
16. Yoder, M., Schadewald, D., & Dietrich, K. (2015). The effect of a safe zone on nurse interruptions, distractions, and medication administration errors. Journal of Infusion Nursing: The Official Publication of the Infusion Nurses Society, 38(2), 140–151. https://doi.org/10.1097/NAN.0000000000000095