Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Rachel Devine Date

Traumatic Injuries among Persons in Custody of Law Enforcement

By

Rachel Devine

Master of Public Health

Global Epidemiology

Anne C. Spaulding M.D., MPH
Committee Chair

Anwar Osborne M.D., MPM, FACEP
Committee Member

Randi N. Smith M.D., MPH
Committee Member

Traumatic Injuries among Persons in Custody of Law Enforcement

By

Rachel Devine

B.S.
University of Montana
2019

Thesis Committee Chair:

Anne C. Spaulding M.D., MPH

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health in Global Epidemiology
2022

Abstract

Traumatic Injuries among Persons in Custody of Law Enforcement
By: Rachel Devine

Introduction:

Individuals in police custody represent a vulnerable subset of trauma patients at risk for disparate care. Though the literature on mortality of persons in police custody is growing, less research exists on morbidity. Hence, we sought to characterize traumatic injuries of persons in police custody at a single urban trauma center. We hypothesized that the majority of injuries would be from assaults and other blunt force trauma such as motor vehicle collisions.

Methods:

We analyzed the institutional trauma registry of a nationally verified Level 1 trauma center in Atlanta, Georgia. Hospitalized adults (18 years or older) who arrived to the emergency department and/or were discharged from the hospital in police custody between Jan. 2016 and Dec. 2020 were included. Patient demographics, injury patterns, clinical characteristics and outcomes were collected and analyzed. Descriptive statistics were performed. Logistic regressions were used to compare the two cohorts.

Results:

There were 24,695 hospitalized trauma patients over the study period. Of these, 738 (3%) individuals were under custody of law enforcement, of which 79.7% (n=588) were Black with mean age of 34.7 years (95% CI 22.7–46.7; SD +/- 12). Two-thirds (n=302, 40.9%) were injured on the street and the leading causes of injury were firearm (n=192, 26%), assault (n=184, 25%), and motor vehicle collision (n=155, 21%). Emergent operations were required in 428 (58%) patients and 27% (n=202) were admitted to the intensive care unit (ICU). Injured patients in custody were more likely to be Black or African American (OR 1.64; 95%CI 1.33–2.02), male (OR 2.98; 95%CI 2.29–3.88), have a self-inflicted injury (OR 2.48; 95%CI 1.54–4.01), and have a major psychiatric illness (OR 2.14; 95%CI 1.27–3.60).

Conclusion:

Interactions with law enforcement, either prior to arrival in the ED/hospital or with subsequent discharge to custody, represent an important subset of trauma victims. Injury in this population is associated with significant healthcare and societal costs as evident by the need for emergent operations and ICU level care. Further studies will be required to explore community factors, understand health disparities, and identify potential targets for intervention in this population.

Traumatic Injuries among Persons in Custody of Law Enforcement

By

Rachel Devine

B.S.
University of Montana
2019

Thesis Committee Chair:

Anne C. Spaulding M.D., MPH

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health in Global Epidemiology
2022

Acknowledgments

I would first like to thank my team of advisors, Drs. Anne Spaulding, Randi Smith, and Anwar Osborne, whose contributions were paramount to the success of this study. Their consistent advice and unswerving enthusiasm served as not only motivation for this thesis, but also my developing public health career.

It is vital to acknowledge that all data was collected through the Trauma Registry, without which this project and subsequent findings would not have been possible.

This work was presented at the National Commission on Correctional Health Care (NCCHC) Spring Conference in April 2022 and will be presented again at the Society for Academic Emergency Medicine (SAEM) Annual Meeting in May 2022. I would like to thank both organizations for the opportunity to disseminate our findings.

Finally, I would like to express my immense gratitude to my support system of family and friends who continue to inspire and encourage me daily.

Contents

Introduction

Trauma centers play a vital role in providing emergent care for a wide array of patients, including individuals in the custody of law enforcement. This population represents a vulnerable subset of trauma patients that has the potential to be at risk for disparate care. Though the literature on mortality of persons in police custody continues to grow, less research currently exists on morbidity. The goal of this study was to analyze the interactions of these patients in a single urban trauma center by characterizing their traumatic injuries and comparing a matching population in the same dataset. We hypothesized that the majority of injuries would be the result of blunt force trauma from mechanisms such as assault and that there would not be significant differences between them and the matched population.

Research Question

Question: Among individuals who were in police custody when they presented to and/or were discharged from the trauma center, what types of traumatic injuries were sustained?

Question: How do demographics and health characteristics of individuals in police custody differ from those who were not?

Objective 1: Describe basic demographics of the study population.

Objective 2: Describe injury types sustained by the study population.

Objective 3: Describe overall health characteristics/health behaviors and compare to individuals not in police custody.

Review of Literature

Traumatic Injury Epidemiology

Traumatic injury is characterized as a serious physical injury to the body (National Institute of General Medical Sciences [NIGMS], 2020). There are two primary types of traumatic injury: penetrating and blunt force (NIGMS, 2020). Penetrating trauma is defined as "when an object pierces the skin or body, usually creating an open wound," while blunt force trauma is defined as "when an object or force strikes the body, often causing concussions, deep cuts, or broken bones" (NIGMS, 2020).

According to the U.S. Centers for Disease Control and Prevention (CDC), injury contributed to more than 278,000 deaths in the United States in 2020 alone, making it the fourth leading cause of death across all age groups (Centers for Disease Control and Prevention, National Center for Injury Prevention and Control [CDC NCIPC], 2020). Many more survive their injuries, with an estimated 594,888,337 (95% CI 546,483,211 - 643,293,462) non-fatal injuries documented in emergency departments between 2001 and 2020 (CDC NCIPC, 2020). This calculates out to an age-adjusted rate of 9,707.5 (CDC NCIPC, 2020). Across all age groups between 2016 to 2020, unintentional fall was the most frequent cause of injury (29.1% of total injuries), followed by unintentional strikes (11.8%), unintentional overexertion (8.2%), unintentional injury of motor vehicle occupant (8.1%), unintentional other specified (7.4%), unintentional poisoning (6.2%), unintentional cut/pierce (6.2%), strike by assault (4.0%), unintentional bite/sting (3.4%), unintentional unknown (2.3%), and other (13.4%) (CDC NCIPC, 2020). This order remains similar among adults ages 18 to 85, with the only difference being unintentional overexertion falling from third to fifth most frequent, surpassed by both unintentional injury of motor vehicle occupant and unintentional other specified injuries (CDC NCIPC, 2020).

The economic consequences of these injuries are immense. Nearly 27 million non-fatal injuries were sustained in the United States in 2019 alone, totaling an economic burden of $4.2 trillion dollars in medical costs, work loss, and statistical life and quality of life losses (Peterson, Miller, Barnett, & Florence, 2021). Over half of these costs were attributed to adults of working age, between 25-64 years of age (Peterson, Miller, Barnett, & Florence, 2021). Per person, the attributable 1-year cost of a non-fatal injury ranges from $1,698 to $80,172, with an average of $6,620 (Peterson, Xu, & Florence, 2021).

For individuals who experience a traumatic injury, the consequences can extend beyond physical ailments and into a patient's psychosocial life. One study conducted at a large urban trauma center found that psychological distress was evident among patients in the months following a traumatic injury, regardless of injury severity (Landsman, Baum, Arnkoff, Craig, Lynch, Copes, & Champion, 1990). The study found that the financial issues and employment problems following an injury were the biggest predictors of distress (Landsman et al, 1990). This is indicative of the multi-faceted concerns that survivors face. The trauma surrounding these injuries also has the potential to lead to emotional dysregulation, somatization, sleep disturbances, intrusive thoughts or memories, dissociation, and more (Substance Abuse and Mental Health Services Administration [SAMHSA], 2014). Persistence of these issues has been linked to eventual diagnosis of post-traumatic stress disorder (PTSD) and substance use disorder (SUD) (SAMHSA, 2014).

Trauma Centers

When a patient sustains an injury, they can be transported to a hospital emergency department (ED) for care. Here, they are triaged and evaluated by a team of physicians to determine the presence of an emergent medical or surgical condition (Penn Medicine, n.d.). Physicians working in emergency departments are prepared to treat patients in critical condition, but most injuries are non-life-

threatening (e.g., broken bones, chest pain, minor burns/lacerations, sprains, signs of heart attack/stroke, etc.) (Penn Medicine, n.d.). Trauma centers are responsible for treating injuries deemed life- or limb-threatening (e.g., traumatic brain injuries (TBI), blunt force trauma, gunshot wounds, stab wounds, serious burns, serious falls) and are equipped with resources to care for the most severe of injuries (Penn Medicine, n.d.).

The resources available and patient load at a given trauma center denote its level status, which can be given through either a designation or verification process (American Trauma Society [ATS] n.d.). Designation is determined at the state or local level and can vary based on the municipality (ATS, n.d.). Verification is given following an evaluation by the American College of Surgeons (ACS), which confirms the presence of sufficient resources as outlined by the Resources for Optimal Care of the Injured Patient (ATS, n.d.). Level I is the highest verification level that a trauma center can achieve and requires the following criteria as described by the Trauma Center Association of America [TCAA] Inc.:

- "Admit at least 1,200 trauma patients yearly or have 240 admissions with an Injury Severity Score of more than 15.
- Maintain a surgically directed critical care service including 24-hour pre and post anesthesia services, an operating room available within 15 minutes, radiology, ICU team coverage, a full spectrum of surgical specialists, medical consultants, support services, 24-hour laboratory services and an adequate blood supply, medical social workers available 24 hours and advanced practitioners.
- Orthopaedic care must be overseen by an individual who has completed a fellowship in orthopaedic traumatology approved by the Orthopaedic Trauma Association.

- Cardiothoracic surgery capabilities must be available 24 hours per day and should have cardiopulmonary bypass equipment.
- Participate in the training of residents and be a leader in education and outreach activities including providing continuous rotations for senior residents, providing emergency medicine and the surgical specialty residency programs, providing an acute care surgery fellowship, and offering continuing education for trauma nurses and continuing medical education for trauma surgeons.
- Establish a successful trauma research program with a minimum of 20 peer-reviewed articles published in specified journals OR 10 peer-reviewed articles published in specified journals and the demonstration of four specified trauma-related scholarly activities.
- Led by an ICU physician boarded in surgical critical care." (Trauma Center Association of America [TCAA] Inc., n.d.)

Americans in Custody

The United States has the highest incarceration rate in the world by large margin, with 629 individuals incarcerated for every 100,000 citizens in 2019 (World Prison Brief, 2019). This is eight percent higher than Rwanda, the country with the next highest rate in that year, which has 580 citizens incarcerated for every 100,000 (World Prison Brief, 2019). Although the U.S. prison population has declined since its peak in 2009, 2.5% of U.S. citizens were under correctional supervision at the end of 2019 (Minton, Beatty, & Zeng, 2021). This is equivalent to 1 out of every 40 citizens (Minton, Beatty, & Zeng, 2021).

Incarcerated individuals have historically been men in their 20's and 30's of racial and ethnic minority groups (The Pew Center on the States, 2008). A report compiled by the Pew Center on the States in 2008 found that 1 in 54 adult men were behind bars, compared to 1 in 255 adult women (The Pew

Center on the States, 2008). The racial breakdown highlighted disparities among racial and ethnic groups, with 1 in 106 white adult men, 1 in 36 Hispanic adult men, and 1 in 15 Black adult men behind bars (The Pew Center on the States, 2008).

These patterns of disparity continue in recent data. As of July 2021, white, Black, and Hispanic U.S. citizens made up 76.3%, 13.4%, and 18.5% of the total U.S. population, respectively (United States Census Bureau, 2021). Despite this, there continue to be large disparities within the U.S. prison population. The imprisonment rate of Black residents in 2018 was approximately 1,134 per 100,000 persons, with Black males being imprisoned at 5.8 times the rate of white males of the same age group (Carson, 2020). Black females were imprisoned at 1.8 times the rate of white females (Carson, 2020). Racial and ethnic disparities were most apparent in 18–19-year age range, with Black and Hispanic males 12.7 and 3.3 times more likely to be imprisoned than their white counterparts, respectively (Carson, 2020).

Health within Correctional Facilities

The Eighth Amendment to the U.S. Constitution prohibits "cruel and unusual" punishment and gives incarcerated individuals the right to healthcare during incarceration (Rold, 2008). State spending on correctional health care has risen substantially in recent years, with a median growth rate of 13 percent across 41 states between 2007 and 2011 (The Pew Charitable Trusts & the John D. and Catherine T. MacArthur Foundation, 2014). This spending totaled $8.2 billion nationwide in 2009 before declining to $7.7 billion in 2011 (The Pew Charitable Trusts & the John D. and Catherine T. MacArthur Foundation, 2014). The high amount of spending is indicative of an aging incarcerated population with complicated physical and mental health needs, while a decline in overall spending showcases efforts to meet budget constraints (The Pew Charitable Trusts & the John D. and Catherine T. MacArthur Foundation, 2014).

Individuals in custody of law enforcement tend to have poorer health status than the general population (Bingswanger, Krueger, & Steiner, 2009). Poor health can be exacerbated by environmental factors such as over-crowding, unsanitary conditions, and violence (Cloud, Parsons, & Delany-Brumsey, 2014). Common health issues include higher rates of infectious disease, mental health issues, and substance abuse disorders (Cloud, Parsons, & Delany-Brumsey, 2014).

A 2006 special report by the U.S. Department of Justice found that 56% of State prisoners, 45% of Federal prisoners, and 64% of jail inmates met Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) criteria for a mental health disorder (James & Glaze, 2006). This is a large divergence from the general public, where approximately 18% of U.S. adults live with a mental illness (SAMHSA, 2015). The National Institute on Drug Abuse (NIDA) estimates that more than 65% of the U.S. incarcerated population also met DSM-IV criteria for a substance use disorder (SUD) (National Institute on Drug Abuse [NIDA], 2020). By comparison, 8.1% of Americans over the age of 12 were estimated to have an SUD in 2014 (SAMHSA, 2015).

Prior to confinement, incarcerated populations have historically had difficulties affording medical services. A special report by the Bureau of Justice in 2002 stated that nearly 60% of people in jail reported a monthly income of less than $1,000 and over 19% reported no income at all (James, 2002). Medical insurance is also lacking for many incarcerated persons. One study of San Francisco jails concluded that approximately 90% of people entering were uninsured (Wang, White, Jamison, Goldenson, Estes, & Tulsky, 2008). A similar post-release study in Illinois conducted found 85% of people uninsured 16 months after their release from jail (Mallik-Kane, 2005). Incarcerated individuals are not eligible to purchase private insurance plans and, though they can apply for Medicaid coverage, it will not cover any medical services received during incarceration (HealthCare.gov, n.d.). Medicaid expansion has addressed access to healthcare in the community to a certain extent but does not cover

all services, which could explain the challenges that incarcerated populations have regarding their health.

Injuries within Correctional Facilities

Many individuals report sustaining an injury during their incarceration. The 2002 Survey of Inmates in Local Jails found that approximately 1 in 8 jail residents reported an injury since being admitted to the facility (Maruschak, 2006). Of these individuals, about half reported that their injury was the result of a fight and half reported injury due to an accident (Maruschak, 2006). Male residents were more likely to be injured compared to female residents (14% versus 10%) and were more likely to report injuries from a physical altercation (7% versus 4%) (Maruschak, 2006). Residents age 24 or younger were twice as likely to be injured compared to residents age 45 or older and five times as likely to be in an altercation (Maruschak, 2006). Length of stay also appeared to be a factor, with 4% of individuals with a stay of 7 days or less reporting an injury versus 30% of residents with an injury of 1 year or more (Maruschak, 2006). A 2012 study of injuries in New York City jails found that 66% of 4,695 reported injuries were classified as intentional (Ludwig, Cohen, Parsons, & Venters, 2012). Inmate-on-inmate aggression was identified as the leading cause of injury (40% of total injuries), following by slips and falls (27% of total injuries) (Ludwig, Cohen, Parsons, & Venters, 2012).

A 2010 study on the prevalence and risk factors of injuries in state prison found that prison residents were even more likely to report an injury during their stay. Data collected from the 2004 Survey of Inmates in State Correctional Facilities found that almost one-third of respondents had experienced an injury since admission (Sung, 2010). Risk factors for both violence-related and accident-related injuries included having history of violent offenses, violent victimization, and psychiatric treatment. (Sung, 2010). Work assignments appeared to protect against violence-related injury but increased the risk of sustaining an injury due to accident (Sung, 2010).

Another study within the prison system catalogued orthopaedic injuries sustained within a prison population. Of the 630 identified orthopaedic injuries, 65% were attributed to injuries of the hand and wrist region and 20% were attributed to the ankle and foot regions (Barreto, Sanchez, Grandizio, Maniar, & Horwitz, 2020). Upper limb injuries were found to occur at 2.5 times the rate of lower limb injuries (Barreto, Sanchez, Grandizio, Maniar, & Horwitz, 2020). Over a third (36%) of injuries required surgical treatment, with the most common procedures addressing ankle, metacarpal, or distal radius fractures (Barreto, Sanchez, Grandizio, Maniar, & Horwitz, 2020).

An important, understudied subset of injuries sustained in a correctional facility are those that are self-directed. A nationwide survey was distributed to the mental health directors in all 51 state and federal prison systems for a 2011 study on self-injurious behavior (Appelbaum, Savageau, Trestman, Metzner, & Baillargeon, 2011). Respondents revealed that, although less than 2% of the total prison population engaged in self-injurious behavior, 85% of systems experienced events involving self-injury at least weekly (Appelbaum, Savageau, Trestman, Metzner, & Baillargeon, 2011). Some respondents indicated that these events occur daily within their systems (Appelbaum, Savageau, Trestman, Metzner, & Baillargeon, 2011).

Methods

Data was taken from the trauma registry at the Marcus Trauma Center at Grady Memorial Hospital, which is a nationally verified Level 1 trauma center in Atlanta, Georgia. All hospitalized adults (aged 18 years or older) who presented to the trauma center between January 1, 2016 and December 31, 2020 were included in the initial dataset. All hospitalized adults (aged 18 years or older) who arrived to the emergency department and/or were discharged from the hospital in custody within this time frame were included in the primary study cohort. There was a total of 738 individuals in this cohort.

For comparisons made between patients in police custody and patients not in police custody, a three to

one matching ratio was utilized based on the chief complaint. For the few instances where an exact match could not be made based on chief complaint (n=25), the primary external cause of injury code (e-code) was used instead. A discharge status of "alive" was also part of inclusion criteria since all individuals in the first cohort were found to be discharged alive. This sample of 2214 individuals comprised the second cohort.

Patient demographics, injury patterns, clinical characteristics, and outcomes were collected and analyzed for both cohorts. Descriptive statistics were performed for individuals in police custody. Logistic regressions were run in SAS to make comparisons between demographics and health characteristics in the two cohorts. All comparisons controlled for age, gender, and race unless otherwise specified.

Ethical Consideration

Study protocol was reviewed and approved by the Emory University Institutional Review Board (IRB).

Results

A total of 24,695 trauma patients were hospitalized at the trauma center between January 1, 2016 and December 31, 2020. Of these, 738 (2.99%) of patients were identified as being under custody of law enforcement on arrival and/or discharge from the trauma center.

Demographics

The majority of the cohort were men (90.24%, n=666) with a mean age of 34.7 years (95% CI 22.7–46.7; SD +/- 12). Patients in police custody were far more likely to be men compared to patients not in police custody (OR 2.98; 95%CI 2.29–3.88). Nearly two-thirds (79.7%, n=588) of the patients were Black or African American and most were non-Hispanic or Latino (92.59%, n=2050). Patients in

police custody were more likely to belong to an ethnoracial minority compared to patients not in police custody (OR 1.35; 95%CI 1.07–1.71). Patients in police custody were even more likely to be Black or African American after controlling for major psychiatric illness, self-inflicted injury, drugs detected, illegal drugs, and alcohol above legal limit (OR 1.64; 95%CI 1.33–2.02).

Table 1: Patient Demographics for Both Cohorts

Variable	In Police Custody (n=738)	No Police Custody (n=2214)
Age		
Mean (SD)	34.7 (12.03)	39.67 (16.44)
Gender n (%)		
Male	666 (90.24)	1658 (74.89)
Race n (%)		
Black or African American	588 (79.67)	1525 (68.88)
White	107 (14.50)	475 (21.45)
Asian	4 (0.54)	26 (1.17)
American Indian	2 (0.27)	6 (0.27)
Other	23 (3.12)	102 (4.61)
Unknown	14 (1.90)	78 (3.52)
Ethnicity n (%)		
Hispanic or Latino	30 (4.07)	152 (6.87)
Not Hispanic or Latino	704 (95.39)	2050 (92.59)
Unknown	4 (0.54)	12 (0.54)

Patient Transport

Of the 738 total patients in police custody, 86 (11.65%) both arrived and left the trauma center in custody, 79 (10.70%) arrived but did not leave in custody, and the remaining 573 (77.64%) left but did not arrive in custody. Approximately three-quarters arrived by ground ambulance (73.44%, n=542). Most of the cohort (60.38%, n=667) was transported directly from the scene of the injury. Almost a sixth of individuals (16.40%, n=121) were injured in a zip code containing a county jail or federal prison.

Table 2: Patient Transport Information for Police Custody Cohort

Variable	n (%)
Arrived From	
Scene	667 (90.38)
Referring Hospital	38 (5.15)
Home	10 (1.36)
Other	21 (2.85)
Unknown	2 (0.27)
Zip Code of Injury	
In zip code of county jail or federal prison	121 (16.40)
Mode of Arrival	
Ground Ambulance	542 (73.44)
Police	165 (22.36)
Private/Public Vehicle	28 (3.79)
Helicopter Ambulance	2 (0.27)
Other	1 (0.14)

Injury Characteristics

Even though penetrating trauma made up only 38% of injuries, firearm was the single leading cause of injury overall (by chief complaint), with over a quarter of patients presenting with a firearm-related chief complaint (26.02%, n=192). This was followed closely by assault (24.93%, n=184) and motor vehicle collision (21%, n=155). The streets were the most identified place of injury (40.92%, n=302), followed by a home (13.96%, n=103) and a residential institution (13.55%, n=100). Over one-sixth (17.89%, n=132) of patients did not specify a place of injury. The mean injury severity score (ISS) was 9.98 (95% CI 9.41–10.55; SD +/- 7.97). Approximately five percent of the cohort was hospitalized as the result of a self-inflicted injury (4.47%, n=33), making them nearly two and a half times as likely to have a self-inflicted injury compared to patients not in police custody (OR 2.48; 95%CI 1.54–4.01).

Table 3: Injury Overview for Police Custody Cohort

Variable	n (%)
Injury Type	
Blunt force trauma	452 (61.25)
Penetrating trauma	286 (38.75)
Chief Complaint	
Assault	184 (24.93)
Bicycle	1 (0.14)
Biting	6 (0.81)
Fall	87 (11.79)
Firearm	192 (26.02)
Glass	6 (0.81)
Knife	38 (5.15)
Motorcycle	29 (3.93)
Motor vehicle collision (MVC)	155 (21.00)
Penetrating mechanism	19 (2.57)
Pedestrian	16 (2.17)
Other	1 (0.14)
Place of Injury	
Street	302 (40.92)
Home	103 (13.96)
Residential Institution	100 (13.55)
Public Building	59 (7.99)
Recreation	5 (0.68)
Industry	2 (0.27)
Farm	1 (0.14)
Unspecified	132 (17.89)
Unknown	19 (2.57)
Injury Severity	
Mean Injury Severity Score [ISS] (SD)	9.98 (7.97)
Self-inflicted?	
Yes	33 (4.47)

A total of 1720 injuries were reported among patients in police custody, averaging a total of 2.33 injuries per patient. The most frequently injured anatomical region was the lower extremity, with almost have of the cohort experiencing an injury in this region (47.15%, n=348). This accounted for over a fifth of the overall injuries (20.23%). The next most frequently injured region was the upper

extremity (18.20% of total injuries), followed by the face (14.65% of total injuries) and the thorax (13.66% of total injuries). External injuries were the least commonly reported, comprising only 2.73% of total injuries and with only 6.37% of the cohort experiencing them.

Table 4: Injury by Anatomical Region among Police Custody Cohort

Variable	n (% of total injuries)
Head Injuries	196 (11.40)
Face Injuries	252 (14.65)
Neck Injuries	52 (3.02)
Thorax Injuries	235 (13.66)
Abdomen Injuries	190 (11.05)
Spine Injuries	87 (5.06)
Upper Extremity Injuries	313 (18.20)
Lower Extremity Injuries	348 (20.23)
External Injuries	47 (2.73)
Total Injuries (n)	**1720**

Clinical Findings & Health Characteristics

Patients in police custody had a higher percentage of smokers (54.20% vs. 41.10%) and were found to be at a higher risk of being a current smoker (OR 1.43; 95%CI 1.20–170). Notably, patients in custody were at over two times the risk of having a major psychiatric illness compared to patients not in police custody (OR 2.14; 95%CI 1.27–3.60). Higher percentages of patients in police custody were diagnosed with alcohol use disorder, ADD/ADHD, and drug use disorder; however, the differences were not found to be statistically significant upon analysis.

Table 5: Patient Health Characteristics of Both Cohorts

Variable	In Police Custody (n=738)	No Police Custody (n=2214)
Alcohol Use Disorder	55 (7.45)	155 (7.00)
ADD/ADHD	9 (2.71)	17 (0.77)
Current Smokers	400 (54.20)	932 (41.10)
Drug Use Disorder	20 (2.71)	38 (1.72)
Major Psychiatric Illness	26 (3.52)	43 (1.94)

There did not appear to be a significant difference in testing between the two cohorts, with 71.27% of individuals in police custody tested versus 68.42% of those not in custody. This was confirmed in statistical analysis. Although the interpretation of blood alcohol levels can be unreliable, patients in police custody were more likely to have a blood alcohol content beyond the legal limit of 0.08 (OR 1.31; 95%CI 1.05–1.63). Patients in police custody were more likely to be tested for drug use (either prescription or illegal substances) than patients not in police custody (OR 1.62; 95%CI 1.35–1.95). Of the individuals tested, drugs were more likely to be detected in patients in custody (OR 1.59; 95%CI 1.30–1.94). Furthermore, the drugs detected were even more likely to be illegal substances such as cannabis, cocaine, methamphetamine, or heroin (OR 1.88; 95%CI 1.52–2.32).

Table 6: Patient Toxicology Results of Both Cohorts

Variable	In Police Custody (n=738)	No Police Custody (n=2214)
Alcohol Use Indicator [n (%)]		
No (Confirmed by Test)	351 (47.56)	1052 (47.52)
No (Not Tested)	212 (28.73)	698 (31.53)
Yes (Confirmed by Test) [Beyond Legal Limit]	146 (19.78)	345 (15.58)
Yes (Confirmed by Test) [Trace Levels]	29 (3.93)	118 (5.33)
Unknown	0 (0.00)	1 (0.05)
Drug Use Indicator [n (%)]		
No (Confirmed by Test)	65 (8.81)	155 (7.00)
No (Not Tested)	464 (62.87)	1628 (73.53)
Yes (Confirmed by Test) [Illegal Use Drug]	180 (24.39)	302 (13.64)
Yes (Confirmed by Test) [Prescription Drug]	21 (2.85)	97 (4.38)
Unknown	8 (1.08)	32 (1.45)

Hospital Outcomes

Of patients in police custody, the mean time spent in the hospital was 6.23 days (SD+/- 8.38). Over half of patients required emergent operations (57.99%, n=428) and 27.37% (n=202) were admitted to

the intensive care unit (ICU). The majority of patients were discharged or transferred to court or law enforcement (89.30%, n=659). Of the remaining 79 patients, most were discharged home with no continued services (8.40%, n=62) and a small percentage left against medical advice (0.54%, n=4).

Table 7: Hospital Outcomes of Police Custody Cohort

Variable	
Length of Hospital Stay	
Mean # days (SD)	6.23 (8.38)
Intensive Care Unit (ICU)	202 (27.37)
Mean # days (SD)	5.18 (7.21)
Operating Room (OR) [n (%)]	428 (57.99)
Discharged To [n (%)]	
Discharged Home with No Home Services	62 (8.40)
Discharged/Transferred to a Psychiatric Hospital or Distinct Unit of a Hospital	2 (0.27)
Discharged/Transferred to Court/Law Enforcement	659 (89.30)
Left Against Medical Advice or Discontinued Care	4 (0.54)
Not Applicable	11 (1.49)

Discussion

The results of this study give important insight into the demographics and injury characteristics of individuals seeking care for traumatic injuries prior to and/or following interactions with law enforcement. With much of the cohort being overwhelmingly male and belonging to an ethnoracial minority, the overrepresentation evident in the criminal justice system appears to persist in this study. Patients in police custody were significantly more likely to be Black or African American, even after multiple variables were explored to explain the racial disparities between the two cohorts. Most patients in police custody were hospitalized as the result of blunt force trauma (61.25%), with the leading causes of injury being firearm (26.02%), assault (24.93%), and motor vehicle collision (21.00%). Additionally, they were more likely to have a blood alcohol content over the legal limit (OR 1.31; 95%CI 1.05–1.63) and more likely to test positive for illegal drugs (OR 1.88; 95%CI 1.52–

2.32). Though the circumstances leading to initial contact with law enforcement are unknown, these results indicate potential for involvement with illegal activities. However, it is worth noting that alcohol levels in particular are notoriously unreliable from a clinical perspective and can be accompanied by ample bias and health inequities. Notably, patients in police custody were more likely to be diagnosed with a major psychiatric illness (OR 2.14; 95%CI 1.27–3.60) and more likely to have a self-inflicted injury (OR 2.48; 95%CI 1.54–4.01).

The overarching goal of this study was to contribute to the literature regarding injury morbidity among individuals in police custody. The obtained results both describe the injuries of this population and compare the population's characteristics to individuals not in custody. Although there is much to be explored, this gives powerful insight into the inequities that plague persons in police custody. Conversations devoid of stigma and bias are paramount to the patient-physician relationship and recognizing these inequities is the first step to diminishing both. Having a thorough understanding of the implications of inequity also allows physicians and officials the opportunity to develop ethical strategies regarding care. In addition, our findings emphasize the importance of tackling structural issues, such as institutionalized racism. This is particularly important in healthcare settings since physicians can be powerful patient advocates (Sue, 2017). Interactions with individuals in custody must also include an emphasis on privacy since they are at an increased risk for stigmatization (Scarlet & Dreesen, 2017).

This study is subject to certain limitations. It only includes patients of the trauma center, not other parts of the hospital. It also excludes care received at correctional facilities prior to or following care at the Marcus Trauma Center. Since multiple physicians are responsible for entering patient data into the database, there may be some variations in how data was recorded. Additionally, since patient health records are inclusive only of their visits to the trauma center, some preexisting conditions like

major psychiatric illnesses may not have been included for some patients within the dataset. For individuals with recorded interactions with law enforcement we have no details regarding prior or current charges, nor the circumstances of their arrest. It is possible that their injuries are not directly related to their custody status (i.e., law enforcement was called in the case of an outstanding warrant).

Further studies will be needed in order to understand the full scope of how and why individuals in custody of law enforcement utilize trauma services. Potential areas to explore could include disparities among chronic and mental health conditions, differences in chief complaints between cohorts, financial costs attributed to care, or geographical factors such as zip code of injury or patient residence. The finding that black skin and mental illness occur more frequently in a group that should otherwise be equal may have implications in field response. However, a larger qualitative study reviewing the circumstances surrounding custody status for individuals in police custody could provide crucial context for the results of this study. This may also answer certain questions regarding how individuals become entangled in the criminal justice system.

Conclusions

Individuals in the custody of law enforcement represent an important subset of patients with emergent health needs. The healthcare and societal costs attributed to these trauma patients is substantial and the vulnerability of the population is apparent. Therefore, it is crucial to have a thorough understanding of how care for traumatic injuries among individuals in custody of law enforcement is approached at every step of the way, from transport to discharge. It is our hope that this data will serve to generate hypotheses for future studies and provide guidance for potential interventions within the study population.

Resources

American Trauma Society [ATS]. (n.d.). *Trauma Center Levels Explained*. American Trauma Society. Retrieved February 18, 2022, from https://www.amtrauma.org/page/traumalevels

Appelbaum, K. L., Savageau, J. A., Trestman, R. L., Metzner, J. L., & Baillargeon, J. (2011). *A national survey of self-injurious behavior in American prisons*. Psychiatric Services (Washington, D.C.), 62(3), 285–290. Retrieved February 21, 2022 from https://doi.org/10.1176/ps.62.3.pss6203_0285

Band, R. A., Salhi, R. A., Holena, D. N., Powell, E., Branas, C. C., & Carr, B. G.. (2014). *Severity-Adjusted Mortality in Trauma Patients Transported by Police*. Annals of Emergency Medicine, 63(5), 608–614.e3. https://doi.org/10.1016/j.annemergmed.2013.11.008

Barreto Rocha, D., Sanchez, D., Grandizio, L. C., Maniar, H. H., & Horwitz, D. S. (2020). *Traumatic Orthopaedic Injuries in the Prison Population*. JAAOS: Global Research and Reviews, 4(4). https://doi.org/10.5435/jaaosglobal-d-20-00031

Belenko, S., & Peugh, J.. (2005). *Estimating drug treatment needs among state prison inmates*. Drug and Alcohol Dependence, 77(3), 269–281. https://doi.org/10.1016/j.drugalcdep.2004.08.023

Binswanger, I. A., Krueger, P. M., & Steiner, J. F. (2009). Prevalence of chronic medical conditions among jail and prison inmates in the USA compared with the general population. Journal of epidemiology and community health, 63(11), 912–919. https://doi.org/10.1136/jech.2009.090662

Carson, E. Ann. (2020, August). *Prisoners in 2018*. (Report No. NCJ 253516) Washington, D.C.: Department of Justice, Bureau of Justice Statistics. Retrieved February 18, 2022, from https://bjs.ojp.gov/content/pub/pdf/p18.pdf

Centers for Disease Control and Prevention, National Center for Injury Prevention and Control [CDC NCIPC]. (2020) Web-based Injury Statistics Query and Reporting System (WISQARS) [online]. Retrieved February 18, 2022, from www.cdc.gov/injury/wisqars

Cloud, D. H., Parsons, J., & Delany-Brumsey, A.. (2014). *Addressing mass incarceration: a clarion call for public health*. American Journal of Public Health, 104(3), 389–391. https://doi.org/10.2105/AJPH.2013.301741

Colnaric, J., Bachir, R., & El Sayed, M. (2021). *Factors Associated with Survival in Adult Trauma Patients Transported to US Trauma Centers by Police*. Prehospital and Disaster Medicine, 36(1), 58-66. doi:10.1017/S1049023X20001314

Ghassan Bou Saba, Rana Bachir & Mazen El Sayed (2021) *Impact of Trauma Center Designation Level on the Survival of Trauma Patients Transported by Police in the United States.* Prehospital Emergency Care, DOI: 10.1080/10903127.2021.1983092

HealthCare.gov. (n.d.). *Health Coverage Options for Incarcerated People*. HealthCare.gov. Retrieved February 18, 2022, from https://www.healthcare.gov/incarcerated-people/

Jacoby, S. F., Branas, C. C., Holena, D. N., & Kaufman, E. J. (2020). *Beyond survival: The broader consequences of prehospital transport by police for penetrating trauma*. Trauma Surgery & Acute Care Open, 5(1). https://doi.org/10.1136/tsaco-2020-000541

James, Doris. (2002, July). *Profile of Jail Inmates*, 2002. (Report No. NCJ 201932) Washington, D.C.: Department of Justice, Bureau of Justice Statistics. Retrieved February 18, 2022 from http://www.bjs.gov/content/pub/pdf/pji02.pdf

James, D. & Glaze, L.. (2006, September). *Mental Health Problems of Prison and Jail Inmates.* (Report No. NCJ 213600) Washington, D.C.: Department of Justice, Bureau of Justice Statistics. Retrieved February 18, 2022, from https://bjs.ojp.gov/content/pub/pdf/mhppji.pdf

Kaufman, E. J., Jacoby, S. F., Sharoky, C. E., Carr, B. G., Delgado, M. K., Reilly, P. M., & Holena, D. N. (2017). Patient Characteristics and Temporal Trends in Police Transport of Blunt Trauma Patients: A Multicenter Retrospective Cohort Study. Prehospital Emergency Care: Official Journal of the National Association of EMS Physicians and the National Association of State EMS Directors, 21(6), 715–721. https://doi.org/10.1080/10903127.2017.1332127

Landsman, I. S., Baum, C. G., Arnkoff, D. B., Craig, M. J., Lynch, I., Copes, W. S., & Champion, H. R. (1990). The psychosocial consequences of traumatic injury. Journal of behavioral medicine, 13(6), 561–581. https://doi.org/10.1007/BF00844735

Ludwig, A., Cohen, L., Parsons, A., & Venters, H. (2012). Injury Surveillance in New *York City Jails*. American Journal of Public Health, 102(6), 1108–1111. https://doi.org/10.2105/AJPH.2011.300306

Mallik-Kane, Kamala. (2005, August). *Returning Home Illinois Policy Brief Health and Prisoner Reentry.* Urban Institute, Justice Policy Center. Retrieved from https://www.urban.org/sites/default/files/publication/42876/311214-Returning-Home-Illinois-Policy-Brief-Health-and-Prisoner-Reentry.PDF

Maruschak, Laura M.. (2006, November). *Medical Problems of Jail Inmates.* (Report No. NCJ 210696) Washington, D.C.: Department of Justice, Bureau of Justice Statistics. Retrieved February 18, 2022 from https://bjs.ojp.gov/content/pub/pdf/mpji.pdf

Minton, T.D., Beatty, L.G., Zeng, Z.. (2021, July). *Correctional Populations in the United States, 2019 – Statistical Tables*. (Report No. NCJ 300655) Washington, D.C.: Department of Justice, Bureau of Justice Statistics. Retrieved February 18, 2022, from https://bjs.ojp.gov/sites/g/files/xyckuh236/files/media/document/cpus19st.pdf

National Institute on Drug Abuse [NIDA]. (2020, June 1). *Criminal Justice DrugFacts*. Retrieved February 20 from https://nida.nih.gov/publications/drugfacts/criminal-justice

National Institute of General Medical Sciences [NIGMS]. (2020, July 13). *Physical Trauma*. National Institute of General Medical Sciences. Retrieved February 18, 2022, from https://www.nigms.nih.gov/education/fact-sheets/Pages/physical-trauma.aspx

Penn Medicine. (n.d.). *When to go to a Trauma Center vs. the ER?* Penn Medicine. Retrieved February 18, 2022, from https://www.pennmedicine.org/for-patients-and-visitors/find-a-program-or-service/traumatology-surgical-critical-care-and-emergency-surgery/trauma-care-vs-er

Peterson, C., Miller, G.F., Barnett, S.B.L., Florence, C.. (2021, December 3) *Economic Cost of Injury — United States, 2019.* MMWR Morb Mortal Wkly Rep 2021;70:[1655-1659].

Peterson, C., Xu, L., & Florence, C.. (2021). *Average medical cost of fatal and non-fatal injuries by type in the USA.* Injury Prevention, 27(1), 1.1–10. https://doi.org/10.1136/injuryprev-2019-043544

The Pew Center on the States. (2008). *One in 100: Behind Bars in America 2008*. Washington D.C.: The Pew Charitable Trusts. Retrieved February 18, 2022, from https://www.pewtrusts.org/-/media/legacy/uploadedfiles/pcs_assets/2008/one20in20100pdf.pdf

The Pew Charitable Trusts and the John D. and Catherine T. MacArthur Foundation. (2014, July). *State Prison Health Care Spending: An Examination.* The Pew Charitable Trusts and the John D. and Catherine T. MacArthur Foundation. Retrieved February 18, 2022, from https://www.pewtrusts.org/-/media/assets/2014/07/stateprisonhealthcarespendingreport.pdf

Rold, W. J.. (2008). Thirty Years After Estelle v. Gamble: A Legal Retrospective. Journal of Correctional Health Care, 14(1), 11–20. https://doi.org/10.1177/1078345807309616

Scarlet, Sara, & Dreesen, Elizabeth. (2017). Surgery in Shackles: What Are Surgeons' Obligations to Incarcerated Patients in the Operating Room?. AMA Journal of Ethics, 19(9), 939–946. https://doi.org/10.1001/journalofethics.2017.19.9.pfor1-1709

Substance Abuse and Mental Health Services Administration [SAMHSA]. (2014) Trauma-Informed Care in Behavioral Health Services. Treatment Improvement Protocol (TIP) Series 57. HHS Publication No. (SMA) 13-4801. Rockville, MD: Substance Abuse and Mental Health Services Administration. Retrieved April 15, 2022, from https://www.ncbi.nlm.nih.gov/books/NBK207191/#:~:text=Initial%20reactions%20to%20trauma%20can,effective%2C%20and%20self%2Dlimited.

Substance Abuse and Mental Health Services Administration [SAMHSA]. (2015). *Behavioral health trends in the* United States: Results from the 2014 National Survey on Drug Use and Health. No. SMA-15-4927. Substance Abuse and Mental Health Services Administration. Retrieved February 18, 2022, from http://www.samhsa.gov/data/sites/default/files/NSDUH-FRR1-2014/NSDUH-FRR1-2014.htm

Sue, Kimberly. (2017). How to Talk with Patients about Incarceration and Health. AMA Journal of Ethics, 19(9), 885–893. https://doi.org/10.1001/journalofethics.2017.19.9.ecas2-1709

Sung H. E. (2010). Prevalence and risk factors of violence-related and accident-related injuries among state prisoners. Journal of Correctional Health Care: The Official Journal of the National Commission on Correctional Health Care, 16(3), 178–187. https://doi.org/10.1177/1078345810366287

Trauma Center Association of America [TCAA] Inc. (n.d.). *Trauma Center Levels Defined*. Trauma Center Association of America (TCAA), Inc. Retrieved February 18, 2022, from https://www.traumacenters.org/

United States Census Bureau. (2021, July 1). *U.S. Census Bureau QuickFacts: United States*. United States Census Bureau. Retrieved February 21, 2022, from https://www.census.gov/quickfacts/fact/table/US/PST045221

Wang, E. A., White, M. C., Jamison, R., Goldenson, J., Estes, M., & Tulsky, J. P.. (2008). *Discharge planning and continuity of health care: findings from the San Francisco County Jail*. American journal of public health, 98(12), 2182–2184. https://doi.org/10.2105/AJPH.2007.119669

Widra, E., & Herring, T.. (2021, September). *States of Incarceration: The Global Context 2021*. Prison Policy Initiative. Retrieved February 21, 2022, from https://www.prisonpolicy.org/global/2021.html

World Prison Brief. (2019). *Highest to Lowest - Prison Population Total*. World Prison Brief. Retrieved April 8, 2022, from https://www.prisonstudies.org/highest-to-lowest/prison-population-total?field_region_taxonomy_tid=All