Likelihood of being seen within emergency departments' assigned urgency times for poisoned and injured individuals

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Abstract

The objective of the present study is to determine the likelihood of injured or poisoned patients in special populations, such as those patients that are elderly and self-injurious, being seen within an emergency department's triage nurse assigned urgency. Data from the National Hospital Ambulatory Medical Care Survey (2007) was utilized in this study. Multi-level models and multivariate linear regression models were used; patient age, sex, reported pain levels, wait time, and injury type were examined as potential predictors of being seen within assigned urgency. From a random sample across all US Emergency Departments, 5616 patients nested in 312 hospital emergency departments were included into the study. Typically, approximately 1 in 5 emergency department patients were not seen within their triage nurse assigned urgencies. The typical patient in the average hospital had an 81% likelihood of being seen within their assigned urgency. Patients who were oldest [odds ratio (OR)=0.0990] and had self-inflicted injuries (*vs* assault OR=1.246 and OR=1.596) had the least likelihood to be seen within their assigned urgencies. As actual wait-time increased for patients, they were less likely to be seen within their assigned urgencies. The most powerful predictors of the study's outcome were injury type and age, indicating that patients from special populations such as the elderly or those with injuries resulting from deliberate self-harm are less likely to be actually priority patients independent of triage nurse assigned urgencies.

Introduction

Wait times in the Emergency Department (ED) settings have received considerable attention in the past several years. Between 2003 and 2009, visits to EDs across the United States increased by approximately 25%.[1] Over the past several years both volume of patients and wait time in EDs have drastically increased.[2] This has led to a lack of adequate resources to meet the needs of patient care which has in turn led to a reduction of quality of care. Thus, it is imperative that the factors related to excessive wait times be investigated and addressed, since longer waits often translate into less than optimal patient outcomes.[1-3]

In a report released by the US Government Accountability Office (GAO) concerns over ED crowding, wait times, and ambulance diversion were discussed. In their study the GAO found that patients with the most urgent needs were the least likely to be seen on time in hospital EDs: patients with recommended wait times of less than 1 min spend on average 73.9 min in the waiting room before being seen. Similarly, patients with urgency level recommended wait times (1-14 min) were only 50% likely to be seen on time, and waited on average 37 min before seeing a physician.[4] In 2009 it was reported that hundreds of thousands of patients wait 24 h or more before receiving necessary medical attention.[5] For special populations such as suicidal or self-injurious patients, longer waits can translate into further injurious behavior or possibly death.[6] Bindman *et al.*'s[6] observational study found that longer wait times were associated with patients leaving the ED before being seen by a healthcare professional. Their study also found that patients who left before being seen where twice as likely to report worsening of pain or seriousness of their health problem.[7] Because of this, special attention may be warranted for groups that are more at risk for death like young children or the elderly or those patients who engage in self-harming behaviors. Patients that are deemed critically ill by triage nurses usually have higher priority to be seen, but this urgency-based process still has its flaws. In the current study, wait times in the ED setting will be studied for individuals who have been either poisoned or injured. By looking at intentionality of injury, age, and level of pain, this study will look for significant variation in patients at different levels for each factor and whether patients are actually seen within their level of urgency assigned by triage nurses.

Materials and Methods

Using the 2007 National Hospital Ambulatory Medical Care Survey (NHAMCS), the primary research question of whether ED urgency-based assigned wait times being appropriately met are related to nature of injury, age, and pain will be examined.[8] Since the NHAMCS is available online to the general public and was retrieved through the Centers for Disease Control and Prevention, Ambulatory and Hospital Care Statistics Branch, this study was exempt from Institutional Review Board protocol since the database used was publicly available, contained no unique identifiers, and existed before the study protocol was created. The portion of the survey used for the present study is the patient record form compiled by trained staff members in EDs sampled from geographic regions within the 50 states of the US. Within each geographic region primary sampling units, hospitals and clinics with emergency service areas (ESAs) were considered. Types of ESAs included in this database included general, adult, pediatric, fast track, psychiatric, and trauma.[8]

The data collected is from a systematic random sample of patient-visits that was collected during a randomly assigned 4-week period. This data includes patient demographics, expected payment sources, patient complaint and diagnoses, medication therapy, disposition, causes of injury, types of providers seen, diagnostic/screening services rendered, wait-time for each patient, and center ED facility information such as geographic region.[9] All patients with visits to EDs with a reported injury or poisoning in the database were included in the present study. Patients with missing or blank data in the age, urgency, intentionality of injury or level of pain fields were excluded. After applying these inclusion and exclusion criteria, the un-weighted study sample (n=5616) was broken into its nested

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groups of hospital by their reported hospital code (j=312). Each patient was then weighted by the patient weight variable in the database for all subsequent analyses.

Upon initial ED evaluation by a triage nurse, each patient in the analysis was assigned to an ordinal-based urgency factor which indicates the time in which the patient should be seen (immediate, 1-14 min, 15-60 min, 1-2 h, or 2-24 h). Comparing this to the actual wait time recorded, the dichotomous dependent variable *appropriate wait time* was derived. For this variable, patients were coded either a 1 if seen before or within their assigned wait time or a 0 if they were not seen within their assigned wait time. Patient reported pain levels were also collected during initial evaluation with values ranging from 1 to 4, with a 1 indicating a patient that reported no pain and 4 indicating a patient in the most severe pain.

Both a single- and a multi-level model were estimated for the study. IBM SPSS Statistics 19 was used to calculate the single-level binary logistic regression model. In order to estimate the dichotomous dependent variable of whether the appropriate wait time was achieved, the dependent variables included in the model were age, sex, reported level of pain, and dummy codes for intentionality of injury (self-caused intentional, non-intentional, and assault caused by another individual intentionally).

HLM7.0 was used to estimate the multi-level binary logistic regression model. Using a random intercepts model, the conditional (subject-specific) logistic multi-level model was estimated using a Bernoulli distribution for our dependent variable of whether appropriate wait-time was achieved. This model was specifically chosen, because of its useful properties in addressing between subject heterogeneity in general and in present study case, the between-hospital differences in our binary dependent variable.[7] Underlying this model is the assumption that all hospital unit-specific effects are random, giving each hospital its own intercept. It is also assumed that the level-two units (hospitals) for the present study all share a common slope function.

Results

Of the sample chosen, nearly 5% of patients were seen in the sample's EDs for self-inflicted injuries, nearly 5% were seen for assault-inflicted injuries, and the remaining 90% were seen for reported unintentionally inflicted injuries. A single-level binary logistic regression model with level-1 weighting was run to check the appropriateness of the basic model. The model suggests that patients with ED visits associated with assault and non-intentional injuries are significantly different from the intentional self-injury patient group (P<0.000) in terms of being seen within their assigned wait time controlling for pain, sex, and age. The analysis yielded an odds ratio (OR) of 1.596 (95% CI=1.587, 1.605) indicating that patients with injuries classified as non-intentional were 1.6 times more likely to be seen within their assigned wait time than patients with injuries classified as self-inflicted/intentional. Patient with injuries classified as assaults also were more likely to be seen within their assigned wait times (OR=1.246, 95% CI=1.236, 1.255) than their counterparts with self-inflicted/intentional injuries. Pain, sex, and age were also significant in the single level model (P<0.000), indicating that older patients are significantly less likely to be seen within their assigned wait times (OR=0.990, 95% CI=0.986, 0.099) and that females patients and patients with higher reported pain levels were more likely to be seen within their assigned wait times (OR=1.021, 95% CI=1.019, 1.048, and OR=1.049, 95% CI=0.048, 1.051, respectively) (Table 1).

Laplace estimates of the ORs for age (0.989, 95% CI=0.986, 0.994) and wait time (0.978, 95% CI=0.977, 0.978) were found to be significantly different from one (P<0.001) with both coefficients indicating that the variables have an indirect relationship with the dependent variable of being seen within an assigned urgency. The intentionality of injury dummy coded groups for assault (1.619, 95% CI=1.075, 2.437) and non-intentional injuries (1.988, 95% CI=1.503, 2.630) patients were found to be significantly different comparison group of self-caused intentional injuries patients (P<0.05 and P<0.001, respectively). Level of pain and sex were both found to not be statistically significantly different in our model with ORs of 0.988 (95% CI=0.916, 1.066) and 0.974 (95% CI=0.827, 1.146) respectively (Table 2).

Table 1. Descriptive analysis of the phenomenon.

Parameters		Patients (%)	Mean age (years)	SD	Mean wait time (min)	SD	Range	Mean pain level	SD
Triage nurse assigned urgency	Immediate	5.1	43.9	24.3	23.04	28.4	1-174	2.8	1.2
	1-14 min	12.5	40.5	24.1	36.37	53.5	1-610	2.6	1.1
	15-60 min	43.4	37.4	22.9	48.11	63.8	1-910	2.8	1.1
	1-2 h	28.5	32.9	21.1	62.58	71.6	1-800	2.8	1.0
	2-24 h	10.4	33.5	20.6	79.67	104.1	1-749	2.7	1.1
Type of injury	Self-inflicted	4.7	37.2	15.7	67.6	106.7	1-677	1.8	1.1
	Assault	4.7	30.4	15.7	61.9	69.6	1-450	2.9	1.0
	Unintentional	90.6	36.7	23.1	51.6	67.9	1-910	2.8	1.0

SD, standard deviation.

Table 2. Results from single- and multi-level analyses.

Fixed effects	Single-level logistic model				Multi-level logistic model			
	Coefficient	OR	95% CI	P	Coefficient	OR	95% CI	P
Intercept	1.996	7.361	nr	nr	2.652	14.188	9.922, 20.29	<0.001
Age	-0.010	0.990	0.990, 0.990	<0.000	-0.010	0.989	0.986, 0.099	<0.001
Sex	0.021	1.021	1.019, 1.048	<0.000	-0.027	0.974	0.827, 1.146	<0.001
Wait time	-0.018	0.982	0.982, 0.982	<0.000	-0.022	0.978	0.977, 0.097	0.749
Pain°	0.048	1.049	1.048, 1.051	<0.000	-0.012	0.988	0.916, 1.066	0.759
Assault	0.220	1.246	1.236, 1.255	<.000	0.482	1.619	1.075, 2.437	0.021
Non-intentionality	0.467	1.596	1.587, 1.605	<0.000	0.687	1.988	1.503, 2.630	<0.001

nr, not reported values. °Pain was group-mean centered in multi-level analysis and un-centered in single level analysis.

Discussion

Analyses revealed that the typical patient with an injury or poisoning in an average ED is 18.7% likely to have their actual wait time exceed their triage-nurse assigned urgency. Factors found to be statistically related to exceeding assigned urgency were age, actual wait time, and type of injury. Level of patient reported pain was not found to have a significant association with achieving appropriate wait time.

Patients were not randomized to each injury condition, which results in the inability to show causal pathways leading to wait times exceeding assigned urgencies. However, random selection of the sample of patients included in the database did occur which encourages the belief that the present study's findings are generalizable and representative in nature of patients visiting EDs across the United States. Because of the database's rigorous methodology and since over 500 articles have been published using the NHAMCS database,[9] the researcher was confident that the sampling methods used during collection was acceptable.

Another limitation is that exposure misclassification in terms of injury type may have occurred due to the sensitive subject matter of self-injury; thus, it must be recognized that an underreporting of self-injury and/or suicidal behaviors may occur in general. Nonetheless, any misclassification bias would be expected to bias our results towards null, which would indicate that the analyses' estimates of effects are more conservative and truncated than the true differences between injury groups.

Although patients with self-inflicted and assault-inflicted injuries were of low incidence in the population, between-group differences in the outcome variable of appropriate wait time were still detectable at statistically significant levels. Analyses showed that patients with both assault-inflicted and non-intentional injuries were significantly more likely to be received care within their assigned urgencies than those patients with self-inflicted injuries. The average patient with self-inflicted had the lowest probability of being within their assigned urgency at 0.846, while the average patient with assault-inflicted or non-intentional injuries had probabilities of 0.916 and 0.965 of being seen within their assigned urgencies, respectively.

Patients assigned to the highest level urgencies were generally the oldest and at the mean level of pain for the population. Multi-level analyses revealed a general negative trend between both age and pain levels with the study's dependent variable of appropriate wait time, although of these variables only age was found to be statistically significant. According to analyses the typical patient at age 5 is 83.7% likely to be seen within their assigned urgency holding all other factors constant at their population means, where as an identical patient would have only an 81.6% likelihood at age 20, a 76.5% likelihood at age 50, and a 70.6% likelihood at age 80.

Conclusions

The results from both single- and multi-level analyses uncovered substantial deficiencies in the current processes of assigning urgencies to and the treatment of patients with injuries in EDs in the US. Special populations such as the elderly or patients who deliberately cause self-harm should theoretically warrant special attention by healthcare professionals as they are not being seen within their assigned urgencies. The reasons for these shortcomings cannot be directly assessed, but do indicate that problems exist either in one of two areas. One of such is that the processes by which triage nurses are assigning urgencies may have system-level flaws where urgencies may be seen as more idealistic instead of realistic guidelines for the treatment of patients. Secondly, this shortcoming may indicate the intertwinement of social stigma and professional judgments of the physicians who decide when the right time is to treat which patient based on factors outside the severity of physical ailments. Further studies are warranted to investigate specific reasons why this phenomenon is occurring and possibly how EDs across the US could improve patient care for special populations.

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