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Effects of Interruptions on Triage Process in Emergency Department: A Prospective, Observational Study

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Abstract

For 130 million people seeking emergency treatment in the US, incomplete or inaccurate triage examination can result in delays, which could compromise patient outcomes. The purpose of this study was to identify triage interruptions and determine how interruptions affect the triage process. A significant difference was seen in triage duration between interrupted and uninterrupted interviews. Understanding the impact of interruptions on patient outcomes will allow nurses and other health care providers to develop interventions to mitigate the impact.

Keywords

emergency department; interruptions; triage; triage duration; triage examination

Over 130 million people are treated in the emergency department (ED) annually in the US.¹ Nearly all patients begin their ED visit with a triage assessment conducted by an emergency nurse. Triage is the process of assigning acuity to patients to determine their treatment priority. Incomplete or inaccurate triage examinations can result in patient harm or significant misallocation of resources. One possible cause of error in triage is interruptions, which occur frequently.² The purpose of this research was to describe the interruptions occurring during triage and their impact on the triage process and patient outcomes.

BACKGROUND

Triage process

The triage process is the critical first step in the treatment of patients entering an ED.³ During triage, a trained emergency nurse conducts an interview regarding the current illness

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or injury for which the patient is seeking emergency treatment. During this time the nurse conducts a visual and brief focused physical assessment, collects vital signs, and asks about current medications and allergies. Triage can occur anywhere in the ED, including the patient's assigned ED room, a hallway, or a specialized triage area of the department. A triage nurse's first assessment of a patient is a critical determinant of how the patient's ED experience will progress.

Interruptions

A patient seeking treatment may have a triage interview interrupted for myriad reasons (eg, needs of other patients, visitors, or staff). Such interruptions in the triage process cause distractions that can delay getting patients into a treatment area, distract nurses from collecting appropriate triage data, or cause the nurse to make a poor triage decision.⁴ The available interruption literature focuses on the process of interruption. However, in the emergency care setting, interruption context and outcomes of interruption studies are limited.⁵

A recent state-of-the-science review of interruptions during nursing work revealed inconsistencies in counting and classifying interruptions across studies.⁶ However, Brixey et al developed a method to categorize interruptions into a 3-tiered hierarchy of activity.⁷ The classification framework was developed a priori, and categories were tested against a medical error case study, which resulted in no new categories. Rivera-Rodriguez and Karsh concluded that frequent interruptions can cause communication/interaction problems and be linked to errors.⁸

Errors during triage may decrease quality of care and ultimately result in adverse patient outcomes.^{9,10} Until recently, there was a lack of information about the causes and effects of interruptions in the ED. The release of the Institute of Medicine report "Hospital-based emergency care: At a breaking point" alerted the public that interruptions were one of the challenges contributing in the struggle to provide high quality care to patients.¹¹

Interruptions are common in the ED and triage is not exempt. Emergency nurses are frequently interrupted during their clinical work, and such interruptions lead to an incorrect triage decision, missed symptom identification, incomplete assessment, or unasked questions, and could potentially delay care resulting in significant morbidity or mortality.¹²⁻¹⁵ While the ED interruption studies examined interruption effect on specific task or person (physician), ED environment and patient outcomes were inadequately investigated.⁵ Although the researchers made advancements to the categorization of interruptions, there is a need for additional specificity regarding types of interruption.¹⁶ To address these limitations, the aim of this study was to identify the source and causes of triage interruptions, how interruptions affect the triage process and patient care, and determine if various types of interruptions affect triage differently.

METHODS

Design

We conducted a prospective observational study for 6 months in 2015 using convenience sampling at 2 adult EDs. Direct observations of triage interviews were conducted by 2 trained researchers after obtaining informed consent from the triage nurses. Approval was obtained from the authors' university Institutional Review Board.

Sample and setting

Observations occurred at 2 adult EDs. One was an urban Level 1 728 bed trauma center with 55 ED beds, which sees 75,000 patients per year, and the other was a suburban Level 3 trauma center with a 28 bed ED, which sees 42,000 patients per year, both in the same health care system.

The sample consisted of 8 triage nurses. Inclusion criteria were 1) emergency nurse and 2) assignment to triage for the shift when observations occurred. The exclusion criterion was if the triage patient was a member of a vulnerable population (prisoner, pregnant, or mentally disabled). Triage nurses were approached at the beginning of their shifts and asked to participate in the study. We had 100% participation. Nurses were provided \$10 gift cards for participation.

Instrumentation

The Triage Interruptions Assessment Tool (TIAT) was used to measure interruptions in clinical practice for the nurses included in the study. The TIAT is a 66-item instrument with 8 subscales used to measure and categorize interruptions. The TIAT captures: 1) source of interruption, 2) cause of interruption, 3) task interrupted, 4) nurses' reaction to the interruption, 5) potential impact of interruption on patient outcomes, 6) errors, 7) duration of triage, and 8) duration of interruption.¹⁷ The TIAT has established content validity (CVI=0.91) and a strong interrater reliability with a kappa of 0.773 with the adult ED population at both an academic Level 1 trauma center and suburban ED.¹⁷ Validity was verified through focus groups and content validity analysis, while reliability was assessed through direct observation in the ED. The data for this study were obtained during the interrater reliability phase of the parent study. Two researchers observed the triage process and independently completed the TIAT.

Outcome variables

The outcome variables for this study were triage duration and patient outcomes. Positive patient outcomes were categorized as anything necessary to improve or expedite the care of ED patients (eg, EKG in triage or physician entering to begin evaluation of the patient). Negative patient outcomes included delays and errors (eg, the nurse stating s/he made an error, the nurse leaving the room without logging out of the computer). Outcome variables were not mutually exclusive, meaning it was possible for an interruption to be both positive (radiology arrives to perform chest x-ray) and negative (nurse leaves and does not complete allergy list).

Procedures

The researcher approached eligible nurses at the beginning of their shift, informed them of the scope and purpose of the study, and obtained written informed consent for participation prior to initiating study activities. Because no data were collected on the patients, consent from the ED patients was not required. Due to the nature of triage, no explanation was given to the patients prior to triage unless the patient inquired. If patients did inquire, they were informed of the study purpose. Triage interviews were observed, and the data were recorded using the TIAT. Data collectors remained outside of the triage room to diminish the risks of having a Hawthorne effect or data collectors causing interruptions. Although outside the rooms, data collectors could see and hear the nurse-patient encounters and observe any interruptions.

Data analysis

Descriptive statistics, t-tests, Chi-square analyses, and 1-way ANOVA were used to identify the source and causes of triage interruptions, and how interruptions affected the triage process and outcomes. Logistic regression and Chi-square analyses were used to examine the impact of the various types of interruptions. We chose logistic regression because of the lack of past research to inform our selection of reliable predictors. All analyses were conducted using IBM SPSS Statistics 23 (Armonk, NY).

RESULTS

Eight nurses (4 female, 4 male) were followed for 118 observations. Seventy-eight (66.1%) observations occurred at the Level 1 trauma center. All observations occurred between 7am and 7pm. The median age of the nurses was 37 (range 25–59). Median duration of ED nursing experience was 8 years (range 5–17). Educational backgrounds included bachelor degrees (n=5) and associate degrees (n=3). None of the nurses were board certified emergency nurses. Chi-square analysis found no relationship between the nurses and presence of interruptions ($X^2=9.285$, $p=.233$). Additionally, there was no significant difference between the mean triage durations for each of the nurses as determined by 1-way ANOVA ($F[104,13]=1.225$, $p=.358$).

Impact of interruptions on triage time

Of the 118 observations, 67 (57%) were identified as being interrupted. Due to the lack of normality of the durations of triage and interruptions, both variables were transformed using the log normal for the analysis. T-tests comparing the triage duration among the interrupted interviews, which averaged 6.64 minutes (1.515, 29.537), and uninterrupted group, which averaged 4.54 minutes (1.609, 10.651) showed a significant difference ($t=-3.025$, $p=.004$).

We also calculated the percent of triage time used to address an interruption by dividing the triage time by the duration of interruption. Interruptions lasted 3.66 minutes (0.69, 5.65). Of the 67 interrupted triage interviews, 17% (SD=.0196) of the triage time was dedicated to interruptions.

What is interrupting the triage process

Information on the interruptions found in this study can be found in Table 1. Triage was most commonly interrupted by other nurses during face-to-face interactions. However, 10.5% of the time triage nurses interrupted themselves by remembering to do something they were supposed to do previously or to get misplaced supplies. Patients also were considered a source of interruption when they would stop the triage interview to answer their phone or talk to the nurse or family members about non-visit related issues. Sixty-seven percent of the time, the triage nurse would stop the triage interview with the patients and immediately address the interrupter. Other reactions to interruptions were to ignore it, or to pause triage and either delegate or delay addressing it.

Patient outcomes were difficult to assess, but delays in care had the most obvious impact. Positive outcomes of interruptions (n=10) included any interruption beneficial to the patients receiving timely care, such as patient care assistants interrupting triage by entering the room to begin an ECG or physicians entering to begin their assessment. Other interruptions considered to have positive impact were related to retrieving equipment or answering patient questions to provide better care. Only 2 errors were observed, and both occurred during bedside triage encounters. Nurses were notified when errors were observed so that they could be addressed and patient care was not compromised. The errors were leaving the bedside while remaining logged into the patient's electronic health record, and the nurse reporting charting the incorrect patient complaint. Over half of the patient outcomes did not have observable errors and were deemed unable to be assessed due to the inability of the data collectors to view the charts during the triage process to assess for errors.

How different types of interruptions affect patient outcomes

Correlations between the ED occupancy and duration of triage were analyzed. Because triage duration did not have a normal distribution, this variable was transformed using log normal. This analysis showed that during higher ED occupancy triage interviews were shorter (Spearman's $\rho = -.246$, $p=0.027$).

Chi-square analysis was conducted to determine if relationships could be identified between interruption characteristics (source, cause, task, and nurse reactions) and patient outcomes (positive and negative). Although an interruption could contribute to both positive and negative outcomes, no such observations were made. The only variable that had a significant relationship was observed errors with the type of task being interrupted. The tasks interrupted when the 2 errors occurred were physical assessment and medication review. To include the duration of triage and duration of interruption into the Chi-square analysis, times needed to be transformed into categorical variables so they were divided into 2 minute time blocks. Patient outcomes had significant relationships with the source of interruption, the task that was interrupted and the nurse's reaction to the interruption (Table 2).

A regression model was constructed to determine which variables affected the duration of triage. The hospital, occupancy of the ED, whether triage was interrupted, number of patients waiting for triage, waiting for ED beds, number of patients in the ED currently, and number of available rooms were included in the original model. The original model has an

$R^2 = 0.290$ and an adjusted R^2 of 0.238. The F change statistic of 5.576 was statistically significant ($p < .001$). The least significant variables were manually removed 1 at a time, and the analysis was rerun until only the significant variables remained. The final model had only 1 predictor, interruptions. The presence of triage interruptions was statistically significant ($p < .001$) to the duration of triage.

Of the 67 interrupted triage interviews, outcomes were recorded on 32 subjects. The data collectors were unable to assess outcomes in the remaining 35 observations. Outcomes were dichotomized into positive and negative where negative included both observed errors and delays. Sixty-nine percent ($n=22$) of the outcomes reported for the interrupted interviews had negative outcomes. A simple logistic regression was conducted, and a significant relationship was identified ($X^2 = 4.709$ $p = .030$) between negative outcomes and interruptions.

We calculated the duration of the interruptions and also calculated the proportion of the triage interview spent on addressing the interruption (duration of interruption divided by the duration of triage). Although analysis showed the duration of the interruptions was not predictive of patient outcomes (score = .388 $p = .533$), the percent of the triage interview dedicated to addressing the interruptions was predictive, $B(SE) = 4.10(2.030)$ $p = .044$, $OR = 0.017$ (95% $CI = .000-.888$).

DISCUSSION

Interruptions have been linked to mistakes, decreased productivity, and decreased human efficiency, and have been shown to adversely affect health care. This study demonstrated that interruptions occur frequently in triage. Because they happen so often during this important assessment, more attention should be focused on assessing the impact interruptions have on patient care. Interruptions that occur due to the nature of the ED environment may be an obstacle in providing high quality patient care and have been linked to errors and delays in patient care.¹⁸ Because only 22% of triage interruptions were related to patient care, less urgent, non-patient care related interruptions can affect the quality of care by disturbing the triage process.²

Interruptions affect the communication with patients promoting nurse-patient relationships.² We found that communication between the triage nurse and patient was the task most frequently interrupted (Table 1). Kosits and Jones observed 30 nurses from 3 EDs and found 200 interruptions occurring during the 60 hours of observation (3.3 interruptions per hour per RN) and 27.5% of the total interruptions were related to medication activities that may lead to errors.¹⁹ In our study, an error occurred when the triage nurse was interrupted during medication review, which is also an important component of medication administration. As was the case in this observed error, it has been reported that 13% of physicians and nurses failed to return to task once interrupted, and 18.5% of health care providers failed to return to the original interrupted task.^{20,21}

Errors were documented in 2 tasks, physical assessment and medication review. Physical assessment is a key element of the triage process. Acuity scores are based on both subjective

and objective data. Errors in this assessment can influence the urgency in which care is delivered for emergency patients.

The current demands on EDs have made it vital that patients are treated efficiently and effectively. Triage needs to be quick and accurate to reduce ED congestion as well as to expedite placement of patients into appropriate areas (lobby, treatment room, critical care bay, etc). The results of a prospective time and motion study conducted in Australia showed that emergency physicians were interrupted 6.6 times per hour, and the interruptions were associated with a significant increase in the amount of time required to complete a task such as writing orders, dictating notes, or assessing patients.²¹ To maintain high quality care, it is important that process times are decreased during the triage process while accuracy is maintained or improved. Some interrupted triage interviews had durations higher than 29 minutes while the longest uninterrupted triage interview was only 10 minutes. Decreasing triage times allows patients to be treated sooner, thereby improving the flow of patients through the ED.

Interruptions in triage

Triage interviews that were interrupted were over 2 minutes longer than uninterrupted ones. Although this may not seem clinically significant, repeated delays, even as short as a few minutes, can cause backlogs and prevent a system from functioning efficiently. The longer the interruption, the more of a delay in care occurs. Studies of interruptions in other disciplines have demonstrated that the longer an interruption keeps the interrupted worker from returning to task, the higher the likelihood of errors or the possibility the task will remain incomplete.²¹

Limitations

Data were collected at 2 adult EDs. We were not able to collect data on crowding levels to see the impact that crowding has on triage interruptions. There are no patient data included in this study, so we were not able to identify if certain patient types, genders, or acuity levels were interrupted more frequently. Additionally, measurement of patient outcomes were for short term only. Conducting chart reviews may have provided more information regarding the true impact on patient outcomes.

CONCLUSION

Triage is the important initial assessment where acuity is assigned to an emergency patient. Interruptions during this process can cause delays and interfere with providing safe and efficient patient care. Interruptions during this time increase the process time for triage and can cause system delays to the ED process. Additionally, interruptions can lead to errors in assessment and documentation. It is necessary to identify the interruptions causing the most harm to ED patients and develop interventions to mitigate the adverse impact of these interruptions; thereby decreasing errors and delays, which will lead to improved patient outcomes and ED process time.

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Table 1

Interruptions

Categories	Characteristics	N=67 (%)
Source		
	RN	15 (22.4)
	PCA	9 (13.4)
	MD	3 (4.5)
	EMT	5 (7.5)
	Self	7 (10.5)
	Patient	9 (13.4)
	Family	5 (7.5)
	Other	14 (20.9)
Cause		
	Phone	20 (29.9)
	Face-to-face	40 (59.7)
	Self	7 (10.5)
Task Interrupted		
	Communication	31 (46.3)
	Physical Assessment	26 (38.8)
	Vital signs	7 (10.4)
	Medication review	2 (3.0)
	ECG	1 (1.5)
Nurse reaction to interruption		
	Stop triage/immediately address	45 (67.1)
	Pause triage but delay addressing interruption	3 (4.5)
	Pause triage delegate interruption	8 (11.9)
	Ignore interruption	11 (16.4)
Patient Outcomes		
	Positive	10 (14.9)
	Errors	2 (3.0)
	Delay in care	20 (29.9)
	Unable to assess	35 (52.2)

RN, registered nurse. PCA, patient care assistant. MD, physician. EMT, emergency medical technician. ECG, electrocardiogram

Table 2

Relationships between Characteristics of Interruption with Errors and Outcomes

	Errors X^2	Negative Outcomes X^2
Source	8.345	47.215 ^c
Cause	2.043	5.250
Task	17.657 ^a	24.433 ^a
Nurse reaction	6.116	19.345 ^b
Duration of Triage (categorical)	18.947 ^a	14.768
Duration of Interruption (categorical)	13.760	24.904 ^b

^a
p .05,^b
p .01,^c
p .001