Firearm injuries during legal interventions: Nationwide analysis

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INTRODUCTION: There is limited literature on firearm injuries during legal interventions. The purpose of this study was to examine the epidemiology, injury characteristics, and outcomes of both civilians and law enforcement officials (LEOs) who sustained firearm injuries over the course of legal action.

METHODS: Retrospective observational study using data from the National Trauma Data Bank (2015–2017) was performed. All patients who were injured by firearms during legal interventions were identified using the *International Classification of Disease, Tenth Revision*, external cause of injury codes. The study groups were injured civilian suspects and police officers. Demographics, injury characteristics, and outcomes were analyzed and compared between the groups. Primary outcomes were the clinical and injury characteristics among the victims.

RESULTS: A total of 1,411 patients were included in the study, of which 1,091 (77.3%) were civilians, 289 officers (20.5%), and 31 bystanders (2.2%). Overall, 95.2% of patients were male. Compared with LEOs, civilians were younger (31 vs. 34 years, $p = 0.007$) and more severely injured (median Injury Severity Score, 13 vs. 10 [$p = 0.005$]; Injury Severity Score >15, 44.4% vs. 37.1% [$p = 0.025$]). Civilians were more likely to sustain severe (Abbreviated Injury Scale, ≥3) intra-abdominal injuries (26.8% vs. 16.1%, $p < 0.001$) and spinal fractures (13.0% vs. 6.9%, $p = 0.004$). In-hospital mortality and overall complication rate were similar between the groups (mortality: civilians, 24.7% vs. LEOs, 27.3% [$p = 0.360$]; overall complications: civilians, 10.3% vs. LEOs, 8.4% [$p = 0.338$]).

CONCLUSION: Firearm injuries during legal interventions are associated with significant injury burden and a higher mortality than the reported mortality in gunshot wounds among civilians. The mortality and overall complication rate were similar between civilian suspects and law enforcement officials. (*J Trauma Acute Care Surg.* 2021;91: 465–472. Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.)

LEVEL OF EVIDENCE: Epidemiologic, level IV.
KEY WORDS: Firearm injuries; legal intervention.

Firearm injuries during legal interventions are a significant public health problem in the United States, affecting both public and law enforcement agencies.[1–3] Recent high-profile cases have fueled public concerns as well as national and international debates about policing.[4] According to data from Mapping Police Violence (a private advocacy group compiling data through original research from crowdsourced databases, criminal records databases, police reports, obituaries, and social media), approximately 1,000 civilians die each year during interaction with law enforcement, with 7,641 civilian deaths in between 2013 and 2019 and 1,114 in 2020.[5] To put these fatalities into context, in 2018, there were approximately 61.5 million Americans who had at least one interaction with law enforcement.[6] This translates to a risk of death of 0.001% following interaction with police. By comparison, the lifetime odds of death by heart disease are 16.7%; cancer, 14.3%; opioid overdose, 1.0%; and motor vehicle crash, 0.9%.[7] However, despite the rarity of civilian deaths by police, such incidents have a major negative impact on both communities and law enforcement agencies, necessitating continuing efforts for their prevention. Furthermore, police officers are also affected by gun violence. According to the latest data from the Federal Bureau of Investigation, 511 officers were feloniously killed in between 2010 and 2019 and 44 as of December 1 in 2020.[8]

Similar to gun violence among civilians, firearm injuries during the course of legal action remain understudied, primarily because of the lack of uniform, integrated national data.[9–13] As a consequence, there is great variability in the data sources and methods used among existing studies, which span across multiple scientific disciplines. Recent reports on law enforcement-related firearm injuries and fatalities have investigated the epidemiological and situational characteristics of these incidents,[14–16] the impact of firearm legislations and gun ownership on the rate of these events,[17,18] and whether racial biases are associated with the use of deadly force by police officers.[19,20] A limited number of studies have examined collectively law enforcement-related injuries; however, police officers were underrepresented, and a separate analysis of gunshot wounds was not performed.[21–25] While the aforementioned investigations have made significant contributions to the literature, nationwide clinical data on injury characteristics and outcomes of both officers and civilians who sustain firearm injuries during legal interventions are lacking.

The purpose of this study was to comprehensively examine the demographics, injury patterns, and outcomes of both civilians and law enforcement officials who were injured by firearms during legal interventions, using nationwide trauma-center based data.

PATIENTS AND METHODS

Study Design and Data Source

This retrospective observational study was designed to examine the demographics, injury patterns, and outcomes of both civilians and law enforcement officials who were injured by firearms over the course of legal action. Data were derived from the National Trauma Data Bank (NTDB), which is maintained by the American College of Surgeons' Committee On Trauma.[26] The NTDB is the largest trauma data repository in the world with voluntary participation of trauma centers across the United States. The data contained in the NTDB are standardized at the time of submission using the validation system and rules defined in the National Trauma

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Data Standard data dictionary.[27] The NTDB contains deidentified data, and the present study was approved by the Institutional Review Board of the University of Southern California.

Study Population

All patients injured by firearms during legal interventions between October 2015 and December 2017 were identified using the *International Classification of Disease, Tenth Revision* (*ICD-10*), external cause of injury codes (ecodes). The *ICD-10* took effect in October 2015 and was used for data abstraction since it provides expanded codes allowing identification of the victim as officer or civilian suspect. The following *ICD-10* ecodes were used to extract our study population: Y35.001A, Y35.002A, Y35.003A, Y35.011A, Y35.012A, Y35.013A, Y35.021A, Y35.022A, Y35.023A, Y35.031A, Y35.032A, Y35.033A, Y35.091A, Y35.092A, and Y35.093A (Supplementary Table 1, http://links.lww.com/TA/B933). No exclusion criteria were applied. The study groups were injured civilian suspects and law enforcement officials. Injuries to bystanders were analyzed and presented separately.

Data Collection

Data abstracted for analysis included demographics (age, sex, race), type of gun used (handgun, rifle, machine gun, other), clinical data (systolic blood pressure, heart rate, and Glasgow Coma Scale score on admission), comorbidities, injury data (Abbreviated Injury Scale [AIS] for each body region, Injury Severity Score [ISS]), and disposition after hospital discharge. Specific intracranial injuries (penetrating injuries to the skull with depth of penetration >2 cm, intracranial hemorrhage), neck injuries (vascular, laryngeal, tracheal), intrathoracic injuries (heart, pulmonary contusions, hemothorax, pneumothorax, diaphragm), intra-abdominal injuries (solid organs and hollow viscera), spinal fractures (cervical, thoracic, lumbar spine), and upper and lower extremity fractures (humerus, radius/ulna, pelvis, femur, tibia/fibula) were also recorded. Primary outcomes were the clinical and injury characteristics among the victims. Secondary outcomes included in-hospital mortality and length of intensive care unit (ICU) and hospital stay.

Definitions

Legal Intervention

The *ICD-10* provides sequential ecodes regarding injuries during "legal intervention." Injuries under this category are defined in the *ICD-10* as "any injury sustained as a result of an encounter with any law enforcement official, serving in any capacity at the time of the encounter, whether on-duty or off-duty. Includes: injury to law enforcement official, suspect and bystander." For brevity, the term *law enforcement official* is used interchangeably with the term *officer* in this study.

Admission Vital Signs

Hypotension was defined as systolic blood pressure of <90 mm Hg and tachycardia as heart rate >120 bpm.

Intra-abdominal Injuries

Solid organs include liver, spleen, kidney, and pancreas. Hollow viscera include stomach, small intestine, large intestine, urinary bladder, and ureter.

Vascular Injuries

Vascular injuries refer to named vessels within each body region.

Missing Data

Missing data for all included variables in the study ranged from 0.0% to 11.9% and were omitted from analysis. Variables with more than 5.0% missing data were initial systolic blood pressure in the emergency department (5.9%), comorbidities (8.7%), and transport times (ranged from 9.8% to 11.9%). Missing data for key variables (age, sex, AIS, ISS, mortality, ICU, and hospital length of stay) were less than 2%.

Statistical Analysis

Univariate analysis was used to compare baseline characteristics, injury patterns, and outcomes between injured civilian suspects and law enforcement officials. The frequency of severe injury (ISS of >15), the anatomic distribution of severe injuries (defined as AIS of ≥3), and inhospital mortality were analyzed and compared between the groups. Normality of data distribution for continuous variables was assessed using the Shapiro-Wilk test, evaluation of skewness, and inspection of their histograms. Categorical variables were summarized as numbers and percentages. Nonparametric continues variables were presented as medians with interquartile range (IQR). Hypothesis testing for categorical variables was performed using the χ^2 test or Fisher exact test as appropriate. The Mann-Whitney *U* test was used to compare nonparametric continuous variables. Statistical significance was defined as a *p* value of <0.05. All statistical analyses were performed using IBM SPSS for Windows, version 23.0 (SPSS Inc., Chicago, IL).

RESULTS

Demographics and Baseline Characteristics

A total of 126,365 patients were injured by firearms and entered in the NTDB from 2015 to 2017. Among 2,057 (1.6%) who were injured during legal interventions, 1,411 were coded using the *ICD-10* and included in our study. Of these, 1,091 were civilians (77.3%); 289 (20.5%), law enforcement officials (LEOs); and 31 (2.2%), bystanders. The patient flowchart is shown in Figure 1. The epidemiological characteristics of the two groups are outlined in Table 1.

Clinical and Injury Data

Overall, hypotension (systolic blood pressure, <90 mm Hg), tachycardia (heart rate, >120 bpm), and Glasgow Coma Scale of ≤8 were frequent on admission (23.6%, 19.3%, and 36.4%, respectively) without statistically significant differences between the groups ($p > 0.05$). The median ISS was 13 (IQR, 6–25), significantly higher in civilians compared with LEOs (13 [IQR, 8–25] vs. 10 [IQR, 5–22], $p = 0.005$). More civilians sustained severe trauma (ISS, >15) compared with LEOs (44.4% vs. 37.1%, $p = 0.025$) (Table 2).

With regard to injury patterns, there were no significant differences between the groups in the frequency of head, face, neck, upper and lower extremity injuries ($p > 0.05$). Overall, 15.4% of admitted patients suffered injuries to the head, whereas the frequencies of chest, abdominal, and upper and lower extremity injuries were close to 50%. The most common severely

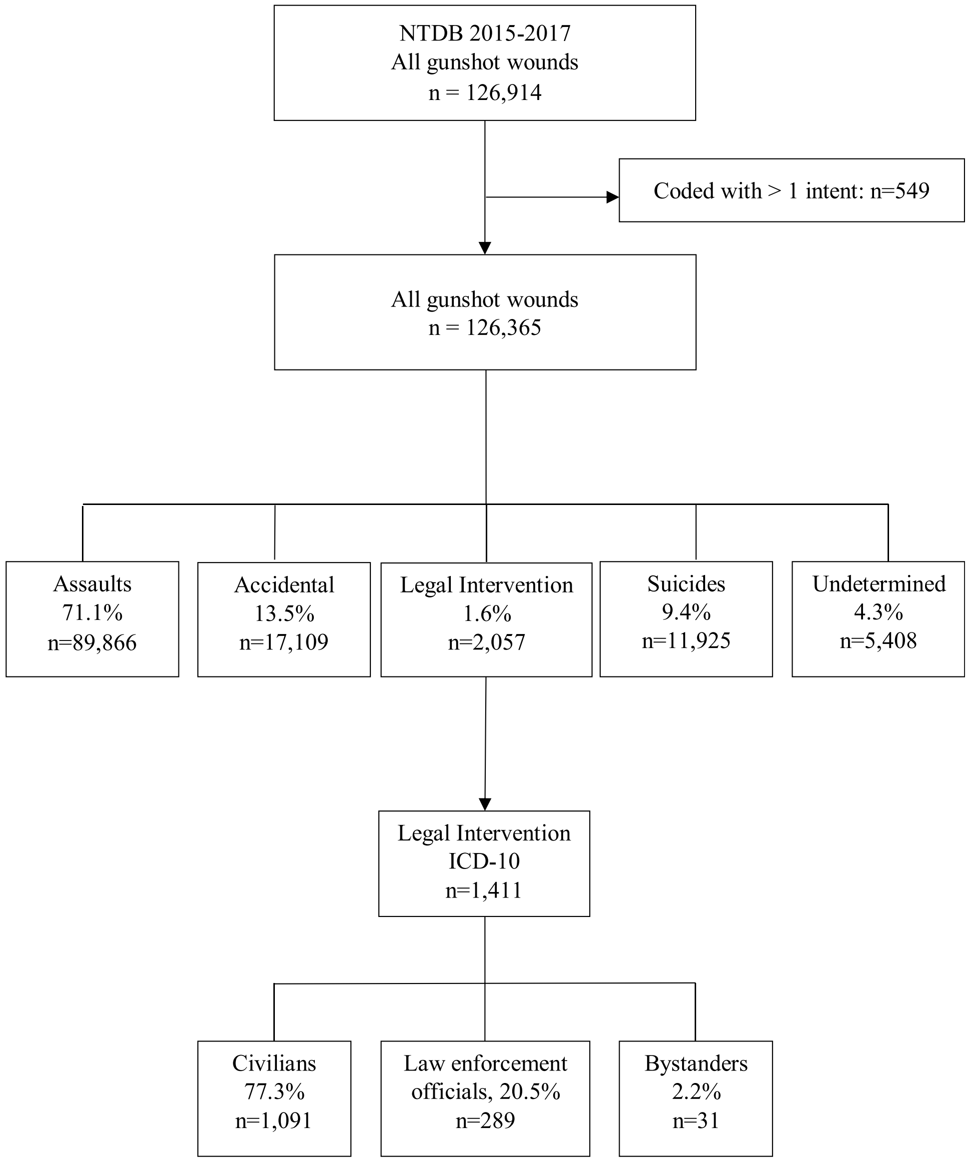

Figure 1. Patient flowchart.

injured (AIS, ≥3) body regions were the chest (32.1%) and abdomen (24.5%). There was a trend for more severe (AIS, ≥3) chest injuries in civilians compared with LEOs (33.2% vs. 28.0%, $p = 0.09$). While abdominal trauma was common in both groups (45.4% vs. 41.3%, $p = 0.213$), civilians were more likely to suffer severe (AIS, ≥3) intra-abdominal injuries (26.8% vs. 16.1%, $p < 0.001$). Overall, severe torso (chest and/or abdomen) injuries were significantly more likely in the civilian group (46.9% vs. 36.4%, $p = 0.002$). Injuries to the spine were also more frequent in civilians (15.0% vs. 8.0%, $p = 0.002$) but without difference in the frequency of severe (AIS, ≥3) spinal trauma (4.4% vs. 2.8%, $p = 0.234$). Overall, 11.0% of victims suffered severe (AIS, ≥3) upper extremity injuries, and 19.8%, severe lower extremity injuries without differences between the groups. Multiple injuries (AIS ≥2 in ≥2 body region) were more frequent in civilians compared with LEOs (47.9% vs. 39.5%, $p = 0.012$) (Table 2).

A detailed description of specific injuries within each body region is presented in Table 3. The rate of penetrating injuries to the head with >2-cm penetration of the skull was relatively low (3.1%) and without difference between the groups ($p = 0.447$). Overall, 6.2% of patients suffered intracranial bleeding. Spinal fractures were more common in civilians compared with LEOs (13.0% vs. 6.9%, $p = 0.004$). Intrathoracic injuries were diagnosed with similar frequency between the groups. Five percent of victims suffered injuries to the heart ($p = 0.167$). Intra-abdominal solid organ injuries were diagnosed in 20.7% of the patients and were similar between the groups; however, civilians were more likely to suffer hollow viscus injuries compared with LEOs (23.7% vs. 16.3%, $p = 0.007$). Upper (17.3%) and lower (14.1%) long bone fractures were similar between the groups with civilians suffering significantly more vascular injuries to the upper extremities compared with LEOs (6.1% vs. 2.4%, $p = 0.013$) (Table 3).

TABLE 1. Baseline Characteristics and Transport Data

	Total (N = 1,380)	Civilian (n = 1,091)	LEO (n = 289)	
	n (%)	n (%)	n (%)	*p*
Age, median (IQR), y	32 (25–40)	31 (25–40)	34 (27–41)	0.007
≤18	89 (6.5)	78 (7.2)	11 (3.8)	0.038
>65	21 (1.5)	15 (1.4)	6 (2.1)	0.417
Sex, male	1,314 (95.2)	1,041 (95.4)	273 (94.5)	0.499
Type of gun				
Handgun	655 (47.5)	517 (47.4)	138 (47.8)	0.912
Rifle	28 (2.0)	21 (1.9)	7 (2.4)	0.594
Machine gun	5 (0.4)	2 (0.2)	3 (1.0)	0.065
Other/unspecified	692 (50.1)	551 (50.5)	141 (48.8)	0.604
Comorbidities				
Smoking	282 (22.4)	245 (24.5)	37 (14.2)	<0.001
Hypertension	82 (6.5)	60 (6.0)	22 (8.4)	0.158
Diabetes mellitus	32 (2.5)	25 (2.5)	7 (2.7)	0.870
Transport mode				
Ground ambulance	1,073 (78.2)	863 (79.5)	210 (73.2)	0.024
Air transport	261 (19.0)	197 (18.1)	64 (22.3)	
Police	21 (1.5)	14 (1.3)	7 (2.4)	
Private/walk in	13 (0.9)	7 (0.6)	6 (2.1)	
Other	5 (0.4)	5 (0.5)	0 (0.0)	
Transport times, min*				
EMS response**	7 (4–14)	7 (4–14)	8 (4–15)	0.407
EMS scene†	11 (8–18)	11 (7–18)	12 (8–20)	0.275
EMS transport‡	34 (25–56)	34 (25–56)	35 (26–57)	0.437

*Applicable only to patients who were admitted directly from the scene and transported by EMS (n = 1,166).
**EMS response: time from dispatch to scene arrival.
†EMS scene: time from dispatch to departure from the scene.
‡EMS transport: time from dispatch to hospital arrival.
EMS, emergency medical services.

Outcomes

Overall, in-hospital mortality was 25.2% (348 of 1,378 patients) with a median time to death of 23 minutes (IQR, 5–167 minutes) from hospital admission and without significant difference between the groups (civilians, 24.7% vs. LEOs, 27.3%; $p = 0.360$). Among patients who were admitted directly from the scene, 14.3% (172/1,207) were dead on arrival and a total of 18.6% (224/1,207) were pronounced dead in the emergency department. A higher proportion of LEOs were dead on arrival compared with civilians (13.2% vs. 18.5%, $p = 0.032$). Law enforcement officials were also more likely to die in the emergency department (17.4% vs. 23.3%, $p = 0.033$). The overall mortality rate among patients with severe injury (ISS, >15) was 44.2%, again higher in LEOs compared with civilians (42.1% vs. 53.8%, $p = 0.028$). In total, 60.3% of patients who survived to discharge were admitted to the ICU, with a median length of stay of 4 days (IQR, 2–8). The median hospital length of stay was higher in civilians compared with LEOs [7 (IQR, 3–14) vs. 5 (IQR, 2–10), $p = 0.003$]. Approximately 10% of patients developed at least one complication, without significant differences between the groups. Outcomes, complications, and disposition after hospital discharge are summarized in Table 4.

Bystanders

There were 31 (2.2%) bystanders among the victims of legal interventions involving firearms. Three of the bystanders died (9.7%) and all of them where dead on arrival in the emergency department. The epidemiological and clinical characteristics in this group are shown in the supplemental Table 2 (http://links.lww.com/TA/B933).

DISCUSSION

Contemporary literature centers primarily on racial disparities among victims of police use of force. In this study, we focused on providing detailed clinical information regarding injury characteristics and outcomes of both civilians and law enforcement officials who were injured by firearms during legal interventions. The first noteworthy finding was the high mortality, in both civilians and law enforcement officers, which was significantly higher than what has been reported in the general population. The overall mortality in this study was 25.2%, which is

TABLE 2. Admission Vital Signs and Injury Characteristics

	Total (N = 1,380)	Civilian (n = 1,091)	LEO (n = 289)	
	n (%)	n (%)	n (%)	*p*
ED vital signs				
SBP <90 mm Hg	306 (23.6)	240 (23.3)	66 (24.6)	0.649
HR >120 bpm	255 (19.3)	203 (19.4)	52 (18.8)	0.843
GCS ≤8	488 (36.4)	386 (36.2)	102 (36.8)	0.858
Injury severity				
ISS, median (IQR)	13 (6–25)	13 (8–25)	10 (5–22)	0.005
ISS >15	587 (42.9)	481 (44.4)	106 (37.1)	0.025
ISS ≥25	368 (26.9)	307 (28.3)	61 (21.3)	0.017
Injured body region				
Head	211 (15.4)	169 (15.6)	42 (14.7)	0.689
Head AIS ≥3	140 (10.2)	111 (10.3)	29 (10.1)	0.945
Face	257 (18.8)	201 (18.6)	56 (19.6)	0.709
Face AIS ≥3	13 (1.0)	12 (1.1)	1 (0.3)	0.323
Neck	120 (8.8)	91 (8.4)	29 (10.1)	0.363
Neck AIS ≥3	30 (2.2)	24 (2.2)	6 (2.1)	0.899
Chest	672 (49.2)	541 (50.1)	131 (45.8)	0.197
Chest AIS ≥3	439 (32.1)	359 (33.2)	80 (28.0)	0.090
Abdomen	608 (44.5)	490 (45.4)	118 (41.3)	0.213
Abdomen AIS ≥3	335 (24.5)	289 (26.8)	46 (16.1)	<0.001
Torso (chest and/or abdomen) AIS ≥3	610 (44.7)	506 (46.9)	104 (36.4)	0.002
Spine	185 (13.5)	162 (15.0)	23 (8.0)	0.002
Spine AIS ≥3	55 (4.0)	47 (4.4)	8 (2.8)	0.234
Upper extremity	728 (53.3)	590 (54.6)	138 (48.3)	0.055
Upper extremity AIS ≥3	150 (11.0)	121 (11.2)	29 (10.1)	0.609
Lower extremity	626 (45.8)	491 (45.5)	135 (47.2)	0.600
Lower extremity AIS ≥3	271 (19.8)	217 (20.1)	54 (18.9)	0.648
Multiple injuries				
AIS ≥2 in ≥2 body region	630 (46.1)	517 (47.9)	113 (39.5)	0.012
AIS ≥2 in ≥3 body regions	272 (19.9)	223 (20.6)	49 (17.1)	0.186

ED, emergency department; GCS, Glasgow Coma Scale; HR, heart rate; SBP, systolic blood pressure.

TABLE 3. Injury Distribution

	Total (N = 1,380)	Civilian (n = 1,091)	LEO (n = 289)	
	n (%)	n (%)	n (%)	p
Head				
Penetrating injury to skull, >2 cm penetration	43 (3.1)	32 (2.9)	11 (3.8)	0.447
Intracranial hemorrhage	85 (6.2)	69 (6.3)	16 (5.5)	0.620
Neck				
Vascular injury	20 (1.4)	17 (1.6)	3 (1.0)	0.781
Larynx	9 (0.7)	6 (0.5)	3 (1.0)	0.406
Trachea	6 (0.4)	4 (0.4)	2 (0.7)	0.611
Esophagus	3 (0.2)	2 (0.2)	1 (0.3)	0.506
Spinal fracture				
Any	162 (11.7)	142 (13.0)	20 (6.9)	0.004
Cervical spine	36 (2.6)	32 (2.9)	4 (1.4)	0.142
Thoracic spine	68 (4.9)	56 (5.1)	12 (4.2)	0.493
Lumbar spine	74 (5.4)	67 (6.1)	7 (2.4)	0.013
Chest				
Vascular injury	59 (4.3)	47 (4.3)	12 (4.2)	0.907
Heart injury	69 (5.0)	50 (4.6)	19 (6.6)	0.167
Pulmonary contusion	305 (22.1)	244 (22.4)	61 (21.1)	0.647
Esophagus	6 (0.4)	5 (0.5)	1 (0.3)	1.000
Diaphragm	132 (9.6)	107 (9.8)	25 (8.7)	0.552
Hemo/pneumothorax	390 (28.3)	316 (29.0)	74 (25.6)	0.260
Abdomen				
Vascular injury	79 (5.7)	66 (6.0)	13 (4.5)	0.313
Any solid organ	285 (20.7)	236 (21.6)	49 (17.0)	0.081
Any hollow viscus	306 (22.2)	259 (23.7)	47 (16.3)	0.007
Retroperitoneal hemorrhage	57 (4.1)	49 (4.5)	8 (2.8)	0.191
Upper extremity				
Vascular injury	74 (5.4)	67 (6.1)	7 (2.4)	0.013
Any long bone fracture	239 (17.3)	194 (17.8)	45 (15.6)	0.377
Humerus fracture	128 (9.3)	100 (9.2)	28 (9.7)	0.785
Radius/ulna fracture	132 (9.6)	114 (10.4)	18 (6.2)	0.030
Pelvic fracture	123 (8.9)	96 (8.8)	27 (9.3)	0.773
Lower extremity				
Vascular injury	51 (3.7)	41 (3.8)	10 (3.5)	0.811
Any long bone fracture	195 (14.1)	154 (14.1)	41 (14.2)	0.975
Femur fracture	138 (10.0)	118 (10.8)	20 (6.9)	0.050
Tibia/fibula fracture	76 (5.5)	50 (4.6)	26 (9.0)	0.003

significantly higher than the mortality reported in gunshot wounds among civilians, with the latter ranging from 9% to 15%.[28–31] It is likely that the types of firearms and bullets used in legal interventions, by both officers and civilians, are different and potentially more lethal than the weaponry used by the general population. Hollow point bullets, designed to expand and maximize tissue damage, may be used more commonly in these circumstances.[32,33] Semiautomatic weapons and hollow point bullets are widely used by police forces across the country. It is also possible that many of these injuries occur at close range, which improves the accuracy of the shooter and causes more soft tissue damage.

Another interesting finding was the slightly higher mortality in the LEO group, despite the significantly lower ISS and the use of protective body armor by the police. It is possible that the prehospital time in the LEOs is much shorter than civilian patients, because many police agencies have a policy of immediate self-transportation with police vehicles for injured officers. In these situations, critically wounded officers who would have died at the scene make it to a hospital. This is supported by the findings that significantly more LEOs were dead on arrival or died in the emergency room.

Overall, severe torso injuries (AIS, >3) were significantly more likely in the civilian group which clearly supports the value of personal protective body armor.[34] However, chest and abdomen remain the most commonly severely injured anatomical body areas in both civilians and LEOs. Specific injuries within each body region were similar between the groups, with the exceptions of spinal fractures, hollow viscus, and vascular injuries to the upper extremity which were more frequent in civilians. Lastly, the severity of these injuries as well as their impact on both the patients and hospital resource utilization is reflected

TABLE 4. Outcomes and Resource Utilization

	Total (N = 1,380)	Civilian (n = 1,091)	LEO (n = 289)	
	n (%)	n (%)	n (%)	p
Mortality	348 (25.2)	269 (24.7)	79 (27.3)	0.360
Dead on arrival*	172 (14.3)	126 (13.2)	46 (18.5)	0.032
Death in ED*	224 (18.6)	166 (17.4)	58 (23.3)	0.033
Time to death, min*	23 (5–167)	25 (6–165)	15 (4–183)	0.174
Mechanical ventilation**				
No. ventilated, n (%)	459 (44.6)	390 (47.6)	69 (32.9)	<0.001
Ventilator days†	3 (2–6)	3 (2–6)	3 (2–6)	0.918
ICU**				
No. admitted, n (%)	621 (60.3)	510 (62.2)	111 (52.9)	0.014
ICU LOS, d‡	4 (2–8)	4 (2–8)	4 (2–7)	0.162
Hospital LOS, d**	6 (3–13)	7 (3–14)	5 (2–10)	0.003
Complications§				
Any complication	136 (9.9)	112 (10.3)	24 (8.4)	0.338
Unplanned OR	39 (4.2)	33 (4.4)	6 (3.2)	0.473
ARDS	7 (0.7)	7 (0.9)	0	0.356
Deep vein thrombosis	25 (2.7)	22 (2.9)	3 (1.6)	0.448
Pulmonary embolism	15 (1.6)	14 (1.9)	1 (0.5)	0.327
Acute kidney injury	21 (2.2)	18 (2.4)	3 (1.6)	0.782
Sepsis	17 (1.8)	15 (2.0)	2 (1.1)	0.548
Hospital disposition				
Home	316 (22.9)	223 (20.5)	93 (32.2)	<0.001
Court	462 (33.5)	386 (35.4)	76 (26.3)	
Rehabilitation center	52 (3.8)	44 (4.0)	8 (2.8)	
Extended care facility	45 (3.3)	39 (3.6)	6 (2.1)	
Psychiatric unit	38 (2.8)	35 (3.2)	3 (1.0)	
Other	117 (8.5)	93 (8.5)	24 (8.3)	

Categorical variables are presented as frequencies and percentages. Continues variables are presented as medians with IQRs.

*Applicable only to patients who were admitted directly (n = 1,209). Transferred patients were omitted from analysis.

**Patients who survived to discharge (n = 1,058).

†Applicable only to patients who required mechanical ventilation (n = 459).

‡Applicable only to patients who were admitted to the ICU (n = 621).

§Patients with LOS longer than 48 hours (n = 959).

ARDS, acute respiratory distress syndrome; ED, emergency department; LOS, length of stay; OR, operating room.

in the finding that 60% of victims required admission to the ICU and 45% required mechanical ventilation.

The literature on gunshot wounds during legal interventions is particularly scarce and in most reports the officers are underrepresented. In a statewide study from Pennsylvania which included 261 law enforcement related firearm injuries, the authors reported a mortality rate of 23.4% which is similar to the present study.[35] A few other studies have looked collectively at law enforcement related injuries; however, without a separate analysis of gunshot wounds.[22–25] In a prospective study using data from three police departments, Bozeman et al.[22] focused on the incidence of different force modalities used by police and their association with significant injuries. They concluded that firearm use by police is rare (0.4% [6/1,399] of all force utilizations) but most likely to result in severe injury.[22] Chang et al.[23] compiled information from several federal databases and found that 26% (1,011/3,958) of all law enforcement related injuries were due to gunshot wounds. A statewide study from Illinois which included 836 patients, reported similar (27%) incidence of gunshot wounds among civilians who were injured during legal interventions.[24] On the other hand, in a recent nationwide study including 7,203 civilians who presented to trauma centers with law enforcement-related injuries, the incidence of gunshot wounds was 44%.[25] The authors attributed the higher incidence of gunshot wounds in their study to the fact that they included only patients who presented to trauma centers, and who, therefore, were more likely to represent the most severely injured patients. None of these studies reported injury patterns or outcomes among victims of law enforcement related firearm injuries.

Several limitations must be acknowledged. Firstly, the study is subject to the limitations associated with retrospective design, including reporting and selection bias.[36] Secondly, patients who die at the scene are not included in NTDB. As a result, the true injury severity and mortality cannot be assessed. Thirdly, trauma centers treat approximately 70% of firearm injuries in the United States.[37] Patients treated by non-trauma centers are not included in the database. This represents a potential selection bias that we could not correct. Lastly, we could not account for cases that were "suicide by cop", that is, cases in which the civilian attempted to cause his own death through police action.[38,39] According to recent reports, "suicide by cop" accounts for approximately 20% of all firearm injuries during legal interventions.[15] The NTDB contains clinical data without further information surrounding the incident. Such information is routinely collected in most cases during assessment of patients with firearm injuries and could complement the clinical data contained in the NTDB, facilitating future research on gun violence. With these limitations in mind, we utilized one of the best national trauma center-based database to examine firearm injuries during legal interventions.[13] Given the scarcity of evidence on this subject, our findings represent a useful addition to the literature and the initial step towards a better understanding of the impact of these injuries on both patient and hospital level.

Firearm injuries during legal interventions are associated with significant injury burden and a higher mortality than the reported mortality in gunshot wounds among civilians. The mortality and overall complication rate were similar between civilian suspects and law enforcement officials.

AUTHORSHIP

D.D. and P.K.L. designed the study. P.K.L. and D.A.J. performed the literature search and data collection. P.K.L. and D.A.J. analyzed the data. All authors contributed to the interpretation of the data and the final version of the article. D.D. and M.L. supervised all aspects of study design, data acquisition, analyses, and article writing.

DISCLOSURE

The authors declare no conflicts of interest.

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