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The two faces of intentional self-inflicted injury: High in-hospital mortality, low postdischarge mortality, but high readmission rates

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ABSTRACT

Background: Intentional self-inflicted injuries present unique challenges in treatment and prevention. We hypothesized intentional self-inflicted injuries would have higher in-hospital and postdischarge mortality than nonintentional self-inflicted injuries trauma.

Methods: Adult patients evaluated 2008 to 2012 were identified in our trauma registry and matched with mortality data from the National Death Index. Intentional self-inflicted injuries were identified using E-Codes. Readmissions were identified and analyzed. Intentional self-inflicted injuries patients who died in-hospital were compared with those surviving to discharge. Univariate analysis was performed using nonparametric tests. Kaplan-Meier curves were plotted to compare mortality ≤5 years postdischarge between intentional self-inflicted injuries and non-intentional self-inflicted injuries patients.

Results: In the study, 8,716 patient records were evaluated with 245 (2.8%) classified as intentional self-inflicted injuries. Eighteen (7.8%) patients with intentional self-inflicted injuries had multiple admissions, compared with 352 (4.4%) patients with nonintentional self-inflicted injuries with readmissions ($P = .0210$). In-hospital mortality was higher for intentional self-inflicted injuries compared with patients with non-intentional self-inflicted injuries (18.7% vs 4.9%, $P < .0001$). Survival analysis demonstrated that patients with intentional self-inflicted injuries had significantly lower postdischarge mortality at multiple time points.

Conclusion: Patients with intentional self-inflicted injuries trauma have high in-hospital mortality, but low postdischarge mortality. We attribute this to high lethality mechanisms but appropriate psychiatric treatment and rehabilitation. However, the high intentional self-inflicted injuries readmission rate indicates further study of intentional self-inflicted injuries follow-up is warranted. Better prevention strategies are needed to identify and intervene in patients at-risk for intentional self-inflicted injuries.

Introduction

Intentional self-inflicted injury (ISI) is a broad term meant to encompass acts of suicidal intention and nonsuicidal self-injury, such as cutting, burning, scratching, head banging, asphyxiation, poisoning, and self-hitting.[1,2] Worldwide >800,000 people die from ISI each year, and half of ISI deaths have a history of prior ISI.[3,4] According to a longitudinal study of suicide attempt patients, 7% eventually died by suicide, 23% reattempted nonfatally, and 70% had no additional attempts.[5]

In the United States, suicide is the tenth leading cause of death, with 44,965 suicides in 2016, or 13.9 deaths per 100,000 Americans.[6] The Institute of Medicine estimates $11.8 billion per year in lost productivity owing to suicide and the direct medical and work loss costs of all ISI totals $70 billion annually.[7,8]

Unfortunately, suicide rates are on the rise. From 1999 to 2016, 44 states experienced a significant increase in suicide rate, with 25 states reporting an increase >30%. Moreover, the national rate of

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emergency room visits for nonsuicidal self-injury also increased by 42% between 2001 and 2016.[8]

Increased suicide rate is associated with decreased urbanization, and the suicide rate for the most rural counties in America increased by 53% between 1999 and 2017.[9] Suicide risk has been associated with lower health and mental health provider density in Appalachia.[10] In Virginia, suicide is 3× more common than homicide, and in the rural Appalachian counties, the suicide rate is well above the state and national average (15.8–17.4 per 100,000 from 2007–2013).[11,12]

Recognizing the substantial and increasing burden of ISI in our region of rural southwestern Virginia, we aimed to compare outcomes of ISI trauma patients with non-ISI trauma patients. Our first objectives were to compare these groups in terms of demographics and across 2 measures: inpatient mortality and postdischarge mortality. We hypothesized that ISI would have higher inpatient and postdischarge mortality than non-ISI trauma. During our study, however, we noted unexpected findings in ISI readmission. We then added an additional objective: to compare ISI trauma and non-ISI trauma patient readmission rates. The goal of the study was to help guide treatment and prevention efforts for ISI patients in our region.

Methods

The trauma registry of our Commonwealth and American College of Surgeons and verified level 1 trauma center was queried for all patients ≥18 years old evaluated or admitted by our trauma service between July 2008 and December 2012. Patients who survived to discharge were matched with mortality data from the National Death Index from 2008 to 2013. Patients with ISI were identified by *International Classification of Diseases, Ninth Edition* external cause of injury codes (E-codes) as determined by the trained trauma registrars at the time of chart review for data entry into the trauma registry. E-codes of interest involved those indicating suicide or self-inflicted injury specifically: 950, suicide and self-inflicted poisoning by solid or liquid substances; 951, suicide and self-inflicted poisoning by gases in domestic use; 952, suicide and self-inflicted poisoning by other gases and vapors; 953, suicide and self-inflicted injury by hanging, strangulation, and suffocation; 954, suicide and self-inflicted injury by submersion (drowning); 955, suicide and self-inflicted injury by firearms, air guns and explosives; 956, suicide and self-inflicted injury by cutting and piercing instrument; 957, suicide and self-inflicted injury by jumping from high places; 958, suicide and self-inflicted injury by other and unspecified means; and 959, late effects of self-inflicted injury. No attempt was made to determine suicidality because E-codes do not distinguish suicidal attempt from nonsuicidal self-injury.

Patient records were cross-checked for readmissions to determine the number of unique patients and calculate the readmission rates. Non-ISI and ISI patient demographics, injury mechanism, and outcomes were compared using univariate analysis with Wilcoxin 2 sample tests for median values and χ^2 tests for nonmedian values. Mechanism of injury, specific cause, and readmission rates were compared using χ^2. ISI patients who died while in hospital were identified and compared with those who survived to discharge using the same univariate analysis methods. Postdischarge mortality analysis was performed using Kaplan-Meier curves examining mortality ≤5 years after hospital discharge for trauma patients with and without ISI. Additional univariate analysis was performed on ISI patients who survived and died during the post discharge period. Univariate analysis was conducted using Wilcoxin 2 sample tests for median values, however, for nonmedian values Fisher exact test with Bonferroni correction was used because of the small sample size.

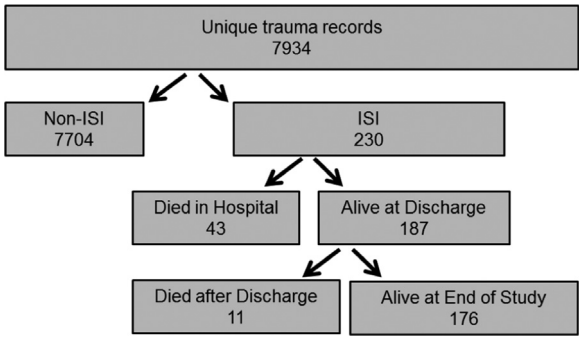

Fig 1. Study design.

This study was approved by the Carilion Clinic Institutional Review Board with appropriate safeguards instituted to protect patient information during the data matching with the National Death Index.

Results

A total of 8,716 adult trauma evaluations were identified during the study period. Searching for patients with multiple evaluations and admissions demonstrated 800 repeat records, accounting for 370 patients. Combining these groups yielded 7934 unique patients for further analysis. Of the 8,716 total patient records, 245 (2.8%) were classified by E-code as ISI. Of these, 33 records were from repeat patients, accounting for 10 unique ISI patient records. In total, 230 unique patients with ISI were identified. In-hospital mortality occurred in 43 (18.7%) of ISI patients, with the remaining 187 surviving to discharge. In the period ≤5 years after initial discharge 11 ISI deaths (5.9%) were identified, with the remaining 176 surviving throughout the study period. ISI mortality in the various subgroups is summarized in Fig 1.

Our initial analysis examined all patients, directly comparing those with and without ISI. Demographics, injury patterns, in-hospital mortality, and disposition are summarized in Table I. Patients with ISI were significantly more likely to be younger, male, have a lower median Injury Severity Score (ISS), and require intensive care unit (ICU) admission and mechanical ventilation. Regarding specific injury patterns, no particular system was more commonly injured in the ISI population. Overall head and neck injuries, chest injuries, abdominal and pelvic injuries, and extremity injuries were statistically more common in the non-ISI patients. There was no significant difference in race between the ISI and non-ISI groups. ISI in-hospital mortality was significantly higher than non-ISI patients, despite the finding that non-ISI patients had a higher median ISS.

Cause of injury between the ISI and non-ISI groups is summarized in Table II. At our trauma center, the most frequent mechanisms of injury were motor vehicle crash (36.7% all traumas) followed by fall (31.6% all traumas); however, these mechanisms were very infrequently used by ISI patients. χ^2 analysis demonstrated that ISI was dependent both on specific cause ($\chi^2 = 1{,}432.3$, $df = 1$, P value $< .0001$) and overall mechanism ($\chi^2 = 1{,}432.3$, $df = 1$, P value $< .0001$) with penetrating injuries, specifically gunshot wounds, followed by stabbings, predominating in the ISI group. The impressive statistical significance of the χ^2 analysis precluded the need for post-hoc analysis to determine the dependent relationship of mechanism and motive.

Table I
Demographics, injuries, and outcomes in all trauma patients

	Non-ISI	ISI	*P* value
n	7,704	230	
Median age	48	39.5	<.0001
White	85.9%	87.8%	.4112
Male	64.6%	74.4%	.0023
Median ISS	9	5	<.0001
Mechanical ventilation	13.6%	42.2%	<.0001
ICU admission	25.2%	42.1%	<.0001
Median HLOS (days)	3	3	.2972
Head and neck injuries (%)	42.4%	26.5%	.0003
Facial injuries (%)	13.9%	13.5%	.1128
Chest injuries (%)	32.8%	18.3%	<.0001
Abdomen/pelvis injuries (%)	18.8%	12.6%	.0118
Extremity injuries (%)	34.2%	16.5%	<.0001
In-hospital mortality (%)	4.9%	18.7%	<.0001
Discharge to rehab (%)	6.6%	49.1%	<.0001
Discharge to home (%)	70.8%	22.6%	<.0001
Readmissions	353 (4.4%)	18 (7.8%)	.0210

HLOS, hospital length of stay.

Table II
Cause of injury in all trauma patients

Cause	Non-ISI	ISI
Blunt		
Fall	2,491 (32.3%)	16 (7.0%)
Motor vehicle crash	2,902 (37.7%)	6 (2.6%)
MCC	639 (8.3%)	0 (0.0%)
Other	1,082 (14.0%)	33 (14.4%)
Pedestrian accident	191 (2.5%)	0 (0.0%)
Penetrating		
GSW	198 (2.6%)	109 (47.4%)
Stabbing	201 (2.6%)	66 (28.7%)

GSW, gunshot wound.

Examining patients with repeat records yielded stark differences between the ISI and non-ISI groups. The overall readmission rate among patients with ISI was 7.8%, significantly higher than the 4.4% in the non-ISI group ($\chi^2 = 5.33$, df = 1, $P = .0210$). Closer analysis of the repeat ISI records was performed and is summarized in Table III. Overall it was found that only 1 patient reattempted suicide; however, this patient made a total of 7 attempts during the study period. Nine patients were readmitted for late effects and complications from their initial ISI injuries. An additional 8 ISI patients returned to the hospital but for unrelated, non-ISI trauma. These 8 were not included in the ISI readmission analysis. When our analysis was repeated including only patients with penetrating mechanisms, no statistical differences in readmission rates were discovered. These results are further detailed below.

The next step in our analysis examined mortality differences in the group of 230 unique ISI patients. Patient characteristics between those ISI patients who died in-hospital versus those who survived to discharge are summarized in Table IV. Patients with ISI who died during the in-hospital period were more likely to be older, have gunshot wounds, have significantly higher median ISS of 25, have a significantly higher abbreviated injury scale head or neck (with a median score of 5), and have facial injuries. These patients who successfully committed suicide were also more likely to have been admitted to the ICU and undergo mechanical ventilation. Only 69.8% were admitted to an ICU, likely indicating death shortly after arrival or in the emergency department before admission. Patients surviving to discharge were significantly more likely to have injuries to abdomen or pelvis and were more likely to have self-inflicted stabbings. The reported disposition for patients surviving to discharge after ISI are summarized in Table V.

Table III
Repeat records of ISI patients

Patient	No. of records	Reason for admission	Inclusion
1	7	1–7 stabbing	First unique Second to Seventh repeats
2	2	1 stabbing 2 puncture wound	First unique, Second repeat
3	2	1 stabbing 2 late effects of stabbing	First unique, Second repeat
4	2	1 GSW 2 s/p GSW	First unique, Second repeat
5	2	1 stabbing 2 stabbing	First unique, Second repeat
6	2	1 GSW 2 late effects of GSW	First unique, Second repeat
7	2	1 stabbing 2 stabbing	First unique, Second repeat
8	2	1 GSW 2 late effects of GSW	First unique, Second repeat
9	2	1 fall (jump from 40-foot bridge) 2 late effects of fall	First unique, Second repeat
10	2	1 GSW 2 late effects of GSW	First unique, Second repeat

GSW, gunshot wound.

Table IV
ISI patient demographics, mechanisms, and outcomes

	ISI patients (n = 230)		*P* value
	Died in hospital	Alive at discharge	
n	43	187	
Median age	44	38	.0426
White	93.0%	86.6%	.2477
Male	81.4%	72.7%	.2406
Penetrating	83.7%	74.3%	.3838
GSW	33 (76.7%)	76 (40.6%)	<.0001
Stabbing	3 (7.0%)	63 (33.7%)	
Median ISS	25	4	<.0001
Mechanical ventilation	34 (79.1%)	60 (32.1%)	
Median vent days	1	0	<.0001
ICU admission	30 (69.8%)	68 (36.4%)	
Median ICU stay	1	0	.0125
Median HLOS	1	4	<.0001
Median abbreviated injury scale head/neck	5	0	<.0001
Facial injuries (%)	25.6%	10.7%	.0042
Chest injuries (%)	13.9%	19.2%	.2663
Abdominal/pelvic injuries (%)	2.3%	15.0%	.0142
Extremity injuries (%)	4.6%	19.2%	.0104
Median abbreviated injury scale external	0	1	<.0001

HLOS, hospital length of stay; *GSW*, gunshot wound.

Additional analysis examined the postdischarge mortality of ISI patients surviving to hospital discharge. Group demographics between deaths and survivors are summarized in Table VI. Overall, patients who died in the postdischarge period were older and more likely to have stabbed themselves. Survival analysis using Kaplan-Meier curves ≤5 years after initial admission demonstrated significantly lower postdischarge mortality in the ISI group compared with other non-ISI trauma patients at multiple time points (Fig 2). Overall, 94.1% of ISI patients remained alive at the end of the study period, compared with 88.6% of those with non-ISI trauma. Given the low median ages actuarial analysis was not performed.

Owing to the high incidence of penetrating trauma in the ISI group, a final subset analysis was performed examining only patients who were injured with penetrating mechanisms. These results are summarized in Table VII. Overall patients with ISI were significantly more likely to be older, white, and female (although a

Table V
Disposition of ISI patients who survived to discharge

	ISI, alive at discharge
n	187 (81.3%)
Returned to hospital	18 (7.8%)
Disposition	
Home	43
Returned to hospital	1
Died after discharge	2
Home health	5
Returned to hospital	1
Home with outpatient rehab	1
Inpatient rehab	115
Returned to hospital	6*
Died after discharge	6
Intermediate care facility	4
Died after discharge	2
Skilled nursing facility	3
Returned to hospital	1
Acute care hospital	4
Jail/prison	11
Returned to hospital	1
Unknown	

* One patient attempted suicide by stabbing 7 times during the analysis timeframe and was discharged to rehabilitation each time.

Table VI
Demographics and mechanisms of ISI patients at end of analysis

	ISI who survived to discharge (n = 187)		*P* value
	Died after discharge	Alive at end of study	
n	11	176	
Median age	45	38	.0237
White	9.9%	86.4%	.5526
Male	72.7%	72.7%	.6186
Penetrating	81.8%	73.9%	.7646
Stabbing	63.6%	31.8%	.0456
Median ISS	1	4	.4610
Median ventilation days	0 (72.7%)	0 (65.9%)	.4687
Median ICU stay	0 (72.7%)	0 (63.4%)	.4799
Median HLOS	5	4	.1542
Head/neck injuries (%)	18.2%	14.2%	.4036
Facial injuries (%)	9.1%	1.8%	.4363
Chest injuries (%)	9.1%	1.8%	.2239
Abdominal/pelvic injuries (%)	18.2%	14.8%	.3488
Extremity injuries (%)	27.3%	18.7%	.2070
External injuries (%)	9.1%	44.7%	.0117

HLOS, hospital length of stay.

male preponderance remained) and require ICU admission and mechanical ventilation, with a higher incidence of head and neck and facial injuries. Not unexpectedly, the ISI group also had a higher median ISS, a higher in hospital mortality, and were more likely to require rehabilitation admission if they survived to discharge. There was no statistical difference in readmission rates. As demonstrated in Fig 3, survival analysis using Kaplan-Meier curves for the penetrating trauma subgroup did not demonstrate any significant differences in postdischarge mortality up to 5 years after discharge ($P = .0706$).

Discussion

Intentional self-inflicted injury, attempted suicide, and suicide are global health problems.[3,4] In the United States in 2017 suicide remains the overall tenth leading cause of death. However, in the adolescent and young adult populations, suicide ranks second, after

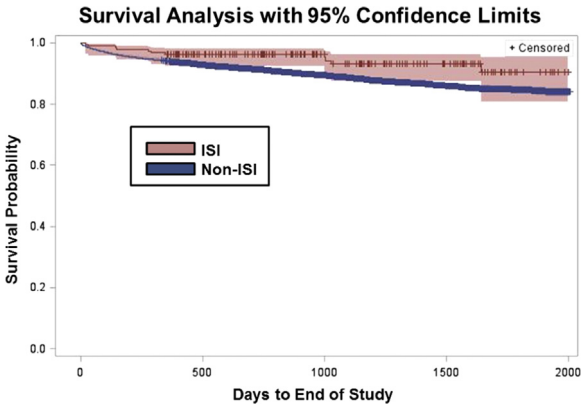

Fig 2. Five-year postdischarge survival of ISI patients versus non-ISI patients.

Table VII
Demographics, injuries, and outcomes in patients with penetrating trauma

	Non-ISI	ISI	*P* value
n	479	175	
Median age	32	41	<.0001
White	51.2%	86.3%	<.0001
Male	85.0%	74.3%	.0016
Median ISS	1	5	.0006
Mechanical ventilation (%)	12.8%	40.6%	<.0001
ICU admission (%)	18.4%	40.5%	<.0001
Median HLOS (days)	1	2	<.0001
Head and neck injuries (%)	7.9%	25.1%	<.0001
Facial injuries (%)	6.5%	14.5%	.0003
Chest injuries (%)	17.7%	16.6%	.6895
Abdomen/pelvis injuries (%)	16.1%	10.3%	.0623
Extremity injuries (%)	21.7%	15.4%	.0784
In-hospital mortality	4.0%	20.6%	<.0001
Discharge to rehabilitation	2.9%	51.4%	<.0001
Post discharge mortality	3.0%	6.5%	.0706
Readmissions	35 (7.3%)	9 (5.1%)	.3281

HLOS, hospital length of stay.

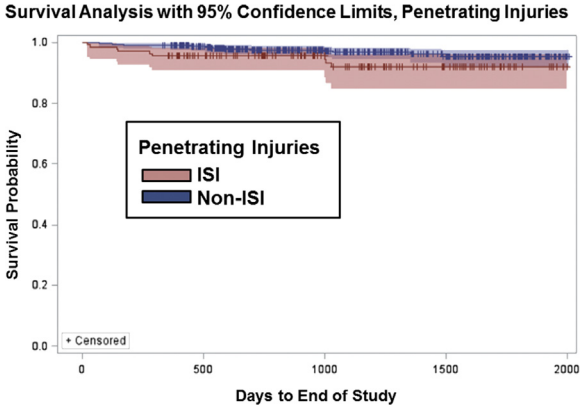

Fig 3. Five-year postdischarge survival of ISI versus non-ISI patients with penetrating injuries.

only unintentional injury.[13] In 2015, injuries sustained by ISI accounted for >575,000 US emergency department visits.[14] Estimates of the overall cost of ISI in the United States range from $11 billion to almost $100 billion dollars annually.[8,15,16]

Our trauma center is the only designated level 1 center in southwestern Virginia, with a large catchment area encompassing 35 counties and 16 incorporated cities and several counties in

southern West Virginia and northern North Carolina. Given this catchment area in the heart of the Appalachian region, with its associated higher rates of suicide, it is not surprising that ISI and suicide represents a major local issue.[10–12]

Overall, our study demonstrated that ISI is represented by 2 very distinct groups. The first, representing those with a high percentage of gunshot wounds and severe head injuries, displays a high in-hospital mortality. This group primarily represents those with self-inflicted gunshot wounds to the head with severe traumatic brain injury. Because options for postinjury medical care for this population are extremely limited, efforts to reduce the mortality of this cohort need to concentrate on primary prevention, attempting to directly reduce suicide in the general population by decreasing risk factors for suicidal behavior.[17] This is a complex task owing to the multiple predisposing factors, including biologic, psychologic, and stress-related components.[18]

The second group identified, those who survived their hospitalization for ISI, represents an interesting cohort. Although the use of penetrating trauma was also common in this group, the mechanisms differed considerably. Gunshot wounds still represented the most common mechanism, however self-inflicted stabbings were the second most common mechanism, accounting for a third of the total injuries. Overall, this group had good outcomes, and although their overall readmission rate was greater than non-ISI trauma patients, their 5-year postdischarge mortality was significantly lower. This did not seem to be due to the differences in penetrating trauma rates between the groups. In addition, we only identified one patient with multiple readmissions for ISI suggesting that postdischarge efforts at secondary suicide prevention were generally successful. In addition, examining the readmissions after ISI revealed that other than the one true ISI recidivist, all other readmissions occurred for complications related to their initial presentation or other non-ISI trauma. This underscores the need to consider both adequate treatment of the physical injuries and psychiatric rehabilitation in the management of patients with ISI.

One area that has been explored is increased integration of psychiatry with trauma surgery in the evaluation of all patients, not exclusively those with ISI. In a pilot project at another institution, psychiatrists embedded with the trauma surgery team identified preexisting psychopathology in 68% of the trauma patients evaluated and raised the overall awareness of psychopathology in this at-risk population.[19] Routine implementation of such interdisciplinary collaboration reportedly exists at some level 1 trauma centers and would only serve to improve our current collaboration, which routinely exists between trauma surgery, internal medicine, social work, and case management.

An important issue with the data coding was discovered in our efforts to quantify the postdischarge course of the ISI survivor group. When examining the discharge disposition present in our trauma database during the study period, we discovered that no mechanism existed to distinguish patients discharged to inpatient psychiatric facilities for further treatment of acute suicidality, major depression, or other psychiatric illness contributing to the ISI. Examining the National Trauma Data Standard used to provide guidance for data collection revealed that discharge to a psychiatric facility was not independently coded until the 2014 update.[20] Before this, discharges to an inpatient psychiatric setting were coded together with patients discharged to an inpatient rehabilitation facility. Because our study period occurred before this change and our dataset was deidentified after the merge with the National Death Index, we were unable to quantify the number of patients receiving inpatient versus outpatient psychiatric services after discharge. As such we cannot exactly quantify efforts at secondary prevention which occurred after ISI injury discharge. This is an area in which future study is planned.

This study is not without other limitations. First and foremost, it is a retrospective review of a prospectively collected trauma database. Because an inherent inaccuracy rate is common in any large administrative database, our conclusions might be effected to some degree.[21,22] Furthermore, mortality data from the National Death Index is based on cause of death determination as reported on the death certificate. Given the well-documented issues, which exist with cause of death reporting on death certificates, it is impossible to establish causation between the postdischarge deaths and the ISI.[23,24] Moreover, our ISI data does not include suicide decedents who do not survive to hospital evaluation, or milder forms of ISI that may not require trauma service evaluation or admission. This may lead an underestimation of ISI recidivism. In the future we plan to investigate this further using an identified dataset allowing chart review though our electronic medical record of other emergency department and other outpatient encounters.

In conclusion, trauma patients who present with ISI demonstrate 2 distinct patterns: one with high in-hospital mortality, the other with low postdischarge mortality. The high in-hospital mortality likely relates to the high lethality mechanisms used, whereas the low postdischarge mortality could relate to patients receiving appropriate treatment and follow-up for underlying psychiatric issues. Even with the low postdischarge mortality, the ISI readmission rate is significantly higher than other trauma patients. It is well documented that ISI is a significant risk factor for future suicide attempts.[3] Our data indicate that ISI trauma is another risk factor for readmission. Additional study of this at-risk population is clearly needed. One important implication of these early results, however, is that trauma surgeons should guard themselves against cynicism when caring for ISI patients because these men and women may have better postdischarge mortality than is commonly thought.

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Conflict of interest/Disclosure

The authors report no conflicts of interest relating to this project.

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Discussion

Dr Dave Lal (Milwaukee, WI): I would first like to thank the Association for accepting me as a new member and allowing me the privilege of discussing this well-presented and informative study.

ISI, or intentional self-injury, is an important topic that needs to be addressed from a public health perspective. The rates of ISI continue to increase to epidemic levels in this country. This paper provides information on mechanism of injury, lethality, and long-term sequela of ISI. Hopefully, researchers can use this information to devise programs, laws, and direct resources to address this vexing problem.

I have several questions:

1. What public health efforts should be implemented to decrease the rate and high mortality associated with ISI in your community?
2. Not surprisingly, the mechanism for injury is uniquely different between non-ISI patients and ISI patients. Firearms made the largest percentage of those with intentional self-injuries. With that in mind, is there opportunity for efforts to address gun violence in your community? For example, would gun laws or gun waiting periods on gun purchases or keeping mentally ill individuals from getting firearms maybe result in decrease in the lethality here? Also, what mental health programs or initiatives could be devised to address this epidemic?
3. You showed that despite a lower ISS in the ISI group, the in-hospital mortality was significantly higher. This is probably due to the high mortality of gunshot wounds to the head. Are there other mechanisms that can explain this? With knowing this information, are there any efforts we can make as health care providers to decrease the in-hospital mortality?
4. Why do you think the ISI patients have nearly double the rate of readmissions after discharge? As most of the readmissions are not due to recidivism, but actually injury from the index injury, are there efforts or services that can be implemented to reduce the readmission rates? You talked about being discharged to a rehabilitation center, but could medical homes, nurse managers, or more social workers help?
5. Lastly, it is counterintuitive, but ISI patients alive at discharge had a lower post-discharge mortality as compared to the non-ISI cohort. Can you postulate an explanation for this finding?

Dr Katherine Howe: Thank you. Your first question touched on public health interventions. Certainly, suicide is a very broad-based problem. The CDC recommends primary prevention, focusing on all those socioeconomic factors that predispose folks to suicide. Unfortunately, that is very broad based as well.

One area that has been focused on in the past is access to lethal means, which I believe segues into your next question, which is what role do we have in terms of influencing gun legislation? Obviously, if you start looking into studies focusing on gun legislation, you can find a study to support whichever persuasion you favor. The problem, of course, is that it is difficult to prove causality when it comes to studying gun legislation and gunshot wounds.

Studies on specific legislation, such as waiting periods, background checks, and restrictions on the number of guns you are able to purchase in a 30-day period, have shown mixed results. Virginia has fairly lax gun laws when it comes to those specific areas. There was a renewed interest in restricting access to guns after the Virginia Tech massacre, which took place in neighboring Blacksburg. Our hospital treated the victims of the Virginia Tech massacre. There was also a renewed interest in restricting access after one of our state senator's sons stabbed him 13 times and then killed himself with a rifle.

After incidences like this in our community, there is always a big impetus to increase gun legislation. However, one area I would focus on is the availability of mental health beds, which is a big problem in rural communities and something that our hospital is aiming to improve. While this does not change access to lethal means, it can provide a safe place for folks with mental health diagnoses and ideally prevent them from committing an act of suicide.

You also mentioned that there is very high inpatient mortality and what we might actually do to affect that. Unfortunately, as I mentioned, there are a lot of gunshot wounds to the head. By the time they make it to the hospital, that's a tough population to help. So, I think our resources are better spent on prevention when it comes to that mechanism. That includes, as I previously mentioned, access to lethal means. Of course, that is sort of a hot topic.

One additional thing I wanted to touch on: you asked about readmissions. Sometimes we find that people end up back in the hospital for something that seems sort of trivial, like a drain

problem or a wound care problem. I would like to see better cross-training of psychiatric nurses so that if someone goes to a psychiatric facility postdischarge, the nurses taking care of them in the psychiatric facility are better equipped to attend to their post-surgical needs.

Dr Brian Harbrecht (Louisville, KY): Thank you. ISI covers a lot of territory. You had a very nice presentation, and suicide is certainly getting additional resources and additional emphasis. You also had a fairly substantial population of folks who had extremity injuries and ISI, if I remember correctly, includes things like ingested foreign bodies and self-mutilation. Did any of those patients make it into your study? How does one, from a technical database standpoint, try to determine how to focus on suicide when there's a lot of noise about self-mutilation and other forms of nonlethal attempts at self-injury included under the ISI diagnostic code?

Dr Katherine Howe: Thank you. Since we were using the ICD-9 E codes, all of that is included in our data, as long as it got a trauma evaluation. If it didn't get a trauma evaluation, then it wasn't included. It would be impossible prior to the ICD-10 to exclude the noise of nonsuicidal self-inflicted injury. Studies done using coding after the implementation of ICD-10 would allow us to differentiate between suicidal and nonsuicidal ISI.