

Analysis of social determinants of health on emergency department utilization by gunshot wound survivors after level 1 trauma center discharge

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ABSTRACT

Background This project analyzed risk factors for emergency department (ED) utilization without readmission within 2 weeks post-discharge for survivors of gun violence.

Methods A hundred gun violence survivors admitted to a Level 1 trauma center were surveyed. Descriptive analyses and group comparisons were conducted between patients who did and did not use the ED. Factors analyzed are rooted in social determinants of health and clinical care related to the index hospitalization.

Results Of the 100 patients, 31 had an ED visit within 6 weeks, although most (87.1%) returned within 2 weeks of discharge. Factors significantly associated ($p \leq 0.05$) with a return ED visit included: not having an identified primary care provider, not having friends or family to count on for help, not having enough money to support themselves before return to work, and not feeling able to read discharge instructions.

Conclusion Lack of a primary care provider, low health literacy and social support were associated with increased ED visits without readmission post-discharge.

Level of Evidence Level III, Prognostic and Epidemiological

INTRODUCTION

The USA has seen a steady rise in firearm violence in the last several years, with Milwaukee, Wisconsin experiencing a 70% increase in non-fatal shootings since 2019.¹ As a result, the city's only adult Level 1 trauma center has worked to address the needs of this unique patient population. Gunshot wound (GSW) survivors are predominantly young, Black males from lower socioeconomic status—a population that has been historically marginalized by society as well as the healthcare system.²⁻⁵ These patients present to the hospital with wounds that may require operative management. However, outpatient management becomes more complex due to the potential for adverse mental health outcomes such as risk of post-traumatic stress disorder, financial insecurities, or unsafe housing. These social determinants of health (SDOH) in turn influence outcomes after injury.

The outpatient setting is optimal to address clinical recovery in the context of social determinants. However, scheduled follow-up attendance

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Social determinants of health (SDOH) influence outcomes after gunshot wound injury (GSW).
- ⇒ The optimal setting to address recovery-related SDOH is in the outpatient setting, rather than the emergency department (ED).
- ⇒ Historically, clinic attendance after any injury is low and ED utilization within 30 days of discharge is high.

WHAT THIS STUDY ADDS

- ⇒ This study describes self-reported SDOH-based post-discharge needs for patients after GSW at an urban, Midwest, Level 1 trauma center.
- ⇒ SDOH-based post-discharge needs were compared between patients with GSW who did and who did not visit the ED within 6 weeks of hospital discharge.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ Lack of a primary care provider, low health literacy and social support were associated with increased ED visits without readmission post-discharge.
- ⇒ Identifying a primary care provider at time of discharge, leveraging picture-based or simpler language discharge instructions, and increasing engagement with other people are opportunities for intervention.

post-discharge is historically low and post-discharge emergency department (ED) utilization high among trauma patients of any mechanism of injury. Furthermore, patients with penetrating injuries such as a GSW or a stabbing are more than twice as likely to visit the ED within 30 days of discharge when compared with other trauma patients.⁶ Moreover, socioeconomic disadvantage has been associated with increased rates of non-urgent ED utilization.⁷ Non-urgent ED utilization additionally contributes to significant resource utilization.⁸ Prior to this review, there had been no published reports on the SDOH and needs of GSW survivors as it relates to post-discharge ED care.

Thus, this project analyzed factors associated with ED visits that did not result in a readmission within 2 weeks post-discharge for survivors of gun violence. Although not all ED visits after firearm

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Table 1 Descriptive frequencies of demographics, index hospital course, and baseline resources (N=100)

Categorical characteristics	n (%)
Demographic characteristics	
Gender	
Male	81 (81)
Female	19 (19)
Race	
Black or African American	83 (83)
Hispanic	8 (8)
White or Caucasian	7 (7)
Asian	1 (1)
Unknown	1 (1)
Index hospital course	
Insurance	
Medicaid	75 (75)
Medicare	6 (6)
Private insurance	4 (4)
Uninsured	5 (5)
Unknown	10 (10)
Injury Severity Score	
Moderate (9–15)	100 (100)
Discharge disposition	
Home	85 (85)
Acute rehab	7 (7)
Correctional facility	5 (5)
Without home (e.g., shelter, friend's house)	3 (3)
ED visit(s) within 6 weeks post-discharge	
Yes	31 (31)
No	69 (69)
ED visit(s) within 2 weeks post-discharge	
Yes	27 (27)
No	73 (73)
Hospital readmission(s) within 2 weeks post-discharge	
Yes	23 (23)
No	77 (77)
Baseline (pre-injury) resources	
Consistently accessible forms of communication	
Cell phone	86 (86)
Email	58 (58)
Social media	53 (53)
Apps	31 (31)
Other (e.g., none, house phone)	5 (5)
Before you were injured, how did you get around?	
Private vehicle	81 (81)
Public transportation	17 (17)
On foot	10 (10)
Other (e.g., friend, insurance, home health provider)	7 (7)
Taxi/Uber	5 (5)
Bike	3 (3)
Prior living situation	
House	54 (54)
Apartment	41 (41)
Trailer	1 (1)
Hotel	1 (1)
Street	0 (0)
Transient	0 (0)
Shelter	0 (0)

Continued

Table 1 Continued

Categorical characteristics	n (%)
Other (not reported)	4 (4)
Type of support from family/friends	
Physical help	87 (87)
Transportation	86 (86)
Emotional	86 (86)
Financial	74 (74)
Other needs (e.g., public benefits)	19 (19)
Continuous characteristics	
	M (SD)
Length of stay (days)	12.1 (21.8)
Age (years)	32.8 (12.1)
ED, emergency department.	

injury are preventable, firearm-injured patients have unique social and structural determinants of health which may influence how they engage with the healthcare system after hospital discharge. We sought to identify if any specific self-reported SDOH were associated with ED utilization that did not result in a readmission within 6 weeks after hospital discharge. The aims of this project were to better understand the immediate SDOH needs of GSW survivors, and to identify areas of intervention to promote engagement with optimal outpatient care resources.

METHODS

This quality improvement project surveyed GSW survivors admitted to an urban Midwest Level 1 trauma center.

Procedure

Patients were identified daily using the trauma census available through the electronic medical record (EMR) system and surveyed close to the time of their projected discharge. Patients were approached in their hospital room. Project staff described the purpose of the survey, that participation was entirely voluntary and that no personal identifiers would be tied to their responses. Patients could verbally agree to participate or decline. If patients were not available, project staff would only try one or two more times to reach them at a more convenient time that did not interfere with clinical care. This convenience sampling was used until a total of 100 patients with a GSW responded. The survey was first administered in October 2021 and the last response was collected in September 2022.

Survey design

The survey was created and managed using REDCap (Research Electronic Data Capture) hosted at the Medical College of Wisconsin. A total of 38 questions focused on SDOH, including access to a communication device (e.g., cell phone, reliable cell service, computer with Wi-Fi, MyChart), healthcare access (e.g., established with a primary care provider, health insurance), mental healthcare for the patient and their family, safe housing, social support, transportation, personal finances, employment, and health literacy. Health literacy was operationally defined as the patient's perception of their own ability to read at a level that allows them to understand their medical care. Surveys were conducted in-person in the patient's hospital room. The EMR was used to obtain demographic information including age, gender, race, and insurance status, in addition to ED visits and readmissions within 6 weeks of discharge and reason for that visit. Injury severity score, length of stay and discharge disposition were obtained from the local trauma registry.

Table 2 Patient social determinants of health survey responses comparing ED versus no ED visit within 6 weeks post-discharge

Survey question	No ED visit n (row%)	ED visit n (row%)	P value
Communication			
Do you have a cell phone?			0.66
Yes	66 (69.5)	29 (30.5)	
No	3 (60.0)	2 (40.0)	
Do you have a smart phone?			0.07
Yes	59 (67.1)	29 (33.0)	
No	7 (100)	0 (0)	
Do you have reliable Wi-Fi?			0.87
Yes	63 (69.2)	28 (30.8)	
No	6 (66.7)	3 (33.3)	
Do you have a home computer or laptop?			0.73
Yes	33 (67.4)	16 (32.7)	
No	36 (70.6)	15 (29.4)	
Do you have a way to use a computer if you need it?			0.57
Yes	29 (72.5)	11 (27.5)	
No	7 (63.6)	4 (36.4)	
Do you know what MyChart is?			0.78
Yes	38 (67.9)	18 (32.1)	
No	31 (70.5)	13 (29.6)	
Do you have access to MyChart?			0.85
Yes	18 (66.7)	9 (33.3)	
No	20 (69.0)	9 (31.0)	
Do you know how to use MyChart?			0.57
Yes	18 (64.3)	10 (35.7)	
No	20 (71.4)	8 (28.6)	
Healthcare access			
Do you have a primary care provider?			0.05*
Yes	32 (80.0)	8 (20.0)	
No	37 (61.7)	23 (38.3)	
Do you see your primary care provider regularly (i.e., in the last year)?			1.00
Yes	24 (80.0)	6 (20.0)	
No	8 (80.0)	2 (20.0)	
Do you have health insurance?			0.14
Yes	61 (66.3)	31 (33.7)	
No	6 (100)	0 (0)	
I don't know	2 (100)	0 (0)	
Mental health			
Does your family have access to mental health services as they cope with your trauma?			0.79
Yes	42 (67.7)	20 (32.3)	
No	26 (70.3)	11 (29.7)	
Housing			
Do you plan to return to your living situation?			0.34
Yes	46 (73.0)	17 (27.0)	
No	23 (63.9)	13 (36.1)	
Social support			
Do you have family or friends you can count on for help?			0.05*
Yes	68 (71.6)	27 (28.4)	
No	1 (25.0)	3 (75.0)	

Continued

Table 2 Continued

Survey question	No ED visit n (row%)	ED visit n (row%)	P value
Do you rely on other sources for help (e.g., WIC, neighborhood resources, etc.)?			0.51
Yes	22 (73.3)	8 (26.7)	
No	44 (66.7)	22 (33.3)	
Do you know what services you might qualify for?			0.61
Yes	13 (65.0)	7 (35.0)	
No	56 (70.9)	23 (29.1)	
Financial			
Do you have a job?			0.61
Yes	36 (72.0)	14 (28.0)	
No	33 (67.4)	16 (32.7)	
Do you have enough money to support yourself after injury until you can return to work?			0.02*
Yes	42 (79.3)	11 (20.8)	
No	26 (57.8)	19 (42.2)	
Do you know what the Crime Victim Compensation Program is?			0.88
Yes	10 (71.4)	4 (28.6)	
No	59 (69.4)	26 (30.6)	
Health literacy			
Do you feel that you are able to read at a level that allows you to understand your medical care?			0.03*
Yes	69 (71.9)	27 (28.1)	
No	0 (0.0)	2 (100)	
Can you tell me what injuries you have?			0.31
Yes	62 (67.4)	30 (32.6)	
No	6 (85.7)	1 (14.3)	
Do you know where to go to find health information?			0.14
Yes	45 (65.2)	24 (34.8)	
No	24 (80.0)	6 (20.0)	

*p≤0.05

ED, emergency department; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Statistical analysis

Statistical analyses were performed using STATA Ver.17.⁹ Descriptive analyses were conducted to describe demographic characteristics and hospital course. Age and index hospital length of stay were reported as means with standard deviation, whereas number of patients who visited the ED and other demographic characteristics including gender, race, and type of insurance were reported as percentages. Survey results were compared between patients who had an ED post-discharge within 6 weeks versus those who did not. Each survey question was examined with a X² test. The primary outcome was ED visit without readmission within 2 weeks post-discharge from initial admission. A p value of 0.05 or less indicated statistical significance.

RESULTS

Sample

Descriptive analyses of demographic characteristics, hospital course, and baseline resources are displayed in [table 1](#). The majority of participants were male (81%), Black or African American (83%), and publicly insured through Medicaid

Table 3 Healthcare-related survey responses comparing ED versus no ED visit within 6 weeks post-discharge

Survey question	No ED visit n (row%)	ED visit n (row%)	P value
Index hospitalization			
Did you meet with trauma psychology?			0.97
Yes	48 (68.6)	22 (31.4)	
No	20 (69.0)	9 (31.0)	
Do you feel like you are ready to go home?			0.52
Yes	51 (68.0)	24 (32.0)	
No	18 (75.0)	6 (25.0)	
Anticipated post-discharge follow-up care			
Did patient come to the follow-up Trauma Quality of Life Clinic*?			0.49
Yes	45 (71.4)	18 (28.6)	
No	24 (64.9)	13 (35.1)	
Will you have access to mental health services after you leave the hospital?			0.67
Yes	51 (69.9)	22 (30.1)	
No	17 (65.4)	9 (34.6)	
Will you follow up with your primary care provider when you are discharged?			0.37
Yes	29 (78.4)	8 (21.6)	
No	3 (100)	0 (0)	
Will you be able to get your medications and/or medical supplies such as bandages, cane, crutches, etc., when you are discharged?			0.85
Yes	61 (69.3)	27 (30.7)	
No	8 (66.7)	4 (33.3)	
Do you think you will be able to get yourself to follow-up appointments?			0.48
Yes	63 (70.8)	26 (29.2)	
No	6 (60.0)	4 (40.0)	
Do you want to receive reminders about your appointments?			0.36
Yes	64 (70.3)	27 (29.7)	
No	5 (55.6)	4 (44.4)	
Do you know who to call if you have questions?			0.28
Yes	37 (66.1)	19 (33.9)	
No	32 (76.2)	10 (23.8)	

*Brandolino *et al.*²² 2023
ED, emergency department.

(75%) or Medicare (6%) (table 1). The mean age of participants was 32.8 (\pm 12.1) years. The mean length of stay in the hospital was 12.1 (\pm 21.8) days. Most (n=27 of 31, 87.1%) of the patients who used the ED did so within 2 weeks of discharge.

Most patients anticipated returning to their living situation after discharge (63.6%). However, for those who were not returning to the same situation, most (n=30 of 35; 85.7%) reported having a safe place to go. Prior to injury, most patients reported using a private vehicle for transportation (81%) (table 1). Similarly, for patients who anticipated being able to return for follow-up care after discharge, most anticipated that they would still use a private vehicle (88.2%). Most patients did not know about the Crime Victim Compensation (CVC) Program (85.9%), but most reported planning on applying for it after it was explained to them (90.8%).

Self-reported survey factors associated with a post-discharge ED visit

Several SDOH factors were significantly associated with an ED visit; however, most were not (table 2). These included: not having an identified primary care provider (p=0.05), not having friends or family to count on for help (p=0.05), not having enough money to support themselves until they can return to work (p=0.02), and not feeling able to read discharge instructions (p=0.03). Two patients identified not having the literacy required to understand their discharge instructions, and both (100%) returned to the ED (p=0.03).

Healthcare-related factors from the index hospitalization and anticipated post-discharge follow-up care needs were not significantly associated with whether a patient had a subsequent ED visit (table 3). Most patients had met with trauma psychology during hospitalization (70%). Similarly, near the time of discharge, most patients felt ready to go home (75%), but not all.

DISCUSSION

The purpose of this study was to evaluate factors influencing ED visit without readmission after an admission for GSW. The demographics of our patient population were comparable with other studies evaluating victims of gun violence.^{4 10} A primary factor associated with ED visit without readmission was a lack of a primary care provider (PCP). Although this is a barrier that is addressable in the discharge process, it is important to identify underlying reasons that contribute to patients not having a PCP, one of which is having public insurance. Close to one-third of physicians do not accept new patients who are insured through Medicaid.¹¹ Given that the majority of our sample (>75%) reported public insurance, this ought to be a special consideration for interventions aiming to increase primary care access for GSW survivors.¹² In addition to insurance status, not having a PCP may indicate a lack of engagement in the healthcare system prior to injury. This may be due to issues of access due to insurance but may also indicate other barriers such as a de-prioritization of personal health, a mistrust of the healthcare system, or a lack of understanding of the potential benefits of routine medical care. This is supported by Chapman *et al.*¹³ who indicated that there are several barriers that contribute to primary care visit non-attendance among low-income patients. These include appointment disinterest, competing demands and system insufficiency, such as transportation and appointment reminder systems.

Reduced health literacy indicates an inability to read at a level to understand one's own medical care and, unsurprisingly, was also significantly associated with ED visit without readmission in this sample. Only 12% of adults in the USA have the proficiency to understand or effectively use health information.¹⁴ In general, patients with low health literacy have an increased rate of returning to the hospital or ED within 30 days of discharge.¹⁵ Two instruments are available for clinicians to quickly assess a patient's health literacy: the Rapid Estimate of Adult Literacy in Medicine and the Newest Vital Sign.¹⁶ Beyond assessing health literacy, trauma care teams must then include intervention techniques such as simplifying written materials, incorporating more effective communication techniques, and providing alternatives to written materials, such as picture-based instructions.¹⁷⁻¹⁹ At the systems level, hospitals can create standardized templates tailored to this patient population to improve comprehension.

Social support was the final factor significantly associated with ED visit without readmission. Those who live alone were 60% more likely to visit the ED than those living with a

spouse.²⁰ Perceived poor social support is also a risk factor for other outcomes, such as post-traumatic stress disorder and pain. Increasing engagement with follow-up care may have broad positive impact through increased engagement with people in general.

Finally, all other SDOH examined were not significantly associated with post-discharge ED utilization. These findings suggest that the reasons behind ED visit without readmission were multifactorial and not due to SDOH alone. Although this study presents pilot data, the findings support several opportunities for improvement to standard of care for patients with a GSW and the racial health disparities this patient population experiences. For instance, a PCP ought to be identified prior to discharge. Then, after discharge, a post-discharge navigator could facilitate patient engagement in follow-up care. By demystifying the complexities of care coordination and building trust with the patient and their family, the navigator may offer critical support in parallel with the challenges of returning home, often the location of the index injury. The latter is currently being investigated by this research team.

A limitation of this study was uncertainty of discharge timing. This made it challenging at times for patients to clearly answer questions regarding their anticipated discharge. An additional limitation is that this was a single-site investigation, so visits to other EDs are not accounted for in the present study. It is possible that our study underestimates true post-discharge ED utilization in this population.

In our study, PCP access, health literacy, and social support were significantly associated with post-discharge ED visit without readmission and are barriers that clinicians should address in the discharge process. When supported, these are also indicators of a healthy socioecological environment that facilitates engagement in one's health and well-being.²¹ Overall, this study highlights the opportunity for systems-level change in hospital processes and individualized education to better prepare patients for discharge, thereby decreasing non-essential ED utilization.

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Contributors MES, Td-C, CT, and SEC conceptualized the project design. JTC, JLP, HK, ND, and EAB interviewed patients and collected data. MES conducted the statistical analysis presented. JTC, MES, and AB drafted the article. All authors provided critical revisions and aided in the interpretation of results. All authors approve the final article. The guarantor of this project is MES and in this role they accept full responsibility for the finished work and the conduct of the project, had access to the data, and controlled the decision to publish.

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