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What Is the Effect of COVID-19-Related Social Distancing on Oral and Maxillofacial Trauma?



David C. Ludwig, DDS, MD,* J. Luke Nelson, BS,† Andrea B. Burke, DMD, MD,‡
Melanie S. Lang, DDS, MD,§ and Jasjit K. Dillon, DDS, MBBS||

Purpose: The purpose of this study was to understand the impact of social distancing policies enacted during the COVID-19 pandemic on the epidemiology of oral and maxillofacial fractures at an urban, Level I trauma center in the United States.

Materials and Methods: The investigators designed a retrospective cohort study and enrolled a sample of 883 subjects who presented for evaluation of oral and maxillofacial fractures (OMF) between March 1 and June 30 in the years 2018 through 2020. The primary predictor variable was the evaluation of OMF during a period with social distancing policies (2020 – experimental group) or without social distancing policies in place (2018 or 2019 – control group). The primary outcome variables were the facial fracture diagnosis, the abbreviated injury scale (AIS), injury severity score (ISS), and the mechanism of injury. Appropriate univariate and bivariate statistics were computed, and the level of significance was set at $P < .05$ for all tests.

Results: The number of subjects presenting with OMF was lower during the period of social distancing ($n = 235$ in 2020) than during the periods without (2018: $n = 330$; 2019: $n = 318$). During the period of social distancing, there were more individuals who presented secondary to assault, whereas fewer individuals presented secondary to falls ($P = .05$). On average, those who presented in 2020 had more severe oral and maxillofacial injuries (mean AIS = 3.2 ± 1.2 in 2020 vs 3.0 ± 1.1 in 2019 and 3.0 ± 1.1 in 2018. $P = .03$) and more overall injuries (mean ISS = 20.7 ± 13.1 in 2020 vs 19.2 ± 12.5 in 2019; 17.8 ± 12.8 in 2018. $P = .03$).

Conclusions: The investigators found that during the period of social distancing through the COVID-19 pandemic, the number of OMF cases decreased but that the severity of oral and maxillofacial and overall injuries was higher.

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J Oral Maxillofac Surg 79:1091-1097, 2021

*Resident, Department of Oral and Maxillofacial Surgery, University of Washington, Seattle, WA.

†Dental Student, School of Dentistry, University of Washington, Seattle, WA.

‡Assistant Professor, Department of Oral and Maxillofacial Surgery, University of Washington, Harborview Medical Center, Seattle, WA.

§Clinical Associate Professor, Department of Oral and Maxillofacial Surgery, University of Washington, Harborview Medical Center, Seattle, WA.

||Clinical Associate Professor, Program Director, Chief of Oral and Maxillofacial Surgery, Department of Oral and Maxillofacial Surgery, University of Washington, Harborview Medical Center, Seattle, WA.

Funding: This project was supported in part by the Laboratory of Applied Clinical Research and Research and Training Fund of the Department of Oral and Maxillofacial Surgery, University of Washington School of Dentistry.

Conflict of Interest Disclosures: Dr. Burke is the recipient of an Oral and Maxillofacial Surgery Foundation Grant. Dr. Dillon is the recipient of an Oral and Maxillofacial Surgery Foundation Grant and an Osteoscience Foundation, Philadelphia, Pennsylvania Grant. There are no conflicts of interest in this study.

Address correspondence and reprint requests to Dr Dillon: Department of Oral and Maxillofacial Surgery, University of Washington, 325 Ninth Avenue, Box 359893, Seattle, WA 98104; e-mail: dillonj5@uw.edu

Received November 12 2020

Accepted December 3 2020

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0278-2391/20/31443-9

<https://doi.org/10.1016/j.joms.2020.12.006>

Oral and maxillofacial fractures (OMF) are a significant cause of morbidity for individuals in the United States and around the world.¹ Each year, over 400,000 emergency department visits involve a facial fracture in the United States, contributing to the significant use of healthcare resources.^{2,3} While the cause of facial trauma varies by geographical region, globally, falls are the most common cause, with assault, motor vehicle collision, bicycle collision, and sports-related injuries being the other common causes.^{1,2,4}

In general, individuals with facial fractures are initially evaluated by providers in an emergency or urgent care facility. However, given that facial fractures often occur in the setting of multisystem trauma, trauma centers often see a larger number of individuals with these injuries.^{5,6}

Social distancing is a community mitigation measure, or nonpharmaceutical intervention, used to mitigate the burden and spread of an infectious disease.^{7,8} Social distancing has been discussed previously in the literature as it relates to the reduction of respiratory virus transmission, and most recently, as part of the worldwide response to the SARS-CoV-2 (COVID-19) pandemic.^{7,9}

Community mitigation measures differ by geographic region and can be enacted at the town/city, county, state/province, or national level. During the COVID-19 pandemic, the State of Washington enacted a series of policies aimed at reducing the community transmission of the novel coronavirus. These policies included the closure of educational facilities (3/13/2020), a stay-at-home order (3/23/2020), and the closure of nonessential services (3/25/2020).¹⁰ Apart from mitigating the rapid and widespread transmission of this disease, it is unclear how changes in behavior related to these policies affect the incidence and etiology of facial fractures.

The purpose of this study was to understand the impact of social distancing policies enacted during the COVID-19 pandemic on the epidemiology of facial fractures. The authors hypothesized that the number of facial fracture cases, in general, would decrease as the result of social distancing policies during the COVID-19 pandemic. The authors also hypothesized that the mean severity of injury would increase, and the etiologic distribution of injuries would change, based on the senior author's observations during this period. The specific aims were to 1) measure and compare the frequency of facial fractures sustained by individuals who presented during a period with social distancing policies in place vs those without; 2) estimate and compare the severity of facial fractures between the 2 groups; and 3) estimate and compare the etiology of facial fractures between the 2 groups.

Methods

STUDY DESIGN AND SAMPLE

To address the research questions, we designed and implemented a retrospective cohort study. The study sample was composed of patients who presented to Harborview Medical Center (HMC) in Seattle, Washington for the evaluation and management of injuries and had been enrolled in the institutional trauma registry.

The inclusion criteria were: 1) patients who presented between March 1 and June 30 in the years 2018, 2019 or 2020, and 2) patients who presented with OMF coded as S02.0 through S02.9 as defined by International Classification of Disease, 10th Edition (ICD-10). The exclusion criteria were: 1) cause of facial fracture not documented or unclear, 2) isolated occiput or occipital condyle fractures (ICD-10 code S02.11 - S02.11HS), and 3) inadequate or unclear documentation otherwise.

The time periods were selected to capture patients who presented while measures of social distancing were (experimental group) and were not in effect (control group) and to provide a historical trend and control group for comparison given there may be annual and seasonal variability in trauma patterns.¹¹ The University of Washington (UW) (Seattle, WA) Institutional Review Board approved the present study (UW IRB #10060).

STUDY VARIABLES

The primary predictor variable was the period during which the subject presented for evaluation of their facial fracture. The control groups included those who presented between March 1 and June 30 in the years 2018 and 2019. The experimental group included those who presented during the period of social distancing (March 1, 2020 and June 30, 2020).

The primary outcome variables were the facial fracture diagnosis, the abbreviated injury scale (AIS), injury severity score (ISS), and the mechanism of injury. The AIS and ISS have been used previously in the literature to aid in our understanding of the epidemiology of oral and maxillofacial injuries.^{12,13} These variables were abstracted from the institutional trauma registry and the patients' electronic medical records. The OMF diagnosis was determined based on the ICD-10 diagnosis code associated with the patient encounter. The AIS and ISS were abstracted directly from the trauma registry. The mechanism of injury was defined as assault, bicycle, fall, gun, motor vehicle, motorcycle, pedestrian, or other, as defined in the trauma registry database.

OTHER STUDY VARIABLES

Demographic study variables included age at injury, gender, race, and ethnicity. The race was recorded in the trauma registry and was reported as White, Black or African American, Asian, Native American, Native Hawaiian or Other Pacific Islander, or Not Documented. Ethnicity was reported as Hispanic, Non-Hispanic, or Not Documented.

Other study variables included admission status (outpatient vs admitted), length of hospitalization (defined as # of days), alcohol level (positive, negative, or not tested), toxicology screen (positive for substance, negative, or not tested), payment source (Medicaid, Medicare, charity, commercial, healthcare service corporation (HCSC), Labor and Industries (L&I), self-pay, other, or unknown), work-related (yes or no), abuse reported (yes or no), and abuse investigated (yes or no).

DATA COLLECTION AND ANALYSIS

Two methods of data collection were used: 1) abstraction of study variables from the institutional trauma registry, and 2) abstraction of other or missing variables from the subject's medical record. All data were deidentified and kept in a secure spreadsheet accessible only by members of the research team. Descriptive statistics were used to describe the

subjects and were broken down year-wise for each cohort (2018, 2019, or 2020). Data analysis was conducted using SPSS (SPSS, Inc, Chicago, IL) and the level of statistical significance for all tests was defined as 0.05.

Results

The study sample was composed of 883 subjects who presented to HMC for the evaluation and management of OMF from March 1 to June 30 in the years 2018 through 2020. The number of subjects in the 2020 cohort (n = 235) was lower than the number in the 2018 and 2019 cohorts (n = 330 and 318, respectively).

Table 1 describes the subjects' demographics. Most subjects were male (79% in 2020, 76% in 2019, and 70% in 2018). The majority (78.8%) of subjects were white, and 11.3% were Hispanic. There was a small but nonsignificant increase in the number of Hispanic (14% in 2020 vs 10% in both 2019 and 2018. $P = .28$) and Black/African American individuals (14% in 2020 vs 8% in 2019 and 5% in 2018. $P = .07$) presenting with OMF.

Of the 676 (76.7%) subjects who had blood alcohol level measured, 187 (27.7%) subjects recorded a positive blood alcohol level. More subjects presented with a positive alcohol level in the 2020 cohort than in the

Table 1. PATIENT'S CHARACTERISTICS

Characteristic	2018 Cohort, n (%) n = 330	2019 Cohort, n (%) n = 318	2020 Cohort, n (%) n = 235	P-value*
Gender				$P = .03$
Female	100 (30)	75 (24)	50 (21)	
Male	230 (70)	243 (76)	185 (79)	
Age (in years)				$P = .01$
<18	57 (17)	59 (19)	27 (11)	
18-34	101 (31)	86 (27)	68 (29)	
35-65	116 (35)	126 (40)	117 (50)	
>65	50 (15)	47 (15)	23 (10)	
Race				$P = .07$
Black or African American	17 (5)	26 (8)	32 (14)	
Asian	25 (8)	17 (5)	14 (6)	
White	269 (82)	251 (79)	176 (75)	
Native American	8 (2)	11 (3)	6 (3)	
Not Documented	8 (2)	6 (2)	5 (2)	
Native Hawaiian or Other Pacific Islander	3 (1)	7 (2)	2 (1)	
Ethnicity				$P = .28$
Hispanic	34 (10)	33 (10)	33 (14)	
Non-Hispanic	291 (88)	274 (86)	197 (84)	
Not Documented	5 (2)	11 (3)	5 (2)	

* Chi-Squared Test.

other 2 cohorts (24% in 2020 vs 21% in 2019 and 19% in 2018 $P = .12$). 442 of the 883 subjects performed a toxicology screen, with 207 (46.8%) recording a positive toxicology screening. Subjects presenting with a positive toxicology screen increased in 2020 (27%) compared to 2019 (23%), and 2018 (21%) ($P = .42$); 5.3% of injuries were work-related. Most subjects (54.2%) paid for treatment using state insurance (Medicaid or Medicare). Patients using commercial insurance increased from the 2018 (1%) and 2019 (2%) cohorts to 6% in the 2020 cohort ($P = .01$).

Table 2 describes the subjects' trauma characteristics. The most common injuries included skull base, malar/maxillary/zygomatic, and cranial vault fractures. Most subjects presented with more than one OMF, and the mean number of fracture types sustained by an individual increased slightly in the 2020 cohort compared to the 2018 and 2019 cohorts (mean = 2.1 ± 1.2 in 2020; 2.0 ± 1.2 in 2018; 2.0 ± 1.2 in 2019) ($P = .41$).

Subjects in the 2020 cohort presented with a higher severity of OMF (mean head/face AIS = 3.2 ± 1.2 in 2020) when compared to the 2018 and 2019 cohorts (mean = 3.0 ± 1.1 in 2019 and 3.0 ± 1.1 in 2018) ($P = .03$). Subjects in the 2020 cohort also had higher injury severity scores overall (mean ISS = 20.7 ± 13.1) when compared to the 2018 and 2019 cohorts (mean ISS = 17.8 ± 12.8 in 2018; 19.2 ± 12.5 in 2019) ($P = .03$). Most subjects were admitted to the hospital (76% in 2018, 82% in 2019, and 74% in 2020, $P = .10$). On average, subjects remained hospitalized longer in the 2020 cohort (mean length of stay (LOS) = 11.9 ± 17.8 days) when compared to the 2018 (mean LOS = 8.9 ± 19.0 days) and 2019 cohorts (mean LOS = 10.7 ± 20.4 days), although this was not statistically significant ($P = .16$). Length of stay in the intensive care unit (ICU) also increased in the 2020 cohort (6.3 ± 9.7 days) when compared to the 2018 (4.7 ± 7.3 days) and 2019 cohorts (5.5 ± 9.0 days) ($P = .09$).

The 2020 cohort showed a statistically significant increased proportion of fractures from assault (21% in 2020 vs 15% in 2019 and 18% in 2018, $P = .05$) and a decrease in fractures from falls (29% in 2020 vs 38% in both 2018 and 2019, $P = .05$). There was also an increase in the number of facial fracture cases resulting from gun violence in the 2020 cohort ($n = 17$ (7%) in 2020 compared to $n = 11$ (3%) in both 2018 and 2019, $P = .05$). Subjects in the 2020 cohort presented with less blunt (91% in 2020 vs 95% in both 2018 and 2019 $P = .26$) and more penetrating trauma (9% in 2020 vs 5% in 2018 and 2019). Eight (1%) patients in all 3 cohorts reported domestic abuse, all of which were investigated further by emergency room social workers and providers.

Discussion

Oral and maxillofacial fractures contribute to significant morbidity for individuals, and their management contributes to a consequential use of healthcare resources. The purpose of this study was to understand the impact of social distancing policies enacted during the COVID-19 pandemic on the epidemiology of individuals presenting with OMF to an urban, Level I trauma center in the United States.

Our study found that the number of individuals presenting for the evaluation of OMF was lower during the COVID-19 pandemic while social distancing policies were in place ($n = 235$ in 2020, $n = 318$ in 2019, $n = 330$ in 2018). This was not unexpected when we consider that after March 5, 2020, typical mobility in Washington state, as measured by cell phone location data, was consistently lower than average.¹⁴ This decrease in mobility for individuals peaked between March 30 and April 5, 2020, when mobility was 51% lower than is typical.¹⁴ This has been sustained at around a 20% decrease in mobility for the duration of the COVID-19 pandemic (as of October 2020).¹⁴ Furthermore, Washington state has had between 20 and 50% less highway traffic than is average.¹⁵ As the result of the pandemic and restrictions put in place (eg, "Stay at Home Order"), people are moving around less and staying at home more, making them less likely to sustain oral and maxillofacial injuries in the process.

Our study found that most individuals who sustained OMF were male (78.4% of all subjects), which is consistent with prior literature on the topic.^{3,16-18} While most individuals in our study were white (78.8% of all subjects), there were small but nonsignificant increases in the proportion who were Hispanic (14% in 2020 vs 10% in both 2019 and 2018, $P = .28$) and Black/African American (14% in 2020 vs 8% in 2019 and 5% in 2018, $P = .07$). According to data from the U.S. Bureau of Labor Statistics, 19.7% of Black or African American workers can work from home compared to 29.9% of white workers.¹⁹ Furthermore, only 16.2% of Hispanic or Latino workers can work from home when compared to 31.4% of non-Hispanic or Latino workers.¹⁹ It may be that a smaller proportion of Hispanic and Black or African American workers who remained employed were able to stay at home during the pandemic, contributing to a relatively larger proportion of the population who sustained OMF. There are likely many more variables at play when considering the incidence of oral and maxillofacial trauma by race/ethnicity, which are outside the remit of this paper, and these findings may warrant further investigation.

Table 2. TRAUMA CHARACTERISTICS

Characteristic	2018 Cohort, n (%)	2019 Cohort, n (%)	2020 Cohort, n (%)	P-value
Fracture Type				<i>P</i> = .45*
Cranial Vault	109	101	78	
Skull Base	126	150	104	
Nasal Bone	83	87	65	
Orbit	79	72	52	
Malar/Maxilla/Zygoma	106	99	85	
Tooth	33	19	18	
Mandible	45	27	30	
Other	72	64	56	
Unspecified	0	2	3	
Number of Fracture Types	Mean = 2.0 ± 1.2	Mean = 2.0 ± 1.2	Mean = 2.1 ± 1.2	<i>P</i> = .41†
Mechanism of Injury				<i>P</i> = .05*
Assault	58 (18)	48 (15)	49 (21)	
Bicycle	28 (8)	18 (6)	17 (7)	
Fall	126 (38)	122 (38)	69 (29)	
Gun	11 (3)	11 (3)	17 (7)	
Motor vehicle	54 (16)	55 (17)	37 (16)	
Motorcycle	24 (7)	23 (7)	20 (9)	
Pedestrian	25 (8)	26 (8)	14 (6)	
Other	4 (1)	15 (5)	12 (5)	
Trauma Type				<i>P</i> = .26*
Blunt	312 (95)	301 (95)	213 (91)	
Penetrating	17 (5)	17 (5)	21 (9)	
“Other”	1 (0)	0 (0)	1 (0)	
AIS Score Maximum: Head or Face	Mean = 3.0 ± 1.1	Mean = 3.0 ± 1.1	Mean = 3.2 ± 1.2	<i>P</i> = .03†
Injury Severity Score	Mean = 17.8 ± 12.8	Mean = 19.2 ± 12.5	Mean = 20.7 ± 13.1	<i>P</i> = .03†
Polytrauma (# of other systems involved)	Mean = 3.4 ± 1.6	Mean = 3.6 ± 1.7	Mean = 3.6 ± 1.7	<i>P</i> = .16†
Admission Status				<i>P</i> = .10*
Admitted	251 (76)	261 (82)	178 (74)	
ICU	185 (74)	181 (69)	136 (76)	
Outpatient	79 (24)	57 (18)	57 (24)	
Length of Hospitalization				
Total LOS	Mean = 8.9 ± 18.0	Mean = 10.7 ± 20.4	11.9 ± 17.8	<i>P</i> = .16†
ICU LOS	Mean = 4.7 ± 7.3	Mean = 5.5 ± 9.0	6.3 ± 9.7	<i>P</i> = .09†
Alcohol Level				<i>P</i> = .12*
Negative	183 (55)	169 (53)	137 (58)	
Positive	63 (19)	67 (21)	57 (24)	
N/A	84 (25)	82 (26)	41 (17)	
Toxicology Screen				<i>P</i> = .42*
Negative	90 (27)	89 (28)	55 (23)	
Positive	69 (21)	74 (23)	64 (27)	
N/A	171 (52)	155 (49)	116 (49)	
Work-Related				<i>P</i> = .72*
Yes	15 (5)	18 (6)	14 (6)	
No	315 (95)	300 (94)	221 (94)	
Payment Source				<i>P</i> = .01*
Charity	5 (2)	3 (1)	1 (0)	
Commercial Insurance	2 (1)	5 (2)	15 (6)	
Healthcare Service Corporation	101 (31)	100 (31)	53 (23)	
Labor and Industries	19 (6)	13 (4)	9 (4)	
Medicaid	134 (41)	124 (39)	87 (37)	
Medicare	51 (15)	54 (17)	30 (13)	

Table 2. Cont'd

Characteristic	2018 Cohort, n (%)	2019 Cohort, n (%)	2020 Cohort, n (%)	P-value
Other (other, other government)	11 (3)	7 (2)	7 (3)	
Self-Pay	5 (2)	12 (4)	14 (6)	
Unknown	2 (1)	0 (0)	19 (8)	
Abuse Reported				<i>P</i> = .68*
Yes	2 (1)	4 (1)	2 (1)	
No	328 (99)	314 (99)	233 (99)	
Abuse Investigated				<i>P</i> = .68*
Yes	2 (1)	4 (1)	2 (1)	
No	328 (99)	314 (99)	233 (99)	

Abbreviations: AIS, Abbreviated Injury Scale; ICU, Intensive Care Unit; LOS, Length of Stay.

* Chi-Squared Test.

† ANOVA [95% Confidence Interval].

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The frequency of OMF in our study, from highest to lowest was: skull base (n = 380), malar/maxilla/zygoma (n = 290), cranial vault (n = 288), nasal bone (n = 235), orbit (n = 203), other (n = 192), mandible (n = 102) and tooth (n = 70). This distribution, when it comes to facial fractures only (excluding skull base and cranial vault), with malar/maxillary/zygomatic fractures being the most common, has been seen previously in the literature.^{16,18,20}

Our study found that oral and maxillofacial injuries were more severe during the COVID-19 pandemic. In particular, the mean head/face AIS was higher during the period of social distancing (mean AIS = 3.2 ± 1.2 in 2020 vs 3.0 ± 1.1 in 2019 and 3.0 ± 1.1 in 2018) (*P* = .03). Overall injury burden for these individuals was also higher (mean ISS = 20.7 ± 13.1 in 2020 vs 19.2 ± 12.5 in 2019 and 17.8 ± 12.8 in 2018) (*P* = .03). Patients remained hospitalized longer (mean LOS = 11.9 ± 17.8 days in 2020 vs 10.7 ± 20.4 days in 2019 and 8.9 ± 19.0 days in 2018) (*P* = .16) and had longer ICU stays (mean ICU LOS = 6.3 ± 9.7 days in 2020 vs 5.5 ± 9.0 days in 2019 and 4.7 ± 7.3 days in 2018) (*P* = .09). Although this study does not explain what contributed to the increased severity, there was a trend during the COVID-19 pandemic of more individuals presenting with positive alcohol or toxicology screen results. Research has shown that injury severity may increase secondary to alcohol or drug use but that this varies by the mechanism of injury.^{21,22} Finally, it is unclear if triage behavior for trauma patients in the catchment area of our institution changed during the pandemic as the result of differential allocation of healthcare resources.

Our study found that a greater proportion of individuals were injured secondary to assault (21% in 2020 vs 15% in 2019 and 18% in 2018, *P* = .05) and

gun violence (7% in 2020 vs 3% in both 2018 and 2019, *P* = .05) and less were injured secondary to falls (29% in 2020 vs 38% in both 2018 and 2019, *P* = .05). The distribution of the motor vehicle, motorcycle, and bicycle-related injuries was largely unchanged. Less individual mobility and more people staying at home may explain the decreased proportion of fall-related injuries. The rise in interpersonal violence and subsequent oral and maxillofacial trauma may be explained by economic and overall stressors, social isolation, and sociopolitical conflict during the COVID-19 pandemic.²³ Interestingly, there was no change in our study to the number of individuals, specifically reporting domestic abuse. Regardless, communities should continue to make available services to those who are at risk of abuse during times of social distancing, and trauma centers should continue to identify individuals who were victims of interpersonal violence.

There are several limitations to our study that was performed at a single Level I trauma center in the United States. It is unclear if a different proportion of trauma patients were transported to our institution or if patients were selected for transfer/transport that had sustained more severe injury. The period of inclusion for our study was during the early phase of the COVID-19 pandemic "lockdown." It is unclear how the results would change during shorter or longer periods of social distancing or if they would change based on geography or local politics. Furthermore, the catchment area for HMC began to "open up" as Washington state's "Stay Home, Stay Healthy" order expired on June 1, 2020, and King County, Washington entered "Phase 2" of reopening on June 19, 2020. However, as mentioned before, mobility and highway traffic remained lower than average during the month of June.^{14,15} Regardless, it is important to understand

the burden of oral and maxillofacial trauma and how social distancing policies may result in fewer patients with more severe injuries that individually may require more healthcare resources.

In conclusion, the number of OMF cases decreased, but the severity of oral and maxillofacial and overall injuries was higher during the COVID-19 pandemic when social distancing policies were in place.

At the time of writing, there have been 120,011 COVID-19 cases and 2,482 deaths secondary to COVID-19 in Washington State, 10.4 million cases and 241,907 deaths in the United States, and 52.3 million cases and 1.3 million deaths worldwide.^{24,25}

Acknowledgments

The authors would like to thank Shauna L. Carson, Program Support Supervisor, Harborview Medical Center-Trauma Program, for helping us obtain the data from Institutional Trauma Registry.

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