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Back so soon? Characterizing emergency department use after trauma

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ABSTRACT

Background: Trauma readmissions have been well studied but little data exists regarding Emergency Department (ED) utilization following an injury. This study was performed to determine the factors associated with a return to the ED after trauma.
Methods: A retrospective review of all adult trauma patients evaluated between January and December of 2014 was performed. Demographics, follow-up plan, and characteristics of ED visits within 30 days of discharge were recorded. Predictive factors of ED utilization were identified using univariate analysis and multi-logistic regression.
Results: Fourteen percent of 1836 consecutive patients returned to the ED within 30 days of initial trauma. On multi-logistic regression, penetrating trauma (OR 2.15 $p = 0.001$), and scheduled follow-up (OR 1.81 $p = 0.046$) remained significant predictors.
Conclusions: Penetrating trauma victims are at increased risk of returning to the ED, most often because of wound or pain issues. Recognizing these factors allows for targeted interventions to decrease ED resource utilization.

Introduction

Annual visits to the emergency department (ED) have risen steadily for over two decades.[1] Several papers have discussed that the ED frequently provides non-emergency care, and that this phenomenon is partly responsible for the increasing cost of health care in the United States.[2] Although evaluation after a trauma is considered an appropriate use of ED resources, the care following discharge of these patients should rarely require an ED visit. ED utilization has also become a marker of healthcare quality and, accordingly, the body of literature has increased.[3] Vashi et al. identified a 7.5% ED utilization rate in patients discharged within 30 days of admission for the most common medical and surgical diagnoses, but the literature regarding trauma patients' use of the ED after discharge is limited.

Ladha and colleagues demonstrated that 13.3% of trauma patients utilized the ED utilization within 30 days of discharge. They identified lack of insurance and lower incomes as risk factors for returning to the ED.[4] However, their study included only those patients who had been admitted to the hospital and a large portion of the trauma population is discharged directly from the ED without admission, what is termed "treat-and-release".[5] Little is known about the treat and release group's interactions with the healthcare system after their discharge. This study was designed to identify and characterize the group of trauma patients utilizing the ED following an index trauma, regardless of ED disposition (admitted or discharged).

Materials and methods

Froedtert Memorial Lutheran Hospital (FMLH) in Milwaukee, WI is an American College of Surgeons-verified Level I trauma center that serves southwest Wisconsin. This retrospective cohort study identified all adult patients evaluated by the trauma service at FMLH from January to December 2014 who returned to the ED within 30 days of their index trauma encounter. Patients were identified using the trauma registry, which is a comprehensive database of patients admitted to the trauma center. We also maintain an internal record of all trauma patients not admitted or who did not meet trauma activation criteria. Trauma team

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activation is determined by pre-established criteria that dictate the resources and personnel who respond to a trauma. The decision to consult the trauma service for those not meeting activation criteria is at the discretion of the ED attending physicians. Patients younger than 18 or who died during the admission were excluded. We also excluded patients in the registry who had not been evaluated by the trauma service.

Chart review was conducted using the electronic medical record (EMR). Only the index trauma and the first ED visit (if applicable) following the index trauma were analyzed. Data collected included mechanism of injury (MOI), injury type (blunt or penetrating), length of hospital stay (LOS), intensive care unit (ICU) LOS, services consulted, if the patient was a transfer, the day of week of discharge (from ED or hospital if admitted), discharge disposition, and patient follow-up plan. The follow-up plan was categorized as either "as needed," follow-up necessary (but patient instructed to call for appointment), or the patient's appointment was scheduled before discharge. Similar data from any 30-day ED visits were collected, but also included ED diagnosis, ED check-in time/day, if patients had called the trauma clinic prior to their ED visit, if the trauma service was re-consulted, ED diagnosis, and disposition. The EMR also allowed for capture of patient encounters at two other EDs within the FMLH system.

Descriptive and statistical analysis was performed for all trauma patients meeting inclusion criteria, both admitted and the treat and release patients. Continuous variables were reported as the mean and median, where applicable. Fisher's exact and Chi-square tests were used to analyze discrete variables while Wilcoxon rank-sum was used for continuous variables. Multi-logistic regression was performed to further delineate factors predictive of ED utilization. A p-value of < 0.05 was used for statistical significance. This study was reviewed and approved by the Institutional Review Board of the Medical College of Wisconsin.

Results

In 2014, the trauma service evaluated a total of 1836 patients. The demographic information of all trauma patients is shown in Table 1. The majority were under the age of 65, male, Caucasian or African American and had either Medicaid or commercial insurance. There were 1268 (69.1%) blunt traumas within the entire cohort, but the most common MOIs were motor vehicle crashes (MVC) and gunshot wounds (GSW), accounting for 31.4% and 19.0%, respectively. Two hundred sixty patients (14.2%) returned to the ED within 30 days of discharge from the ED or hospital. One hundred sixty-three (62.7%) arrived during normal clinic hours and only 76 (29.2%) presented on the weekend. Patients returning to the ED were more likely to be African American (51.9%), have Medicaid (43.5%), or to have a penetrating MOI (48.1%). Only 49 (18.8%) of these patients were re-admitted from the ED.

Six hundred sixty-three patients (36.1%) were discharged from the ED following their trauma evaluation. The demographic information of this cohort is shown in Table 2. Eighty-six (13.0%) of the treat and release patients returned to the ED within 30 days. They were more likely to be African American (60.5%), have a penetrating mechanism (53.5%) and have either Medicaid (32.6%) or commercial insurance (34.9%). "As needed" follow-up was recommended for the majority (59.3%) of these patients.

Table 1
Demographic information and characteristics of all trauma patients.

Characteristic	Return to ED	No Return to ED	All Patients	*p*-value
Patients (%)	260 (14.2)	1576 (85.8)	1836 (100)	
Age Median [Q1, Q3]	34 [24.0, 49.2]	36 [25.0, 53.0]	36 [25.0, 53.0]	0.229
18–64 (%)	231 (88.8)	1392 (88.3)	1623 (88.4)	
≥ 65 (%)	29 (11.2)	184 (11.7)	213 (11.6)	
Ethnicity (%)				<0.001
Caucasian	98 (37.7)	763 (48.4)	861 (46.9)	
African-American	135 (51.9)	623 (39.5)	758 (41.3)	
Hispanic	17 (6.5)	140 (8.8)	157 (8.6)	
Other	10 (3.8)	50 (3.2)	60 (3.3)	
Gender (%)				0.712
Male	183 (70.4)	1127 (71.5)	1310 (71.4)	
Female	77 (29.6)	449 (28.5)	526 (28.6)	
Insurance (%)				0.003
Medicaid	113 (43.5)	521 (33.1)	634 (34.5)	
Commercial	62 (23.8)	518 (32.9)	580 (31.6)	
Uninsured	42 (16.2)	301 (19.1)	343 (18.7)	
Medicare	43 (16.5)	236 (15.0)	279 (15.2)	
Penetrating vs Blunt (%)				<0.001
Blunt	135 (51.9)	1133 (72.0)	1268 (69.1)	
Penetrating	125 (48.1)	443 (28.1)	568 (30.9)	
Mechanism of Injury (%)				<0.001
MVC	52 (20.0)	525 (33.3)	577 (31.4)	
GSW	92 (35.4)	256 (16.2)	348 (19.0)	
Fall	33 (12.7)	231 (14.7)	264 (14.4)	
SW	31 (11.9)	171 (10.9)	202 (11.0)	
MCC	17 (6.5)	163 (10.3)	180 (9.8)	
MPC	19 (7.3)	97 (6.2)	116 (6.3)	
Assault	7 (2.7)	65 (4.1)	72 (3.9)	
Original Trauma Disposition (%)				0.100
ED Discharge	86 (33.1)	577 (36.6)	663 (36.1)	
Admission	174 (66.9)	999 (63.4)	1173 (63.9)	
Follow-up Plan (%)				0.002
Scheduled by service	175 (67.3)	933 (59.2)	1108 (60.3)	
Call "if needed"	45 (17.3)	433 (27.5)	478 (26.0)	
Patient to schedule	40 (15.4)	210 (13.3)	250 (13.6)	

MVC, Motor vehicle collision; GSW, Gunshot wound, SW, Stab wound; MCC, Motorcycle collision; MPC, Motor-pedestrian collision; SNF, Skilled nursing facility; LTAC, Long-term acute care facility.

Table 3 provides further details on patients who returned to the ED and demonstrates several differences between the treat and release group versus those previously admitted. The treat and release patients returned to the ED at a median of four days from discharge, were less likely to have called before going to the ED and were less likely to have been directed to the ED by a health care professional. They were also less likely to require a trauma consult and only 3.5% required admission (vs 26% in the group who had been admitted previously).

Univariate analysis of the admitted trauma population demonstrated that race, insurance status, type of trauma, MOI, and scheduled follow-up were significantly associated with return to the ED. On multi-logistic regression analysis only penetrating injury, Medicare insurance, and scheduled follow-up remained significant. Similar univariate predictors were identified in the treat and release group; however, only penetrating trauma, patients instructed to "call for follow-up", and patients with scheduled follow-up remained significant on multi-logistic regression (Table 4).

Discussion

Unnecessary ED utilization further burdens an already strained system and identifying patients at risk of returning to the ED following a trauma offers the potential to decrease ED visits by this group. While there remains a paucity of information on ED use following an injury, even less data exists regarding those patients discharged directly from the ED after their trauma, despite the increase in proportion of the treat and release group.[5]

Our study found that penetrating injury was the most significant risk factor for re-presentation to the ED in both cohorts, a finding not previously demonstrated in the literature.[6–8] While Ladha and Crandall have both demonstrated that self-pay status and Medicaid are risk factors for returning to the ED following a trauma,[4,9] lack of insurance was not a significant predictor in our study. This contrast may be due to differences in the sample demographic and payer status, as the proportion of uninsured patients in the two previous studies was much greater than at FMLH. Interestingly, following implementation of the Affordable Care Act in Wisconsin in 2014, the number of patients with Medicaid evaluated by the trauma team had doubled, and those with self-pay status was reduced by almost half (unpublished data). Finally, pain-related complaints are a common reason for return to the ED in both our study and in previous studies.[4,10]

Our study noted that trauma patients return to the ED within a few days of their trauma and highlighted that follow-up should be arranged earlier than the typical 7–10 days after an injury. Unfortunately, previous research demonstrates that uninsured patients are less likely to follow-up in clinic, which may limit the effectiveness of this strategy.[8,10] Our trauma clinic will see walk-in patients and we have a phone triage nurse available 24-h a day to answer patient questions. Despite these resources the majority of patients utilizing the ED arrived during clinic hours, but the retrospective nature of our study prevented us from elucidating the reason these patients visited the ED instead of using the clinic. A minority of patients contacted our clinic before they went to the ED

Table 2
Demographic information and characteristics of "treat and release" patients.

Characteristic	Return to ED	No Return to ED	All Patients	*p*-value
Patients (%)	86 (13)	577 (87)	663 (100)	
Age Median [Q1, Q3]	30.5 [23.0, 45.0]	31.0 [24.0, 44.0]	31.0 [24.0, 44.0]	0.629
18–64 (%)	83 (96.5)	554 (96.0)	637 (96.1)	0.629
≥ 65 (%)	3 (3.5)	23 (4.0)	26 (3.9)	
Ethnicity (%)				0.212
Caucasian	26 (30.2)	211 (36.6)	237 (35.7)	
African-American	52 (60.5)	289 (50.1)	341 (51.4)	
Hispanic	4 (4.7)	55 (9.5)	59 (8.9)	
Other	4 (4.7)	22 (3.8)	26 (3.9)	
Gender (%)				0.373
Male	65 (75.6)	405 (70.2)	470 (70.9)	
Female	21 (24.4)	172 (29.8)	193 (29.1)	
Insurance (%)				0.415
Medicaid	28 (32.6)	204 (35.4)	232 (35.0)	
Commercial	30 (34.9)	178 (30.8)	208 (31.4)	
Uninsured	20 (23.3)	162 (28.1)	182 (27.5)	
Medicare	8 (9.3)	33 (5.7)	41 (6.2)	
Penetrating vs Blunt (%)				<0.001
Blunt	40 (46.5)	385 (66.7)	425 (64.1)	
Penetrating	46 (53.5)	192 (33.3)	238 (35.9)	
Mechanism of Injury (%)				<0.001
MVC	18 (20.9)	228 (39.5)	246 (37.1)	
GSW	36 (41.9)	110 (19.1)	146 (22.0)	
Fall	10 (11.6)	80 (13.9)	90 (13.6)	
SW	5 (5.8)	50 (8.7)	55 (8.3)	
MCC	8 (9.3)	35 (6.1)	43 (6.5)	
MPC	4 (4.7)	37 (6.4)	41 (6.2)	
Assault	2 (2.3)	18 (3.1)	20 (3.0)	
Discharge Destination (%)				0.585
Home	77 (89.5)	531 (92.0)	608 (91.7)	
Rehab/SNF/LTAC	8 (9.3)	39 (6.8)	47 (7.1)	
Other	1 (1.2)	7 (1.2)	8 (1.2)	
Follow-up Plan (%)				0.007
Scheduled by service	23 (26.7)	134 (23.2)	157 (23.7)	
Call "if needed"	39 (45.3)	354 (61.4)	393 (59.3)	
Patient to call to schedule	24 (27.9)	89 (15.4)	113 (17.0)	

MVC, Motor vehicle collision; GSW, Gunshot wound, SW, Stab wound; MCC, Motorcycle collision; MPC, Motor-pedestrian collision; SNF, Skilled nursing facility; LTAC, Long-term acute care facility.

Table 3
Repeat emergency department encounter details.

Characteristic	Total Population	Previously Admitted	Treat and Release	*p*-value
Patient Total (%)	260 (100)	174 (67)	86 (33)	
Days after Discharge				0.03
Median [Q1,Q3]	5.0 [0.0, 30.0]	5.5 [2.0,12.0]	4.0 [1.0, 9.5]	
Called Prior to ED (%)				0.003
No	230 (88.5)	147 (84.5)	83 (96.5)	
Yes	30 (11.5)	27 (15.5)	3 (3.5)	
Directed to ED (%)				0.04
No	203 (78.1)	129 (74.1)	74 (86.0)	
Yes	57 (21.9)	45 (25.9)	12 (14.0)	
Trauma Consult Needed (%)				<0.001
No	171 (65.8)	98 (56.3)	73 (84.9)	
Yes	89 (34.2)	76 (43.7)	13 (15.1)	
Visit Reason/Diagnosis (%)				N/A
Pain/Medication Request	78 (30.0)	48 (27.6)	30 (34.9)	
Not Related to Trauma	36 (13.8)	28 (16.1)	8 (9.3)	
Wound issues	34 (13.1)	26 (14.9)	8 (9.3)	
Neuro/Psychiatric	30 (11.5)	19 (10.9)	11 (12.8)	
Complication - Other	28 (10.8)	26 (14.9)	2 (2.3)	
Suture/Staple/Equipment	26 (10.0)	11 (6.3)	15 (17.4)	
Other	21 (8.1)	15 (8.6)	6 (7.0)	
Missed Injury	7 (2.7)	1 (0.6)	6 (7.0)	
Disposition (%)				<0.001
Discharge	211 (81.2)	128 (73.6)	83 (96.5)	
Admit	49 (18.8)	46 (26.4)	3 (3.5)	

Table 4
Multi-logistic regression analysis of predictive factors for return to ED.

Factors	Admitted Patients (n = 1173)			Treat-and-Release (n = 663)		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Ethnicity (vs Caucasian)						
African-American	1.26	[0.82, 1.93]	0.29	1.1	[0.59, 2.00]	0.74
Other	1.11	[0.61, 1.94]	0.72	0.79	[0.31, 1.84]	0.61
Insurance (vs Commercial)						
Medicaid	1.54	[0.96, 2.49]	0.08	0.82	[0.44, 1.53]	0.53
Medicare	1.76	[1.06, 2.49]	0.03	1.43	[0.56, 3.37]	0.43
Self-pay	1.10	[0.60, 2.00]	0.75	0.69	[0.35, 1.33]	0.29
Penetrating (vs. Blunt)	2.15	[1.44, 3.21]	0.001	2.23	[1.27, 3.88]	0.005
Admission (vs ED D/C)	0.51	[0.22, 1.13]	0.11	N/A	N/A	N/A
Follow-up Plan (vs "if needed")						
Call to schedule	1.53	[0.59, 4.45]	0.40	1.93	[1.06, 3.44]	0.03
Scheduled by service	2.4	[1.10, 6.45]	0.05	0.67	[1.00, 3.23]	0.04

and these study findings resulted in a revision of our ED discharge instructions to clarify how to contact the trauma clinic. Furthermore, we have expanded our clinic availability to improve access to care (a decision unrelated to this study). A reevaluation of our practice is planned to determine if these changes have impacted the ED utilization rate after trauma. Finally, alternative methods like telephone or virtual appointments should be considered. Using telephone follow-up, Malhotra found that 17% of trauma patients had significant problems that required medical attention.[11] Currently the evidence on telephone follow-up efficacy is inconclusive, but its use could avoid unnecessary visits to the ED and may decrease unnecessary clinic visits as well.[12,13]

This study has several limitations, most notably its retrospective nature. Another significant limitation was the inability to capture ED visits at other hospitals outside of our hospital system. Malhotra and colleagues found that 75% of patients returned to the same trauma center for acute care in the ED, but the suburban location of our trauma center may decrease the likelihood that patients return to our hospital.[11] Even with this limitation, we had similar 30-day ED utilization to Ladha et al. but a prospective study with patient contact after discharge would have to be used to capture other ED visits. Another limitation was that we were unable to determine why some patients had scheduled appointments upon discharge from the ED while others were left to schedule their own appointments. Since follow-up arrangements were a significant risk factor for returning to the ED, any future study should include the rationale behind clinic scheduling decisions. Similarly, we could not determine why patients used the ED instead of the trauma clinic and this information was inconsistently documented in the patient note. Finally, 31% of our trauma patients suffered penetrating trauma, which may differ from other trauma centers and could decrease the applicability of these findings to other facilities.

Despite the above limitations, this study demonstrated that trauma patients frequently return to the ED, especially following penetrating trauma, but that race, and insurance status were not predictors of ED utilization. Most of the return ED visits were within a week of injury but were not severe enough to warrant admission. Future studies comparing the use of interventions aimed at decreasing ED utilization rate are important to decrease the burden of avoidable ED visits.

Previous presentation

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Declaration of competing interest

The authors declare no conflicts of interest.

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