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Trauma patients returning to the emergency department after discharge

Adam D. Shellito, M.D. *, Sohail Sareh, M.D., Hayley C. Hart, B.S., Jessica A. Keeley, M.D., Christine Tung, M.D., Angela L. Neville, M.D., Brant Putnam, M.D., Dennis Y. Kim, M.D.

Department of Surgery, Los Angeles County Harbor-UCLA Medical Center, Torrance, CA, USA

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ABSTRACT

Background: While readmission rates of trauma patients are well described, little has been reported on rates of re-presentation to the emergency department (ED) after discharge. This study aimed to determine rates and contributing factors of re-presentation of trauma patients to the ED.

Methods: One-year retrospective analysis of discharged adult trauma patients at a county-funded safety-net level one trauma center.

Results: Of 1416 trauma patients, 195 (13.8%) re-presented to the ED within 30 days. Of those that re-presented, 47 (24.1%) were re-admitted (3.3% overall). The most common reasons for re-presentation were pain control and wound complications. Patients with Medicare (AOR 2.6, 95% CI 1.3 to 5.2) or other government insurance (AOR 2.5, 95% CI 1.6 to 4.1) were more likely to re-present than patients with private insurance.

Conclusion: A considerable number of trauma patients re-presented to the ED after discharge for reasons that did not require hospitalization. Discharge planning for certain vulnerable groups should emphasize wound care, pain control and scheduled follow-up to decrease the reliance on the ED.

Introduction

In the United States, nearly 3 million people are hospitalized annually for traumatic injuries with the associated economic burden of $671 billion dollars per year.[1,2] Nearly 50% of all trauma patients have some form of government insurance, and 11–20% lack health insurance altogether.[3–5] Previous studies have demonstrated that uninsured patients or patients with public insurance who suffered unintentional injury were less likely to receive scheduled follow-up care.[6,7] With nearly half of all medical care in the U.S. being delivered through emergency departments, it is not surprising that uninsured or underinsured trauma patients have a growing reliance on the emergency department (ED) as a primary source of post discharge follow-up care.[8]

Readmission rates have increasingly become a measure of quality of care, ranging from 2 to 4% among trauma patients at 30-day follow up.[9–11] While readmission rates may be an important benchmark, re-presentation to emergency departments has not been investigated with as much scrutiny.[12] Average charges for ED visits, ranging from $1200 to over $2000, are substantially higher for patients and hospital systems compared to other avenues of care such as office visits ($167) or urgent care visits ($193).[13–15] In addition to high financial cost, ED visits are time consuming and inefficient for patients, families and providers.[16,17] Given the significant costs and time burden of emergency room visits compared to these other avenues of care, re-presentation of trauma patients deserves attention. The objectives of this study were to determine the rates and contributing factors of re-presentation to the ED among trauma patients. We hypothesized that a higher proportion of trauma patients who returned to the emergency department after discharge would be uninsured or have public health insurance.

Material and methods

Study design and setting: This study was deemed exempt from the Institutional Review Board at the Lundquist Institute for Biomedical Innovation at Harbor-UCLA Medical Center. Using a retrospective cohort study design, we completed an analysis of trauma patients admitted to an academic county-funded level 1

* Corresponding author.
E-mail address: ashellito@dhs.lacounty.gov (A.D. Shellito).

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trauma center over a one-year period.

Data source and study participants: We queried the institutional trauma registry for all adult trauma patients who required hospitalization between June 2018 to June 2019. Patients younger than 18 years old, as well as those patients who did not survive to index discharge were excluded from analysis. The patient's electronic medical record (EMR) was then used to determine if patients returned to the ED within 30 days of discharge. For patients with multiple return visits to the emergency department or re-admissions within 30 days, only the index ED return visit was included for analysis so a single patient could not be counted more than once.

It is standard practice for all discharged trauma patients to receive standardized discharge instructions; however, these instructions are customizable by the surgical and nursing team depending on their specific injuries, home instructions and pharmacotherapies. These instructions can be printed in English or Spanish and the surgical team shares the responsibility with nursing to review instructions with patients in their primary language. The hospital system does not currently have a post-discharge follow-up phone call system in place for discharged trauma patients.

Data collection: Data from the trauma registry was cross-referenced with patients' EMR to obtain granular level information regarding their index admission. Furthermore, all additional encounters within 30 days of index discharge, including scheduled follow-up appointments and reasons for re-presentation to the ED were identified. Injury severity score (ISS) was extracted from the trauma registry, and divided into two categories: $\leq$15 and > 15 (major trauma).[18] Insurance status was divided into four categories: private insurance (health maintenance organization (HMO), other private insurance, workers' compensation), Medicare (Medicare A&B), government (Medicaid/Medi-Cal, military, or other government) and uninsured (cash or self-pay). Reasons for re-presentation to the emergency department were divided into nine categories consistent with prior investigations[9,19]: pain control (i.e. uncontrolled pain, pain medication refill), wound complication (i.e. wound/surgical site infection, dressing attention/supplies and negative pressure dressing complications), medical/pre-traumatic condition (i.e. unrelated to traumatic event such as hypertension, tachycardia or seizure), administrative (i.e. chief complaint was "missed follow-up" or "I need follow up"), disease progression (i.e. sequelae of traumatic event such as deep vein thrombosis or progression of head bleed), other infection (e.g. urinary tract infection), against medical advice (AMA) or elopement, recidivism (i.e. suffered additional trauma), and missed injury or discharge error (e.g. missed intracranial hemorrhage). To assess the impact of follow-up attendance on re-presentation rates, patients were stratified based on their follow-up compliance at time of index discharge. Of note, it is regular practice for all discharged trauma patients to receive some type of scheduled follow-up, however, the specific clinic and type of follow-up depends on the injury syndrome and insurance status at time of discharge. Therefore, patients were grouped by type of follow-up and compliance with that specific follow-up. Groups included: those that were compliant with (i.e. attended) their scheduled trauma follow-up visit, those that were not compliant with (i.e. did not attend) their scheduled trauma clinic follow-up, those that were provided a non-trauma follow-up (e.g. orthopaedic, neurosurgery), and those that were not provided any follow-up appointment (out of plan or follow-up deemed unnecessary).

Data analysis: The primary outcome of interest was re-presentation to the ED within 30 days of index discharge. Secondary outcomes included reasons for re-presentation and 30-day readmission rates. For comparative analysis, patients were stratified into the Re-Presentation (*RP*) and No Re-Presentation (*NRP*) cohorts. Nonparametric univariate analysis comparing the two cohorts was completed using the Mann-Whitney *U* test and chi-square tests as appropriate. A multivariable random-effects logistic regression model was developed to identify predictors of re-presentation, controlling for clinically relevant patient characteristics, including age, sex, race, ISS, trauma mechanism, insurance status, disposition and follow-up compliance. Descriptive statistics are reported as a mean $\pm$ 95% confidence interval (CI) unless otherwise stated. Adjusted odds ratio (AOR) are reported with 95% confidence intervals (CI). A p-value less than 0.05 was deemed statistically significant. All analyses were performed using Stata software (Version 16.0, Stata Corporation, College Station, TX).

Results

Of the 1416 trauma patients identified during the study period, 13.8% (n = 195) returned to the ED within 30 days of index discharge and comprised the *RP* cohort. Among patients that re-presented, 47 (24.1%) required readmission (3.3% overall). Median time to re-presentation was 7 days after discharge (IQR 2–14). Among the *RP* cohort, the most common reasons for re-presentation were pain control (23.1%, n = 45) and wound complications (23.1%, n = 45) (Fig. 1). For patients that required readmission, the most common reasons were disease progression/sequelae of traumatic injury (31.9%) and AMA/elopement (19.1%) (Table 1).

Among the entire sample of trauma patients, the patients tended to be male (72.1%), Hispanic (44.3%), suffer from blunt trauma (79.9%), and have government insurance (51.6%). The average age was 46 $\pm$ 21 years old with an average ISS of 11.2 $\pm$ 8.6.

Patient characteristics among the *RP* and *NRP* cohort are displayed in Table 2. *RP* patients were on average younger (41 vs. 46 years old, $p < 0.001$), more likely to be male (80.0% vs. 70.8%, $p = 0.008$), non-white (92.3% vs. 81.4%, $p < 0.001$), and suffer from a penetrating injury (30.3% vs. 17.9%, $p < 0.001$). Furthermore, *RP* patients were more likely to be noncompliant with their scheduled trauma clinic follow-up appointment (20.2% vs. 11.1%, $p < 0.001$), and more likely to have eloped or left AMA during their index hospitalization (11.8% vs. 4.4%, $p < 0.001$).

On multivariable regression, black patients (adjusted odds ratio [AOR] = 2.3, 95% CI 1.2–2.3) and Hispanic patients (AOR = 2.0, 95% CI 1.1–3.6) were more likely to re-present compared to their white counterparts (Table 3). Younger patients in age groups 18–25 years old (AOR 2.8, 95% CI 1.1–7.4) and 25–50 years old (AOR 2.5, 95% CI 1.0–6.4) had a higher odds of re-presenting to the ED compared to older age groups. Additionally, patients with Medicare (AOR 2.6, 95% CI 1.3–5.2) or government insurance (AOR 2.5, 95% CI 1.6–4.1) were more likely to re-present than patients with private insurance. With regards to disposition status, patients requiring home health care (AOR 2.3, 95% CI 1.3–4.1) and those who eloped or left AMA (AOR 2.7, 95% CI 1.5–4.7) were significantly more likely to re-present compared to patients discharged home with self-care. Sex, ISS and trauma mechanism were not significant predictors of re-presentation to the ED after risk adjustment.

Discussion

The results from the present study demonstrated that a significant number of trauma patients return to the emergency department after discharge. However, less than a quarter of those visits resulted in readmission; the total number of readmissions in our sample (3.3%) was consistent with previously published rates of 2–4%.[9,11] These findings suggest that trauma patients re-presented to the ED after discharge for reasons that could be potentially

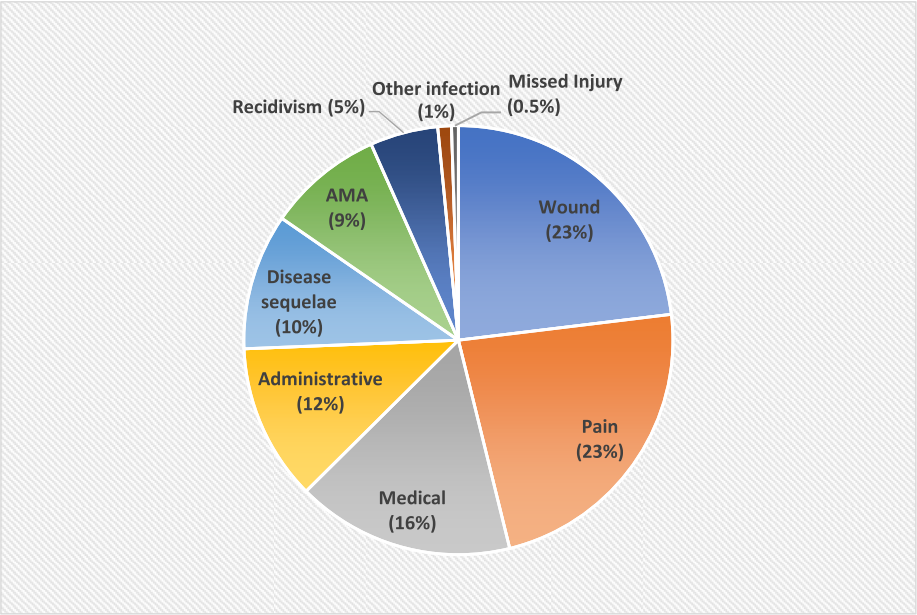

Fig. 1. Reasons for re-presentation to ED.

intervened upon outside of the emergency room. In addition, our data showed that certain patient groups have higher odds of re-presentation. Minority race and younger age were associated with higher odds of re-presentation than their comparative groups. Contrary to prior studies which showed injury severity score and penetrating mechanism were associated with higher odds of readmission, our data showed that these factors were not associated with higher odds of re-presentation to the ED.[9,10,20] These findings are important for discharge planning, as efforts can focus on these more vulnerable groups in an attempt to decrease their reliance on the emergency department as a primary point of care after discharge.

The two most prevalent reasons for return visits to the emergency department, wound complications and pain control, are both potentially modifiable. Wound complications and wound care issues are not only a risk factor for re-presentation to the ED, but also for readmission. Multiple studies evaluating the readmission of trauma patients have shown that wound complications or surgical site infections are among the top reasons for readmission. Wound care issues account for 17–29% of all trauma readmissions.[9–11,20] While our data seem to align with these prior studies (15% of readmissions, see Table 1), only 7 of 45 (16%) patients who re-presented with wound complications required readmission. This reinforces the conclusion that many wound complications or wound care issues can be addressed without hospitalization. Our data is consistent with a similar study of trauma patients by Ladha et al. which reported that "dressing attention" was a significant contributor to re-presentation, but also had very low associated readmission rates.[19] This data suggests that there are a significant number of wound issues that could be appropriately handled in the outpatient clinic, urgent care, or even by telephone. Recently, innovative ways to monitor wounds or surgical sites at home with mobile applications and patient-generated pictures have been used with promising results.[21–23] These systems require patient participation to answer questions about signs of infection and prompt patients to send in daily photos of their wound which are monitored by a healthcare professional.[22] Having this available to patients may provide reassurance about wounds and decrease the need for patients to seek care in the emergency room prior to their scheduled follow-up visits. While the feasibility of these options in a resource-limited setting such as our county-funded hospital may prove difficult, it is an area in need of further research.

In our sample, pain control was the other most common reason for return to the emergency department. However, only 2 of the 45 (4%) patients who re-presented to the ED for pain issues required readmission. This finding may prove particularly useful as prescribing practices can be intervened upon prior to discharge. Pain incidence at the time of discharge after trauma has been estimated as high as 97%, with up to 59% of patients experiencing moderate to severe pain.[24] Not surprisingly then, more than 50% of patients who

Table 1
Reasons for re-presentation to emergency department (ED) and readmission.

Reason	Re-presented to ED (n = 195) N (%)	Re-admitted from ED (n = 47) N (%)
Pain control	45 (23.1)	2 (4.3)
Wound complication	45 (23.1)	7 (14.9)
Medical/pre-traumatic condition	32 (16.4)	6 (12.8)
Administrative/missed follow up	23 (11.8)	2 (4.3)
Disease Progression/sequelae	20 (10.3)	15 (31.9)
AMA/non-compliant	17 (8.7)	9 (19.1)
Recidivism/additional trauma	10 (5.1)	4 (8.5)
Other infection	2 (1.0)	1 (2.1)
Missed injury/discharge error	1 (0.5)	1 (2.1)

Table 2
Baseline characteristics of patients who re-presented to the ED (RP) and those who did not (NRP).

Baseline characteristics	RP (n = 195) N (%)	NRP (n = 1221) N (%)	*p* value
Age (mean ± SD)	41.3 ± 18.8	47.2 ± 21.3	**0.001**
Male sex	156 (80)	865 (70.8)	**0.008**
Race			
White	15 (7.7)	227 (18.6)	**<0.001**
Black	63 (32.3)	282 (23.1)	
Hispanic	93 (47.7)	534 (43.7)	
Other	24 (12.3)	178 (14.6)	
ISS (mean ± SD)	11.8 ± 8.8	11.2 ± 8.6	0.3
ISS >15	58 (29.7)	297 (24.3)	0.105
Penetrating mechanism	59 (30.3)	219 (17.9)	**<0.001**
Blunt mechanism	136 (69.7)	1002 (82.1)	
Insurance			**<0.001**
Medicare	25 (12.8)	239 (19.6)	
Medi-Cal/Other government	139 (71.3)	592 (48.5)	
Private	23 (11.8)	332 (27.2)	
Uninsured	8 (4.1)	58 (4.8)	
Disposition			**<0.001**
Home	124 (63.6)	776 (63.6)	
Home with services	23 (11.8)	61 (5.0)	
Rehab/SNF/post-acute	24 (12.3)	317 (26.0)	
Psychiatric unit	1 (0.5)	12 (1.0)	
AMA/Elopement	23 (11.8)	54 (4.4)	
Follow-up compliance			**<0.001**
Missed appointment	40 (20.2)	136 (11.1)	
Attended	47 (24.4)	187 (15.3)	
No follow-up given	15 (7.8)	198 (16.2)	
Other follow-up	93 (47.7)	700 (57.3)	

Abbreviations: ISS = injury severity score, AMA = against medical advice, SNF = skilled nursing facility.

Table 3
Multivariate logistical regression to predict relative odds of re-presentation to ED within 30 days of discharge.

Predictors of re-presentation	Odds Ratio	[95% Confidence Interval]	p value
ISS>15	1.17	0.8–1.7	0.415
Penetrating mechanism	1.07	0.7–1.6	0.738
Male	1.19	0.80–1.8	0.393
Age			
Age 75-100	1.0 (REF)		
Age 50-75	2.32	1.0–5.5	0.057
Age 25-50	2.54	1.0–6.4	**0.046**
Age 18-25	2.54	1.1–7.4	**0.035**
Race			
White	1.0 (REF)		
Black	2.31	1.2–4.3	**0.009**
Hispanic	1.98	1.1–3.6	**0.027**
Other	1.96	1.0–4.0	0.062
Insurance			
Private	1.0 (REF)		
Medicare	2.63	1.3–.2	**0.006**
Medi-Cal/Other government	2.54	1.6–4.1	**<0.001**
Uninsured	1.59	0.7–3.8	0.299
Disposition			
Home	1.0 (REF)		
Home with services	2.33	1.3–4.1	**0.003**
Rehab/SNF/post-acute	0.67	0.4–1.1	0.118
Psychiatric unit	0.57	0.1–4.6	0.595
AMA/Elopement	2.68	1.5–4.7	**0.001**
Follow-Up Compliance			
Attended trauma follow-up	1.0 (REF)		
Missed trauma follow-up	1.36	0.8–2.3	0.241
No follow-up given	0.42	0.2–0.8	**0.011**
Other follow-up	0.73	0.5–1.1	0.157

Abbreviations: ISS = injury severity score, AMA = against medical advice, SNF = skilled nursing facility.

experience a traumatic injury are discharged home with an opioid prescription.[25] Fears of overprescribing opioids and creating dependence after surgery or trauma may lead clinicians and surgeons to prescribe inadequate amounts of pain medicine upon discharge.[26] With the rising concerns of opioid use and abuse, and the increased scrutiny on prescribing practices, a culture change toward under-prescribing opioids may be detrimental to the trauma patient. Pain management protocols and guidelines for prescribing opioids already exist for other settings. For example, the State of Washington has best practices for prescribing analgesics in the perioperative setting that can be adapted to the post-traumatic setting.[27] In addition, some centers who have implemented standardized post-operative opioid prescribing strategies have shown a reduction in overall opioid prescriptions without an increase in ED utilization.[28,29] By prescribing an adequate quantity of pain medication, both opioid and non-opioid alike, as well as standardizing discharge medications, a reduction in the number of trauma patients returning to the ED in pain may be possible.

Nearly 50% of trauma patients rely on some form of public or government insurance.[3] The percentage of trauma patients treated at our county-funded facility under either Medicaid or Medicare was even higher, at over 70%. A meta-analysis by Newton et al. found that, in general, patients with public insurance or no insurance were more likely to present to the ED for primary medical care.[7] This is supported by our data, as patients in our sample with Medicare or Medicaid were more likely to return to ED after discharge. There are several potential explanations for this finding. First, up to 50% of trauma patients do not have a primary care physician, and thus trauma patients may associate the emergency department as their only avenue of care after discharge.[7,30,31] Additionally, patients with private insurance are more likely to obtain urgent ambulatory care visits if needed, compared to those with government insurance.[32] As resources are limited at our county-funded facility, we do not have advice nurse telehealth systems in place for discharged trauma patients. In addition, access

to trauma clinic is limited to one day per week. These limitations likely leave many patients unsure of where to go or who to call for post-discharge concerns. Fortunately, telehealth medicine has demonstrated promising results with reductions in unnecessary ED visits. A single-institution study of over 5000 patients showed a 6.7% absolute reduction of unnecessary ED visits with the implementation of a telehealth care model leading to savings of nearly one million dollars in a single year.[33] Similarly, automated phone call systems and post discharge monitoring have already been used in the trauma setting with success.[34] Wright et al. showed that over a quarter of discharged trauma patients had questions that required clarification after discharge with regards to symptoms, follow-up appointments, medications or discharge instructions.[35] Given these findings, an area of future research could be whether an automated follow-up telehealth system could be used to reduce the number of unnecessary ED visits in the post trauma setting.

Due to the retrospective nature of our analysis and lack of all available data at time of analysis, this study has inherent limitations. One important data point for discharge planning is primary language. Almost half of our sample was Hispanic, and many of those patients were Spanish-speaking only. The association we found between certain races and increased odds of re-presentation to the emergency department could be affected by primary language. Discharge instructions are very often misinterpreted and a source of confusion with language playing a critical role in understanding.[36] Second, our data was generated from a single metropolitan county-funded level 1 trauma center, and is not necessarily representative of all trauma patients throughout the country. Because we are a safety-net county-funded facility, many of our patients rely on government insurance, including emergency Medi-Cal, and may not have established primary care physicians. This may lead more patients to re-present to the ED than other trauma populations. Our re-presentation rate, however, is consistent with other studies noting re-presentation rates from 7.5 to 13.3%.[19,34] Information on hospital length of stay, either during the index admission or subsequent admissions, was not collected. This information may be a confounding factor that contributes to the increased likelihood of re-presentation or readmission. Lastly, due to inconsistencies in reporting of medical co-morbidities in the institutional registry and missing data, we could not include co-morbidity scores in our analysis. We acknowledge that certain co-morbidities may affect the likelihood of trauma patients to return to the ED shortly after discharge. Despite these limitations, our study adds to the limited body of literature highlighting the unique challenges of discharged trauma patients in a resource limited setting.

Conclusion

The high rate of re-presentation of trauma patients to the emergency department is associated with an undue economic burden and the reasons are multifactorial. Many of these return visits may be unnecessary if preventable risk factors are recognized prior to discharge. Targeted interventions at time of discharge, such as ensuring adequate wound care supplies, pain medications, specific discharge instructions, and knowledge of follow-up clinic visits may help reduce reliance on the emergency department. Socioecomonic factors, language barriers, and other issues related to implicit biases within hospital systems were not the focus of this study, but warrants furthur consideration. Standardizing aspects of discharge planning for trauma patients such as pain management protocols and prescription practices, communication with home health or wound care providers, and perhaps post-discharge follow-up via telehealth systems are all domains of discharge planning also in need of future research.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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