

The Experience of Survivors of Firearm Suicide Attempts

A Retrospective Case Series

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Objective: We sought to identify people who survived firearm suicide attempts to describe the acute stressors, substance use, and mental health conditions related to the attempt.

Background: Most firearm deaths in the United States are the result of suicide. Because firearm suicide attempts have a case fatality rate of approximately 90%, little is known about the precipitating factors that lead to firearm suicide attempts.

Methods: We conducted a retrospective case series of patients admitted to a large hospital system between 2000 and 2019 who survived intentional, self-inflicted gunshot wounds to the head. Through the electronic medical record, we collected information about acute stressors, substance use, and mental health diagnoses before or at the time of the suicide attempt.

Results: Thirty-four patients were included in the study cohort. Patients were predominantly White (74%) and male (88%), with a mean age of 44 (range, 14–82). Nineteen (56%) patients were acutely intoxicated with alcohol upon hospitalization and 17 (50%) patients had a positive urine drug screen. Acute stressors involving interpersonal relationships (53%), work/school (32%), and legal disputes (18%), among others, were documented in 82% of patients. Most patients (65%) had been diagnosed with depression before their index hospitalization. Most patients were discharged to an acute rehabilitation center (41%) or an inpatient psychiatric facility (41%).

Conclusions: Acute stress and alcohol intoxication were common in this cohort of patients who attempted suicide using firearms. These data offer an ability to learn from the experience of survivors of firearm suicide attempts, a rare population.

Keywords: firearm suicide, firearms, guns, suicide

BACKGROUND

In 2021, there were 48,830 firearm-related deaths in the United States (US).¹ The majority of those deaths, 54%, were the result of suicide.¹ Despite being used in just a fraction of suicide attempts, firearms cause more than half of all deaths from suicide in the US.² Due to the lethality of firearms, approximately 90% of those who attempt suicide in this manner will die.^{1,3} The rate of firearm suicides is increasing, with an increase from 6.74 to 7.5 deaths per 100,000 people from

2005 to 2021; this represents an 11% increase over this time frame.^{4–6}

Those who die of firearm suicide are predominantly White, older, and male.⁷ Those with military service, people in rural areas of the country, and those living in states with high a prevalence of firearm ownership are also at higher risk.⁸ Being divorced or being a widower is also associated with an increased risk for firearm suicide.⁸ Much effort has been directed toward decreasing suicide rates by focusing on people with diagnosed mental health disorders or a previous suicide attempt. Prior literature, however, has demonstrated that a minority of individuals who died from firearm suicide (43% in one cohort) had a prior diagnosis of a mental health condition, and 90% of individuals who died from firearm suicide had never attempted suicide previously.⁹ States that have addressed firearm suicide by increasing the number of behavioral health services have produced only a modest improvement in suicide rates, highlighting that this issue is multifactorial.⁴

While a simplistic view may assert that depression and suicide attempts are inextricably linked, in a 20-year cohort study of patients in South Africa who survived firearm suicide attempts and received a subsequent psychiatric assessment, only 37% eventually received a diagnosis of depression, another 19% received a diagnosis of adjustment disorder, and 22% were acutely intoxicated but not depressed.¹⁰ These findings suggest that some patients may have an acute or sub-acute, rather than chronic, driver of firearm suicide attempts. Given the rarity of this population, literature regarding survivors of firearm suicide attempts and the acute stressors that may contribute are limited. While surviving a self-inflicted gunshot wound (GSW) to the head is uncommon, better understanding the experience of such survivors may provide insight into the risk factors contributing to firearm suicide. This may aid investigators, families, and policymakers identify opportunities for prevention interventions.

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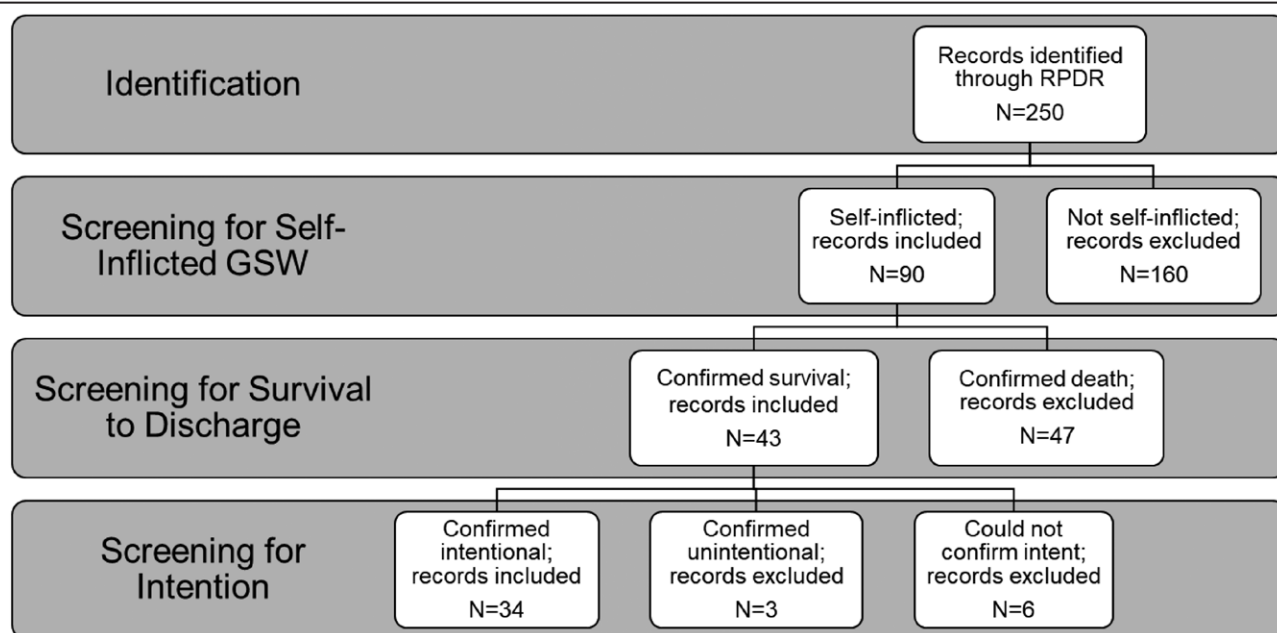


FIGURE 1. Flow diagram outlining the creation of the study cohort. RPDR indicates Research Patient Data Registry.

Therefore, we sought to identify a cohort of patients who survived firearm suicide attempts and describe the acute stressors that preceded the suicide attempt, substance use at the time of the suicide attempt, and previous mental health conditions before the attempt.

METHODS

We utilized a previously established cohort of patients who presented to a MassGeneral Brigham (MGB) level 1 trauma center with a principal diagnosis related to GSW to the head.¹¹ From this cohort, we included patients of all ages who presented between January 1, 2000 and December 31, 2019. Medical records from the index hospital admission were manually reviewed to confirm that the principal diagnosis was reported as GSW. Records were then further evaluated to determine whether the injury was self-inflicted and if the intent was confirmed by treating clinicians to be a suicide attempt. Patients were excluded if the GSW was deemed, by the treating physician, to not be self-inflicted, if they did not survive until discharge, or if the GSW was deemed to be unintentional. In cases where documentation did not adequately delineate between self-inflicted and interpersonal violence, or when there was inadequate documentation about the traumatic event in question, the patient was also excluded from the study.

All notes in the patient's medical record corresponding to their index admission were manually reviewed. The following data were then extracted by 2 investigators (J.R.S. and R.M.): demographic information, potential acute risk factors, potential chronic risk factors, and presence of substance use. The acute risk factors that were examined included potential life stressors documented in the patient's chart, acute alcohol or substance intoxication, and a history of substance use disorder without intoxication at the index visit. Potential stressors were coded and grouped into the following categories: relationships, family illness, housing, work/school, personal medical illness, financial, or legal. Relationship stress was defined as disagreements or interpersonal violence between the patient and spouse, family member, or friend. Acute alcohol intoxication was defined by either the presence of ethanol on the serum drug screen, documentation in the initial history and physical note of a positive ethanol serum drug screen at an outside hospital (if the patient had presented elsewhere and was transferred to the MGB hospital),

or documentation of the patient's report of alcohol consumption before admission. Medical records were also reviewed for the presence or absence of urine drug screen or patient report of recent substance use at the time of admission. Chronic risk factors, such as previously diagnosed mental health conditions, were documented by reviewing admission history and physical notes. Clinical outcome data, such as length of stay, discharge disposition, and need for surgery, were also recorded. The same 2 investigators assigned each patient a level of disability at discharge, as measured by the Modified Rankin Scale (mRS), based on documentation from the treating team during the index hospitalization. Any discrepancies were resolved through discussion and consensus.

Ethical approval was obtained through both the MGB and the Tufts University Health Sciences Institutional Review Boards. Quantitative data were reported using descriptive statistics and interpreted using univariate analysis. Single variable data were reported with its measure of central tendency, variance, and, when appropriate, dispersion.

RESULTS

A total of 250 patients were identified with a principal diagnosis of GSW with injury occurring to the head during the study time frame (Fig. 1). Based on chart review, 160 patients were excluded as their injuries were not self-inflicted. Forty-seven patients were excluded due to death before discharge. Three patients were excluded as their GSW was thought to be unintentional and not due to attempted suicide. Finally, 6 patients were removed due to inadequate documentation to establish the cause of their GSW. The final cohort included 34 patients.

Demographic data are reported in Table 1. The mean age at the time of admission to the hospital was 43.8 years and ranged from 14.0 to 81.7 years. The majority (88%, $n = 30$) of patients in the cohort were male. The majority of patients ($n = 25$, 74%) were White, with only 1 (3%) chart identifying a patient as Black/African American and 1 (3%) identifying as other. Seven (21%) patients did not have race listed in their medical record. Twenty-one (62%) patients were reported as Not Hispanic, while 1 (3%) patient identified as Hispanic. Ethnicity was not reported in 12 (35%) patients. Twenty-three (68%) patients were transferred from outside referring hospitals. Many of these patients were from outside of Massachusetts, with 15 (44%) and

TABLE 1.
Demographics of Patients (N = 34) Enrolled in the Study Cohort

Variable	Number	Percentage
Age on admission (yr)		
Mean (SD)	43.8 (17.3)	
Range	14.0–81.7	
Sex		
Male	30	88%
Female	4	12%
Race		
White	25	74%
Black or African American	1	3%
Other	1	3%
Not specified	7	21%
Ethnicity		
Hispanic	1	3%
Not Hispanic	21	62%
Not specified	12	35%
Initial hospital		
MGB	11	32%
Outside hospital	23	68%
State of residence		
Massachusetts	15	44%
New Hampshire	15	44%
Maine	4	12%

TABLE 2.
Acute and Chronic Risk Factors Identified in the Electronic Medical Record (N = 34)

Variable	Number	Percentage
Acute alcohol intoxication		
Yes (positive SDS or documentation)	19	56%
No (negative SDS)	6	18%
Not documented or tested	9	26%
Possible other intoxication		
Positive UDS or documented substance use	17	50%
Negative UDS	4	12%
Not documented or tested	13	38%
Acute stressor		
Interpersonal relationship	17	53%
Family illness	4	12%
Work/school	11	32%
Housing concerns	3	9%
Financial	4	12%
Personal health	2	6%
Legal	6	18%
Not documented	6	18%
Previous mental health diagnosis		
Depression	22	65%
Anxiety	5	15%
Chronic substance use disorder	20	59%
Bipolar disorder	2	6%
Schizophrenia	1	3%
Attention deficit/hyperactivity disorder	3	9%
Personality disorder	1	3%
Posttraumatic stress disorder	1	3%
None	7	21%

SDS indicates serum drug screen; UDS, urine drug screen.

4 (12%) patients transferred from New Hampshire and Maine, respectively. Fifteen patients (44%) resided in Massachusetts at the time of their injury.

Alcohol and other substance use were commonly identified in this cohort (Table 2). Nineteen (56%) patients had either a positive ethanol serum drug screen or documentation of alcohol consumption before admission to the hospital. For 6 (18%) patients in the cohort, a blood alcohol level was negative, and no ethanol testing or documentation was available

TABLE 3.
Outcomes for Patients (N = 34) Who Survived Firearm Suicide Attempts

Variable	Number	Percentage
Length of hospital stay (d)		
Median (IQR)	18.5 (8–45)	
Range	0–89	
Discharge disposition		
Home	4	12%
Physical rehabilitation facility	14	41%
Inpatient psychiatric facility	14	41%
Left against medical advice	1	3%
In custody of law enforcement	1	3%
Underwent surgery	27	79%
Functional status upon discharge		
No disability (mRS*, 0–1)	14	41%
Mild to moderate disability (mRS, 2–3)	9	26%
Moderately severe to severe disability (mRS, 4)	11	32%

*Range 0–6, with higher scores indicating more disability. IQR indicates interquartile range.

in the medical records for 9 (26%) patients. For 14 (41%) patients, the medical record included documentation of a positive urine drug screen, while 3 (9%) patients reported acute ingestion or chronic use of an intoxicating substance other than ethanol. Benzodiazepines (n = 10), tetrahydrocannabinol (n = 6), and opioids (n = 4) were the most commonly identified substances. The urine drug screen was negative for 4 (13%) patients, and a urine drug screen was not performed in 13 (38%) patients.

Most (82%, n = 28) patients had a documented acute stressor. Acute stressors involved interpersonal relationships (53%, n = 17), family illness (12%, n = 4), work/school (32%, n = 11), housing concerns (9%, n = 3), finances (12%, n = 4), personal health (6%, n = 2), and legal concerns (18%, n = 6). The majority (n = 22, 65%) were reported to have a previous diagnosis of depression, 5 (15%) were previously diagnosed with anxiety, and 20 (59%) had a history of substance use disorder. Previous diagnoses of schizophrenia (3%, n = 1), bipolar disorder (6%, n = 2), borderline personality disorder (3%, n = 1), attention deficit hyperactivity disorder (6%, n = 2), and posttraumatic stress disorder (3%, n = 1) were also reported.

Patients in this cohort frequently required prolonged treatment after the suicide attempt (Table 3). Length of stay during the index admission ranged from 0 to 89 days with a median of 18.5 days (interquartile range, 8–45). A total of 27 (79%) patients underwent surgery at some point during their admission. The median mRS score calculated at the time of discharge for this cohort was 2. Fourteen (41%) patients were discharged with no or no significant disability (mRS, 0 or 1), 10 (29%) patients had mild to moderate disability (mRS, 2 or 3), and 11 (32%) patients had moderately severe disability (mRS, 4). No patients were determined to have severe disability by mRS at the time of discharge. Fourteen (41%) patients were discharged to a rehabilitation center. An additional 14 (41%) patients were transferred to an inpatient psychiatric facility. Four (12%) patients were discharged to home, 1 (3%) patient left against medical advice, and 1 (3%) patient was discharged in the custody of law enforcement.

DISCUSSION

The data from this rare population of individuals who survive firearm suicide attempts may offer insights into the more common population of individuals who did not survive firearm suicide attempts. During the study period, there were 6405 self-inflicted deaths from firearms in Massachusetts, Maine, and New Hampshire combined – the 3 states represented in this

cohort.¹² Given an estimated case fatality rate of 90%, there were approximately 700 individuals who survived a firearm suicide attempt during this time period in these 3 states. Our identified cohort describes almost 5% of this population of firearm suicide survivors.

In this cohort, the mean age of presentation from self-inflicted GSW in this cohort was 44 years. Twelve patients (35%) were younger than age 40, while only 5 (15%) patients were older than age 60, despite the highest rate of completed firearm suicide in the US occurring among older adults. The age distribution in this cohort may reflect that older adults may be less likely to survive their injuries due to a higher prevalence of preexisting comorbidities, less physiologic reserve, or more social isolation leading to an increase in the time between suicide attempt and being found.⁶ The vast majority of this cohort was male. This is consistent with previous literature that suggests that men use more lethal means of self-harm during suicide attempts.⁶ Information about gender identity, however, could not be adequately determined as only 12% of patients had a recorded gender identity. This is particularly relevant, as patients who are transgender are known to have a higher rate of death from suicide than individuals who are cisgender.^{13,14}

Most patients in this cohort were found to have acute ethanol intoxication; this number may be higher than identified, as a quarter of the cohort was not tested for the presence of serum ethanol. Similarly, half of the patient cohort had a positive urine drug screen or otherwise were documented to have ingested intoxicating substance use before presentation for their suicide attempt; this is compared to just 4 patients with a negative urine drug screen. Nearly 60% of patients were documented to have a chronic substance use disorder. Despite not all patients having serum and urine drug tests performed during medical workup, these data suggest that substance use may contribute to an increased risk of firearm suicide, potentially by increasing impulsivity. This finding is consistent with previous research demonstrating an increased risk for suicide attempt in patients who are acutely intoxicated with alcohol versus patients who are sober.^{15–17}

More than 80% of patients within our cohort reported experiencing acute stress before their suicide attempt. The identified stressors were predominantly related to interpersonal relationships, work, or school. These stressors, as well as the others that were documented in this cohort, are not uncommon within the general population, suggesting that the risk for firearm suicide is likely multifactorial. Nearly 80% of patients had a documented chronic mental health condition while the majority of the cohort was acutely intoxicated at the time of emergency department presentation. This is consistent with the stress diathesis model describing risk for suicide by all methods by van Heeringen and Mann, which suggests that suicide risk is influenced by both internal stressors, such as depression, and external stressors, such as financial or interpersonal relationship problems; in this model, suicide risk is further increased by substance intoxication.¹⁸ In a case-control study, Gradus et al also described an increased risk for suicide by any method in patients diagnosed with acute stress reaction immediately after experiencing an external stressor. Both a history of depression and substance use were noted to be effect modifiers in this study.¹⁹ This previous literature and our study's findings reinforce the importance of consideration of suicide risk factors not only in times of severe crisis from a rare life event but also in the context of relatively common life stressors. Lethal means counseling to encourage patients and families in times of potential crisis to limit firearm access may be a particularly important clinical competency considering these findings.²⁰

Although, by virtue of this study design, all patients in this cohort survived until hospital discharge, many required a

protracted course of treatment while recovering from their injuries. The median length of stay was nearly 3 weeks, with a large range; 2 patients were admitted to the hospital for over 80 days. Nearly 80% of patients required at least one surgical procedure during their admission. Only 5 patients within this cohort were able to directly return home, and 1 patient did so after leaving against medical advice. Over 40% of patients required postacute rehabilitation for their traumatic injuries, while an equal number of patients were transferred to inpatient psychiatric hospitalization following medical discharge. Upon discharge, a third of patients had a moderately severe to severe disability based on the mRS score.

The strength of our study lies in this unique patient cohort. Research about firearm-related violence lags behind many other areas of public health; available studies that address the topic of firearm suicide often do not discuss survivors, given their rarity. Several limitations warrant further discussion. This study used retrospective chart review and not all demographic information was documented for each patient. Patients had to be identified initially using diagnosis codes; if patients were miscoded or had an alternate diagnosis listed, it is possible that we were unable to identify a complete cohort of consecutive patients. The retrospective nature of this study necessarily means that clinical evaluations were at the discretion of treating clinicians; not every patient received the same evaluation, such as testing for intoxicating substances, or had all data points, such as acute stressors or previous psychiatric diagnosis, documented. Measuring disability by mRS may be subject to reviewer bias and skewed by subjectivity when retrospectively reviewing patient charts. Additionally, the MGB system underwent a transition in electronic medical record systems in 2017, and thus it is possible that access to all archival medical records was not possible for every potential study patient. Despite a thorough review of records predating 2017, these medical charts were not populated with the extent of information included in patient records after the transition in electronic medical record and thus collection of data from these patients may have been limited. As many patients were transferred from outside hospital systems, complete medical records before arrival at an MGB center, including documentation of the administration of benzodiazepines and opioid medications, were frequently not available. For this reason, it is possible that positive urine drug screen results were due to hospital-administered medications.

For clinicians to effectively identify patients at risk for firearm suicide, they must recognize factors in addition to chronic mental health conditions. Acute stressors and substance use may be among the factors that may prompt clinicians to consider assessing for suicidality and access to lethal means, including firearms. While additional prospective studies involving patients who survive firearm suicide attempts are necessary to validate our findings, data from this cohort can help clinicians to recognize additional potential risk factors for self-inflicted firearm violence.

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