



# Violence Prevention Programs Are Effective When Initiated During the Initial Workup of Patients in an Urban Level I Trauma Center

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## Abstract

This study represents the first attempt at evaluating the ability of the CureViolence Hospital-Response Intervention Program (previously CeaseFire) to disrupt the pattern of violent reinjury. The clinical data points of 300 African American men who presented to our trauma center with a gunshot wound and received intervention at the bedside between 2005 and 2007 (with a 48-month follow-up) were collected. This cohort was matched with a post hoc historical control group using hospital records from 2003 to 2005. The mean age for both groups was 23.9 years. Odds ratios and 95% confidence intervals were obtained. Using a binary logistical regression model, we assessed the performance of three variables of interest: age at the time of the initial injury, treatment group, and initial disposition group to predict recidivism. We utilized the Nagelkerke *R* square method, which described the proportion of the variance of the reinjury rate and validated our findings using the Hosmer–Lemeshow test (for goodness-of-fit). Six percent ( $n = 18$ ) of subjects in the treatment group and 11% ( $n = 33$ ) in the control group returned with a new injury, yielding a total reinjury rate of 8.5%. Most patients returned only once with another violent injury. Individuals who did not receive CureViolence services were nearly twice as likely (odds ratio = 1.94; 95% confidence interval = 1.065, 3.522) to return with a violent reinjury. This finding suggests that Hospital-Response Intervention Programs (HRIP) have a protective effect in violently injured patients. We therefore conclude our HRIP positively affected at-risk patients and prevented violent reinjury.

## Keywords

penetrating injury, behavior changes, counseling, safe community, violence, attitudes

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## Introduction

Injury sustained as a result of acts of violence is currently a public health epidemic in the United States, especially among young men. On a national scale, homicide is the leading cause of death for African American men aged 15 to 24 (Heron, 2011). In Chicago, homicide accounts for nearly 43% of deaths for all male residents between the ages of 15 and 34 (Harper-Jemison et al., 2009).

The public health cost of violence warrants significant attention. Deadly violence disproportionately affects

individuals with lower socio-economic backgrounds, but society at large incurs the costs through higher taxes, reduced property values, and limiting of choices for places to live, work, and visit (Cook & Ludwig, 2002). The estimated cost of medical expenditures and productivity losses for violent deaths in the United States in 2020 was \$483.9 billion (up from \$47 billion in 2005). The average total cost for a fatality due to interpersonal violence in 2020 has been estimated at 10.7 million (notably increased from \$922,073 in 2012) (Centers for Disease Control and Prevention [CDC], 2012, 2022).



Numerous studies have examined chronic recurrent violent injury, yielding incongruent findings (Buss & Abdu, 1995; Cooper et al., 2006; Fein et al., 2002; LISC MetroEdge, 2012; Madden et al., 1997; Morrissey et al., 1991). Analyzing all patients presenting to an urban emergency department (ED), Madden et al. (1997) concluded that “the best predictor of future injury was having been injured once (p. 774).” Although risk factors that presage violent injury recidivism are not well understood, recidivism risk factors have been identified, including being an African American man, being unemployed, being between 18 and 25 years old (Alghnam et al., 2016), being uninsured, use of alcohol and other illicit substances, possession of a weapon, a history of or current drug dealing, a history of fighting and having had previous intentional violent injury (Chamberlin, 2011; Cheng et al., 2003; Cooper et al., 2000; Madden et al., 1997; McVey et al., 2014; Rich & Grey, 2005; Smith et al., 1992; Webster et al., 2013; Wittebrood & Nieuwbeerta, 2000). In fact, the stress response involved in sustaining a violent firearm injury is both a risk factor for additional violence *per se*, and a useful focus for intervention (CDC, 2020).

It is important to emphasize that race *per se* is not a risk factor for injury, but rather a proxy for risk to exposure to racism and structural inequity. It is a social construct, not a biological one (Gannon, 2016). In addition to the above, prior convictions and incarcerations have been identified in recent literature (Richardson et al., 2016) as additional risk factors for recidivism (however, please see Methods section).

The CureViolence (previously known as CeaseFire) intervention focuses on violently injured patients and their visitors. Operating in Chicago's communities that are most affected by the health impact of violent behavior, CureViolence targets those injury predictors listed above (e.g., being an African American man) and utilizes culturally appropriate (i.e., credible) messengers known as violence interrupters to interact with both injured high-risk individuals (HRIs) and their families at the hospital immediately after a violent event. CureViolence aims to stop the spread of violence by using the methods and strategies associated with disease control: detecting and interrupting conflicts, identifying who can be classified

as an HRI, and subsequently addressing social norms (Cease Fire, 2022). When a person arrives at the ED with a violent injury, our on-call chaplains notify the CureViolence Hospital Response Team, which then proceeds to the hospital where they evaluate and consent patients at the bedside. The injured individuals, as well as any friends and family members on site, receive intervention and services from CureViolence Hospital Responders, including bedside visits throughout their hospital stay and follow-up home visits by a trained caseworker-interrupter. The initial intervention targets complex cognitive process adjustments, supported by the efforts of our interrupters who employ culturally appropriate inducers to achieve a moment of self-realization—what we call “the teachable moment.”

The interrupters utilize empathetic strategies such as similar backgrounds (our interrupters are well-known rehabilitated offenders within gang-related environments), similar community ties (our interrupters have emerged from the same zip codes as the current offender and victims of violence we treat), and aided by cultural identities (e.g., race and sex). The interrupters receive training in trauma-informed care, crisis intervention, and de-escalation; in addition, their life stories mimic those of our offenders up to that point (i.e., engaging in gang-related or drug-trade related activity and sustaining life-threatening injuries) to offer a living example of conflict resolution, different life choices and the long-term consequences of traumatic injuries sustained. The interrupters make themselves accessible to their clients, even after-hours, and actively monitor them. Our final aim is to interrupt the transmission of the behaviors endorsing violence, promote healthy alternatives, and ultimately reduce shootings and homicides across target regions and demographics. As such, the methodology is tailored to the individual patient-offender and left to the individual interrupter's judgment of the specific situation.

In 2005, then-CeaseFire and our Level I trauma center launched a partnership to intervene with patients and HRIs presenting to our ED with an intentional violent injury. Designed as a brief in-hospital intervention (with the intention to follow up when back in the community), the primary goals of the partnership (now termed CureViolence) are to reduce violent injury, prevent retaliatory violence, and

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decrease attitudes and perceptions that endorse violent behavior. The initial hospital intervention includes obtaining pertinent background information, identifying high-risk individuals, engaging family members, and arranging follow-up services. These follow-up services involve home visits, identifying the need for social services, and conflict resolution. The aim of these services is to interrupt the transmission of the social norms and individual behaviors that endorse violence as well as to promote healthy alternatives and ultimately reduce shootings and homicides across target areas. The neighborhood of West Garfield in Chicago saw a 67% reduction in shootings in its first year after the initiation of then-CeaseFire and neighborhoods in New Orleans as well as Baltimore saw a similar trend in the reduction of violent penetrating trauma (Chamberlin, 2011; McVey et al., 2014; Webster et al., 2013). There has been reports, however, indicating mixed results with those approaches (Butts et al., 2015).

Recognizing this opportunity for a potentially powerful and effective intervention, our hospital and CureViolence forged a partnership to serve HRIs presenting with violent injuries.

The objectives of this study are threefold:

1. This study aims to contribute information on overall recidivism rates for violent injury to a growing body of literature.
2. This study represents the first attempt at evaluating the ability of the CureViolence community-based in-hospital intervention (and community-based follow-up) to disrupt the pattern of violent reinjury.
3. This study serves as a resource for scholars and violence prevention practitioners interested in conducting similar research.

## Materials and Methods

### Study Population and Sample Size

This research was planned as a hospital-based matched case-control study (with a prospective treatment cohort matched to a historical control group), conducted at Advocate Christ Medical Center, a Level I trauma hospital (at the time, the busiest in the state) located in region 7, but with an extended catchment area encompassing all zip codes south of the I-55 (Chicago's southside region 11) at the time of the study. Institutional Review Board (IRB) approval was obtained prior to any patient recruitment (AHC IRB#: 3252). To calculate the sample size, we consulted the English biomedical literature on the subject available at the time, which estimates the recidivism rate of urban victims of firearm violence at around one third of the patients (Buss & Abdu, 1995; Keough et al., 2001). Using 33% as the exposure rates for the

control group, we considered a minimum odds ratio to be approximately 2.0 (with an alpha risk at 5% and power at 80%), limiting the probability of discordant pairs to 50%. Using our own historical rate of follow up attrition of around 8% per year, we arrived at a sample size of 300 patients per group. For the manuscript submission, we revalidated the recidivism assumptions made (Morrissey et al., 2016; Richardson et al., 2016).

The treatment group, therefore, consisted of 300 African American men who presented to the ED at Advocate Christ Medical Center with a gunshot wound and received CureViolence hospital intervention at the bedside between 2005 and 2007. Exclusion criteria included self-reported race as non-African American, female, and sustaining non-gunshot wound injuries. Written informed consent was obtained from every patient prior to enrollment into the prospective case cohort. The same inclusion criteria were then used in establishing a post hoc control group of 300 patients who did not receive intervention for comparison using hospital records from 2003 to 2005 (i.e., before the program existed). Each treatment case was then matched (1:1) with a control case based on age ( $\pm 3$  years), injury zip code, and bodily injury location.

### Data Collection

Hospital Responders link patients to CureViolence sites based in their own community for further resources and support. Responders work to connect with individuals involved and provide referrals to community resources on a case-by-case basis. The relationship between responders and these patients is close, and they sometimes attend appointments with the patients. The pre-discharge assessments are used as a guide to the referrals, and the newly created CureViolence Database is used to track engagement. Resources may include, but are not limited to, educational opportunities, job training and placement, substance abuse programs, crime victim compensation, and mental health services (Chamberlin, 2011).

Variables of interest included age at time of admission, date and type of violent reinjury, injury zip code, and disposition data for each of the subjects. Injury zip code refers to the zip code where the patient was shot. Disposition was treated as a grouping variable with three possible levels: Admission without Surgery (i.e., Admission), Admission with Surgery (i.e., Operating Room), and Discharge. The criminal record of specific individuals (including previous convictions in Cook County or elsewhere) was unfortunately not available to treating clinicians during this study. Requesting this information to the Chicago Police Department involves a need-to-know for non-law-enforcement parties and such requests are seldom granted. Therefore, while we agree with the value of said markers

(please see above), they were unattainable for the completion of this study.

### Statistical Analysis

Demographics and other variables were collected and imputed into an Excel database (Microsoft, Redmond, WA). Mean and modes were used to analyze continuous variables and percentages for categorical variables. Categorical variables were compared using the  $\chi^2$  test. The odds ratios (ORs) and 95% confidence intervals (CIs) were obtained, and using a binary logistical regression model, we assessed the performance of three variables of interest: age at the time of the initial injury, treatment group, and initial disposition group (based on predictors on reinjury risk gathered from the preceding literature review) to predict our outcome of interest (i.e., recidivism) using the Nagelkerke *R* square method (which described the proportion of the variance of the reinjury rate attributed by the model). We validated our findings using the Hosmer–Lemeshow test (for goodness-of-fit).

All statistical calculations were carried out using SPSS version 2.0 (Chicago, IL). Values of  $p < .05$  were considered a statistically significant difference. The null hypothesis was that adherence to CureViolence inpatient and outpatient interventions will produce no difference in recidivism when compared with the historic control group that received no CureViolence interventions; this was defined before initiating patient recruitment. This article was prepared to conform with the STROBE checklist for case–control studies (von Elm et al., 2008).

### Results

The treatment group completed its target enrollment of 300 patients. The mean age of the treatment group was 23.88 years. Close to 95% of patients in the treatment group (284 individuals) had gunshot-inflicted injuries within zip codes inside Chicago city limits. Nearly 70% of treatment patients (209 individuals) were shot in just five Chicago zip codes. The communities associated with the five zip codes are primarily low-income and African American. These areas also have low educational attainment, high shooting incidents, and high homicide rates. The mean age of the non-treatment group was 23.95 years. Like the treatment group, 96% of non-treatment patients (288 victims) were shot in zip codes within city limits and 66% (199 patients) were shot in the same five Chicago zip codes. With respect to hospital disposition codes, 11 more cases were coded as operating room in the non-treatment group compared with the treatment group. Ten more cases were coded as admission in the treatment group compared with the non-treatment group. None of these differences were statistically significant (Table 1).

**Table 1.** Disposition Codes of Treatment and Non-Treatment Groups.

Disposition	Disposition of cases		
	Treatment	Non-treatment	Total
Admission	143 (47.7%)	132 (44%)	275 (45.8%)
Discharged	95 (31.7%)	95 (31.7%)	190 (31.7%)
Operating room	62 (20.7%)	73 (24.3%)	135 (22.5)
Total	300	300	600

Note. The groups are comparable in all variables:  $\chi^2(2, N = 300) = 1.34, p = .51$ .

Only subjects who reported to our trauma center with an actual violent injury more than once (distinct from those following up for the initial gunshot wound) were considered repeat patients. In total, 6% ( $n = 18$ ) of subjects in the CureViolence treatment group and 11% ( $n = 33$ ) of subjects in the non-intervention group suffered recurrent injury, yielding a total recidivism rate of 8.5% (Table 2).

We examined the type of repeat violent injury across both groups (Table 3). The non-treatment group had just over twice as many visits for reoccurring violent injury compared with the treatment group. Gunshot wounds were the dominant type of repeat injury among both treatment and non-treatment groups. The term “Assault” refers to physical aggression with blunt weapons (i.e., fists, baseball bats, wrenches, etc.) that engender non-penetrating trauma. The number of assaults between groups is notably similar, and the percentage of the repeated violence identified between groups (22% vs. 9.1%) is explained by the actual number of repeated violent injury being nearly doubled in the non-treatment group compared with the treatment group. The notably discrepancy in actual cases of repeated violent injury is mostly due to the non-treatment group having more than double the number of gunshot wounds (GSWs)—the most commonly used means of exercising violence among the studied groups and the main subject of the intervention.

Demographic information and case characteristics were collected for all repeat patients (Table 4). Overall, most individuals returned to our trauma center only one time with another violent injury, although the non-treatment group had a slightly higher mean total number of repeat visits than the treatment group (2.18 and 2.06, respectively). The non-treatment repeat patients were slightly younger in age at both time of first ( $M = 21.97$ ) and second injury ( $M = 23.91$ ) compared with the treatment group ( $M = 23.5$  and  $M = 25.33$ , respectively). Descriptive statistics showed the somewhat younger age distribution of the recidivists ( $M = 22.51$ , Mode = 21.00) compared with non-recidivists ( $M = 24.02$ , Mode = 23.00).



**Table 2.** Recidivism Rates Across Groups.

Outcome	Recidivism rates across groups		
	Treatment	Non-treatment	Total
Returned with a violent injury	18 (6%)	33 (11%)	51 (8.5%)
Did not return with a violent injury	282 (94%)	267 (89%)	549 (91.5%)
Total	300 (100%)	300 (100%)	300 (100%)

Note. The difference is statistically significant:  $\chi^2(1, N = 300) = 4.82, p = .028$ .

**Table 3.** Type of Repeat Violent Injury Across Groups.

Type of repeat violent injury	Treatment	Non-treatment	Total
Gunshot wound	13 (72.2%)	27 (82%)	40 (78.4%)
Assault	4 (22%)	3 (9.1%)	7 (13.7%)
Stab wound	1 (5.6%)	3 (9.1%)	4 (7.84%)
Total	18 (100%)	33 (100%)	51 (100%)

Note. The differences are not statistically significant:  $\chi^2(2, N = 51) = 1.79, p = .41$ .

**Table 4.** Characteristics of Repeat Patients.

Data Points calculated	Treatment group	Non-treatment group	All repeat patients
Total no. of hospital visits (including initial visit) for violent trauma	37 (34.3%)	71 (65.7%)	108
Mean total no. of hospital visits for violent trauma	2.06	2.18	2.14
Mean age at initial injury	23.5	21.97	22.51
Mean age at second injury	25.33	23.91	24.41
Mean years between first and second injury	1.83	1.94	3.9
% injured in same zip code at second injury	9 (50.0%)	16 (48.5%)	25 (49%)
% died as a result of repeat violent injury	1 (5.5%)	3 (9.0%)	4 (7.8%)

The mean amount of time elapsed between first and second trauma visit was 1.94 years. Approximately half of repeat injuries occurred in the same zip code as the initial injury. Just as 68% of the entire sample was first shot in five Chicago zip codes, 69% of repeat patients were shot in these same five zip codes. In the evaluation period of 48 months, three individuals in the non-intervention group and one individual in the intervention group died as a result of their reinjury.

Based on the above, our findings suggest that Cure Violence had a protective effect for violently-injured patients who engaged CureViolence services while in the hospital. Individuals who did *not* receive CureViolence services were nearly twice as likely as the treatment group to return to our trauma center with a violent reinjury (OR = 1.94; 95% CI = 1.065, 3.522). There was a significant association between whether an individual received CureViolence services and whether the individual returned to us with a recurrent violent injury  $\chi^2(1) = 4.822, p < .05$ .

We performed a binary logistic regression model to determine whether initial age, treatment group, and initial disposition group could predict recidivism. Although the

overall model was significant (Nagelkerke  $R^2 = 0.031$ ), the only significant predictor in the model was treatment group; ( $B = 0.670, p = .029$ ). There appears to be no combined effect of additional predictors, Hosmer–Lemeshow  $\chi^2(8) = 4.122, p = .846$ . Based on this, we are able to reject the null hypothesis.

## Discussion

Brief interventions, particularly the teachable moment model—or as Cooper describes it, the golden hour of opportunity—have demonstrated success intervening with trauma patients in EDs (Cooper et al., 2006). Recent literature pertaining Hospital-Based Violence Intervention Programs (HVIPs) offers additional support to the idea of using a “credible messenger” to engage the patient upon arrival and direct them toward a teachable moment (Richardson et al., 2016; Wical et al., 2020). The teachable moment is thus defined as a negative event that motivates patients to re-evaluate the causes and meaning of the event itself and consider risk-reducing behaviors. Furthermore, the “teachable moment” encompasses the

interaction between the interrupters and the victims of violence—a public, yet intimate moment in which the interrupter and the victim engage in a relationship that is based on respect and cultural sensitivity while remaining within the confines of our health care institution policies. As our interrupters will describe it, there are a few instances when the interruption culminates in that “eureka” moment. Most of the time, however, it is more akin to a process that builds on a relationship based in honesty and perceived empathy. In essence, a teachable moment increases patient receptivity to behavior change interventions. CeaseFire (now known as CureViolence) is not a HVIP, but rather a community-based intervention (that happens to initiate during the first hospital stay). CureViolence is particularly unique in that the interrupters are members of the community (and not trained health care personnel) and the majority of the interventions occur in the community where the victim of violence lives, fostering relationships with the individuals and organizations he or she is already most likely to interact with on a daily basis.

It is well known that the face of the intentionally violently injured is predominantly young urban African American men (Becker et al., 2004; Heron, 2011; Rich, 2009; Richardson et al., 2016; Wical et al., 2020). Compared with their White counterparts, almost 20 times as many African American men ages 15 to 24 died as a result of homicide in Chicago in 2006 (Harper-Jemison et al., 2009). Our patients came from the most violent zip codes in the south side of Chicago, and their violent encounters with law enforcement or with rival gangs were related to initiation rituals, territorial disputes, or the drug trade. About 61.8% of gunshot wound patients presenting at our trauma center were between the ages of 16 and 25 ( $M = 20.23$ ) at the time of their first injury, providing further evidence of the epidemic of urban youth violence.

In addition, findings related to injury zip code have implications for the occurrence and concentration of violent injury. Seventy percent of both the initial patient sample and the repeat patient sample were injured in just five zip codes. Roughly half of repeat injuries happened in the same zip code as the initial injury, illustrating the spatial concentration of violence and victimization (Becker et al., 2004). In our sample, most initial violent injuries took place in marginalized communities stricken by poverty and violence; perhaps not surprisingly, the majority of repeat trauma visits resulted from injuries sustained in the exact same communities. CureViolence has interrupters and programs established within all those zip codes, which facilitates follow-up and helps interrupters maintain their credibility (which is something that is earned and can be lost) without undue confusion regarding their roles.

This study contributes to a growing body of violent injury recidivism research. Of the 600 patients tracked, 8.5% returned to our trauma center with a recurrent violent injury within 48 months of the initial gunshot wound. While these findings are not nearly as high as other trauma recidivism studies identifying recidivism rates between 30% and 45% (Buss & Abdu, 1995; Fein et al., 2002; LISC MetroEdge, 2012; Morrissey et al., 1991; Sims et al., 1989), these findings are still meaningful given that, in Chicago, violently injured patients can seek medical help at six other trauma centers besides our own. Moreover, this study did not intend to estimate a general incidence of repeat violent injury rate, but rather a repeat violent injury rate among those patients seen by CureViolence between 2005 and 2007.

Finally, the findings of this study demonstrate a statistically significant association between CureViolence services to violently injured patients at the hospital bedside and a reduced likelihood of violent injury recidivism. This study provides support for our hypothesis that CureViolence intervention patients are less likely to return with a repeat intentional injury than nonintervention patients within 48 months of the initial injury. The disposition data were used to analyze participants based on the clinical-based assumption that immediate discharge from the ED (without a hospital stay) implied a less severe injury (which is useful since Injury Severity scores were not added to the database), and the need for surgery implied a more severe injury (which would increase the stress response and the disability period following the traumatic event). These aforementioned variables are potential confounders (CDC, 2020) to the direct variable under study (i.e., the intervention).

Based on the odds ratio, our results suggest that the CureViolence program had a protective effect for violently injured patients who received CureViolence services within the hospital. Individuals who did not receive these services were nearly twice as likely as the treatment group ( $OR = 1.94$ ;  $95\% CI = 1.065, 3.522$ ) to return to us with a violent reinjury within 48 months. These results are similar to those achieved by other violence intervention programs citing a reduction in hospital readmissions due to violent injury for treatment groups (Cooper et al., 2000; Webster et al., 2013).

While the findings are indicative of a positive effect, there are several limitations to our research. Numerous factors hinder our ability to accurately estimate the repeat injury rate. First, Chicago is served by six Level I adult trauma centers and numerous community hospitals. It is possible that reinjured patients reported to another hospital, a different source of medical care, or did not seek medical attention at all. Human migration may further inhibit accurate counting of repeat visits. The data itself present potential limitations, as the data were gathered only at the

referral trauma center, therefore detailed information on transfer patients is scarce. Furthermore, our conclusions about geographic concentration of traumatic injuries are based solely on the injury zip codes—There are nearly 60 different zip codes in Chicago that stretch as far south as Riverdale (60827) all the way up to Rogers Park (60626) on the city's north side. Because zip codes cover a large region, a more fine-grained geospatial analysis, perhaps at the census tract level (of which Chicago has 866), could provide further insight. Chicago's census tracts have well known boundaries, with little change over the past few decades and providing a more uniform population size that averages 4,000 individuals. The Injury Severity Score (ISS) calculations were not added to the analysis of the two populations for simplicity and because we did not believe it will influence the quality of the intervention, which could be not the case. Finally, Chicago's shooting and homicide rate experienced a decline between 2002 and 2010; therefore, a decrease in the number of repeat trauma visits during the study period may be a byproduct of a greater historical trend.

Additional limitations to our result are the lack of a unified database for mining the specific interventions provided in the community to the HRIs as well as the actual adherence rate to the program. While other studies have reported that violence intervention specialists play a critical role in the relationship between the program participant and the criminal justice system (in itself a predictor of recidivism, as we reviewed before), the lack of a unified database prevents us from assessing this component of the CureViolence system. Ultimately, this is the most severe limitation to our study. Without this information being captured in a way that allow for independent review, it is not possible to determine which intervention most significantly contributes to the observed results, nor can we completely elucidate the mechanisms at play, which is the subject of targeted future implementation and research.

## Conclusion

The CureViolence hospital response component is a feasible and easily implemented intervention for the prevention of recurrent injury caused by acts of violence among exposed populations, such as the communities studied in the south side of Chicago. Compared with no intervention, participation in the hospital component of CureViolence is effective in reducing the likelihood of violent injury recidivism in a statistically and clinically significant fashion. Program implementation could result in significant savings in health care and societal costs via reinjury rate reduction. Additional value could be obtained by utilizing a more cooperative approach and by data sharing (i.e., a unified database)—an investment in resources and staff that appears wholly justified. The

CureViolence hospital-response program constitutes a valuable preventive medicine adjunct to the clinical practice of trauma surgery.

## Authors' Note

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