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Distribution and determinants of police violence in California: Implications for young people and the role of psychiatric disorders

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Distribution and determinants of police violence in California: Implications for young people and the role of psychiatric disorders

By

Kriszta Farkas

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Abstract

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Many recent high-profile killings by law enforcement, including the killing of George Floyd, a 46-year-old Black man, on May 25, 2020, which led to large nationwide protests, have highlighted police violence as a critical public health problem in the United States (US).[1] Each year, approximately 1,000 individuals are killed by law enforcement,[2] and more than 80,000 are treated for nonfatal injuries caused by law enforcement in US emergency departments.[3] Experiences of police violence are inequitably distributed across the US population, with historically marginalized communities bearing the brunt of the burden.[4–6] Research also suggests that these incidents have health and social implications beyond physical injury, including adverse mental health outcomes and distrust in public safety institutions.[7–9] While a growing body of literature – with more recent substantial contributions from public health researchers – has made meaningful contributions to our understanding of the distribution and determinants of police violence, gaps remain due to various methodological limitations and a strong focus on particular individual-level factors. Specifically, past work has often overadjusted for potential mediating factors and has heavily relied on law enforcement agency records, which are prone to bias due to inaccurate reporting by officers and limit inference beyond the jurisdictions studied.[10–12] Additionally, existing research has often investigated police violence incidence aggregated across demographic characteristics or among a limited set of subgroups (e.g., men).

To build on prior work, this dissertation utilizes a large and diverse, population-based healthcare dataset of emergency department and inpatient hospital visits throughout California, from 2005-2017, to contribute to our understanding of experiences of police violence among marginalized groups. In particular, this work focuses on examining police violence among groups in which existing work has methodological limitations – specifically, individuals suffering from psychiatric disorder – and in which research has been limited – specifically, racially marginalized youth. Individuals with mental and substance use disorders are over-represented among police encounters and the criminal justice system;[11,13] however, most existing studies have controlled for potential mediating factors (e.g., hostile behavior/resistance) and have not been able to distinguish between particular types of disorders due to reliance on agency records.[14–17] Further, research assessing experiences of police violence among youth specifically is limited. Although encounters with law enforcement are less common at younger ages, experiences of police violence during childhood and adolescence may be particularly harmful, with potential acute and long-term adverse health implications.[18–20] Taken together with the disproportionate policing of Black youth, there is a need for research to document experiences of police violence in young people's lives.[21,22]

The first chapter provides background on police violence as a critical public health issue in the US and existing literature on the distribution and determinants of police violence. It also motivates the examination of the role of psychiatric disorders in police violence risk and of patterns of police violence among young people specifically. Chapters 2 and 3 examine the relationship between particular psychiatric disorders and nonfatal legal intervention injury among adults throughout California, using hospital discharge records from 2005-2014. Chapter 2 employs a cross-sectional design to assess the over-representation of specific disorders among nonfatal legal intervention injury cases compared to the general US adult population. This work finds that nonaffective psychoses, mood disorders, alcohol use disorders, and drug use disorders were substantially over-represented among adult nonfatal legal intervention injury cases, particularly those treated in inpatient settings, compared to the general population. Comparison of injury severity scores across legal intervention injury cases with and without the disorders studied suggests that the large prevalence differences observed among inpatient cases specifically may partially be explained by the selection of injury cases with disorders into the inpatient setting. Chapter 3 builds on these cross-sectional findings by presenting a cumulative case-control study to assess the relations between specific disorders and subsequent experiences of nonfatal legal intervention injury, both overall and by race/ethnicity, with careful consideration of confounder control to avoid overadjustment for potential mediating factors.[23,24] Results from Chapter 3 show that having particular mental and/or substance use disorder diagnoses in the year prior was strongly associated with subsequent nonfatal legal intervention injury among adults. The strongest associations were observed for personality disorder, comorbid mental and substance use disorder, nonaffective psychosis, and bipolar disorder, and relations varied by race/ethnicity. Potential direct (i.e., disorder-associated symptoms directly increasing risk of encounter and/or injury) and indirect (e.g., poverty- and homelessness-mediated relation between disorders and injury) mechanisms for these relations are discussed.

Chapter 4, a descriptive study, assesses the patterning of legal intervention injuries among young people specifically, throughout California, from 2005 to 2017 – examining inequities at the intersections of age, sex, and race/ethnicity. Findings reveal stark inequities in injuries caused by law enforcement among youth. Specially, they show that Black boys and girls, as young as 10 years old, experience markedly higher rates of injuries caused by law enforcement compared to youth of other races/ethnicities, and that relative inequities are larger at younger ages. These findings lend support to police violence as a form of structural racism, acting through both inequitable exposures to the criminal legal system and harsher outcomes during encounters among Black youth.[21,22,25] Chapter 5 provides overall conclusions, with discussion of the broader implications of findings and recommendations for future work. Overall, this work contributes epidemiologic evidence on the distributions and determinants of police violence, incorporating design and analytic approaches that overcome some of the limitations of existing research, and presents findings that may provide insight into potential points of intervention that can be leveraged to reduce incidents of police violence.

This work is dedicated to my parents, Tivadar Farkas and Kati Farkas; my sister, Timi Farkas; and my partner in life, Upal Sarker, and our kitties, Tobesie and Pen-Pie.

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Chapter 1: Introduction

1.1 Police Violence as a Public Health Problem

The United States (US) has a long history of police violence, particularly against communities of color and other marginalized groups – starting with slave patrols (the first state-sponsored police forces) during the era of slavery, and including the widespread police brutality during the 1960s Civil Rights Movement, as well as the horrific beating of Rodney King, a Black man, by Los Angeles Police Department officers in 1991, which led to nationwide protests.[4,26,27] More recently, numerous high-profile killings of individuals by law enforcement have highlighted police violence as an important public health issue in the US, fueling critical work by community leaders and activists, including that by the Black Lives Matter movement, to end police violence.[27–29] The 2014 killings of Michael Brown, an 18-year-old Black boy in Ferguson, Missouri, and Tamir Rice, a 12-year-old Black boy in Cleveland, Ohio, and the more recent killing of George Floyd, a 46-year-old Black man in Minneapolis, Minnesota, are just a few of these tragic incidents.

In 2018, the American Public Health Association issued a policy statement declaring police violence a critical public health problem in the US.[1] Since then, a number of other professional health organizations, including the American Medical Association and American Academy of Pediatrics, have followed with systems-level guidance on stemming the harms of structural racism, including police violence.[30,31] Based on nationwide death certificate data from the Centers for Disease Control and Prevention, between 2001 and 2019, over 9,000 individuals were killed by law enforcement in the US.[32] However, research suggests that such deaths are grossly undercounted in death certificate data and that the actual number is likely much higher.[33–35] In fact, one database that relies on crowdsourced data (e.g., media reports) estimates the number of deaths from 2001-2019 to be closer to 26,000.[2] While fatal incidents have received much attention from the media and research communities, over the same time period, there were more than 1.5 million individuals with nonfatal injuries caused by law enforcement treated in US emergency departments.[3] Further, deaths caused by law enforcement over the two-year period from 2015 to 2016 resulted in an estimated annual average of approximately 56,000 years of life lost, which is greater than that associated with unintentional firearm injuries (40,752) and similar to that due to maternal deaths (56,490) in the US.[36]

Although fatal and nonfatal injuries caused by law enforcement are rare and account for a small proportion of homicides and assaults overall in the US, they are inequitably distributed across the population, with racially marginalized groups bearing the greatest burden. Black and American Indian or Alaska Native individuals in the US have almost three times the rate of being fatally injured by law enforcement as do White individuals, and the rate among Latinx/Hispanic individuals is approximately 1.6 times that among White individuals.[4,6] Research has also found that 51.5% of all years of life lost due to police violence, from 2015 to 2016, were among people of color despite that they only accounted for 38.5% of the US population.[36] While inequities have decreased since the 1960s, Krieger and colleagues reported that mortality rates due to police violence among Black men, ages 15-34, have remained approximately three to four times those of same-aged White men since

the 1980s.[4] Research has also found similar patterns by race/ethnicity for nonfatal injuries caused by law enforcement treated in US hospitals.[5,37]

A growing body of literature also suggests that police violence may have implications for a range of social and health outcomes beyond injury. More recently, several studies have examined the relation between exposure to police victimization – whether through direct experiences or hearing about police killings in the media – and subsequent poor mental health. This work has found experiences of intrusive police stops to be associated with post-traumatic stress disorder and anxiety,[7] and various forms of police victimization (e.g., physical, sexual, psychological) to be associated with psychological distress, psychosis, and depression.[8,38] Bor and colleagues also reported that police killings of unarmed Black Americans were associated with an increase in poor mental health days among Black Americans living in the same state.[39] Further, cases of excessive police violence may have important implications for public trust in law enforcement and, thus, public safety. Desmond et al. found a substantial decrease in citizen crime reporting, particularly among residents of majority Black neighborhoods, following a high-profile police beating of an unarmed Black man in Milwaukee in 2004.[9]

1.2 Defining Police Violence, Use of Force, and Consequent Injuries

The scientific literature has used a variety of terms for conceptualizing and operationalizing police violence, law enforcement use of force, and consequent injuries caused by law enforcement. While these terms are all interconnected, it is important to clearly differentiate each. Police violence involves physical, psychological, and sexual violence, and neglect (i.e., not responding to a request for aid) by law enforcement (including police, sheriff's deputies, correctional officers, etc.).[1] Police use of force describes a set of behaviors that is used by law enforcement to gain control over a situation and lies along a broad continuum. This continuum ranges from milder behaviors, such as verbal commands (e.g., shouting/cursing, verbal threats) and restraints (e.g., handcuffing), to more coercive behaviors including physical force (e.g., punches, use of weapons).[40] Restraints and physical use of force may result in either nonfatal or fatal injuries caused by law enforcement. The level of force used by law enforcement can be described as "excessive" when it exceeds the amount deemed necessary or reasonable, given a particular encounter between law enforcement and the public.[41]

In this dissertation we used hospital patient discharge records to capture and examine legal intervention injuries, which are defined in the *International Classification of Diseases* (ICD) as nonfatal or fatal "injuries inflicted by police or other law-enforcing agents, including military on duty, in the course of arresting or attempting to arrest lawbreakers, suppressing disturbances, maintaining order, and performing other legal action."[42] Legal intervention injuries are classified according to the following means of injury: firearm discharge, explosives, gas, blunt objects, cutting/piercing instruments, other specified, unspecified, and late effects of legal intervention injury;[42] thus, they capture incidents of police violence, incorporating measures of both the type of force applied and the presence of a resulting injury.

1.3 Overview of Literature on Determinants of Police Violence

The majority of existing work on the determinants of police violence has come from disciplines outside of public health and epidemiology (e.g., criminology, criminal justice, etc.). The main focus has been on police use of force, with varying definitions along a continuum of force,[40] while fewer studies have explicitly examined consequent injuries/fatalities. Although results have been mixed, this work has reported various characteristics of the individual suspect (e.g., demographics, resistance/hostile behavior, socioeconomic status) and officer (e.g., demographics, education, experience/training) to be associated with use of force and/or consequent injuries. More specifically, young Black and Brown men,[43–48] individuals who display resistant, hostile, or disrespectful behavior,[46,47,49] and those of lower socioeconomic status[47,48] have been shown to be at increased risk of experiencing police use of force and/or consequent injuries. At the officer level, research suggests that law enforcement officers who are younger, male, and have less experience and education are at increased risk of using force and/or causing injury during encounters.[46,47,49–52] Much more limited work has examined the role of certain macro-level factors. For example, studies have shown that neighborhood disadvantage,[48] neighborhood crime level,[48,53–55] larger agency size,[53,55,56] and the presence of a full-time internal review unit[53] are associated with greater police misconduct (including use of force), whereas greater hours of in-service training[53] and more stringent recruiting practices[55] are associated with fewer incidents of misconduct. Although this work has improved our understanding of the factors that influence use of force and consequent injuries by law enforcement, the majority of studies have relied on data from a few law enforcement agencies. Agency records may be inaccurate because they often rely on officer perceptions and reporting of incidents and may not be generalizable outside of the particular jurisdictions studied.

As a result of the increased public health concern over police violence, an increasing number epidemiologic studies have aimed to characterize the nature and better understand the determinants of injuries and deaths perpetrated by law enforcement, using statewide and national datasets. This work has mainly examined temporal and geographic trends and racial/ethnic inequities in deaths by law enforcement,[4,6,34,36,57,58] while fewer studies have examined the incidence of nonfatal injuries specifically.[5,37,59] These studies have found substantial racial/ethnic inequities and variation across time and place[4–6,36,57,58,60] in rates of law enforcement-perpetrated deaths and injuries, and have highlighted the need for more valid and comprehensive data sources to enable more rigorous research.[34,61] Despite this progress, gaps in knowledge remain – for example, this body of literature has often examined experiences of police violence aggregated across demographic characteristics (e.g., racial/ethnic groups overall) or among a limited set of subgroups (e.g., young men). Therefore, our understanding of the experiences of other potentially marginalized groups (e.g., Black youth, individuals with psychiatric disorders, etc.) is still limited.

This dissertation aims to build on the existing body of literature by using a large and diverse, population-based database of emergency department and inpatient hospital records throughout California to better understand the distribution and determinants of legal intervention injuries. Chapters 2 and 3 assess the association between specific mental and substance use disorders and nonfatal legal intervention injury among adults, using California-wide records from 2005-2014. Specifically, the first chapter examines the extent to which particular psychiatric disorders are over-represented among nonfatal legal intervention injury cases, by comparing the disorder prevalence among injury cases at the time of treatment for injury to estimates from the National Comorbidity Survey Replication. The second chapter estimates the relationship between particular psychiatric disorders and nonfatal legal intervention injury, both overall and by race/ethnicity, paying careful attention to establish temporal ordering between exposure and outcome and to appropriately control for confounders (e.g., by limiting adjustment for potential mediating factors). Chapter 4

assesses the distribution of legal intervention injuries experienced by young people specifically, overall and at the intersections of age, sex, and race/ethnicity, as well as over time, from 2005 to 2017.

1.4 The Role of Psychiatric Disorders in Risk of Experiencing Police Violence

Several recent high-profile fatal police violence incidents involving individuals with mental illness suggest a potential relationship between mental disorders and injury or death caused by law enforcement.[62–64] This phenomenon may also extend to individuals experiencing substance use disorders because some of the associated behavioral symptoms and social consequences overlap with those of certain mental disorders.[65] Further, comorbidity across mental and substance use disorders is common.[66] An extensive body of literature has documented the over-representation of individuals with mental and substance use disorders in the legal system[13,67–69] and among law enforcement encounters.[70–73] Individuals who experience certain types of psychiatric disorders are more likely to come into contact with law enforcement through 1) increased risk of being victimized;[74] 2) increased risk of engaging in criminal and violent behavior;[75–77] and 3) because law enforcement officers are often the first to respond to mental health crises.[71] Disorder-associated symptoms may be either directly or indirectly (e.g., through downstream social consequences, such as poverty and homelessness) linked to increased risk of victimization and criminal/violent offending.[78,79] Furthermore, certain disorder-related symptoms (e.g., delusions and hallucinations associated with psychosis; disturbances in perception and judgement related to substance use disorder) may increase the risk of being injured during an encounter with law enforcement. Specifically, such symptoms may result in individuals engaging in behaviors that are perceived by officers as resistant or hostile rather than as a result of disease and may therefore increase the likelihood of use of force.

Evidence from existing research on the relation of mental and substance use disorders with use of force/injury by law enforcement has been mixed. While two recent epidemiologic studies have found positive associations between mental and substance use disorders and injury by law enforcement,[80,81] a number of studies outside of epidemiology have reported mixed findings.[14–17] However, these studies have largely relied on law enforcement agency records from a single or few agencies, with relatively small samples and limited generalizability. Use of agency records also relies on officer reports of perceived psychiatric disorder status and use of force or injury to classify exposure and outcome, respectively, which may be prone to considerable misclassification due to inaccurate perceptions or reporting by officers.[10–12] Additionally, most of these studies have adjusted for suspect resistance/behavior during the encounter,[14–17] which may be downstream of psychiatric disorders and thus, should not be adjusted.[23]

Chapters 2 and 3 of this dissertation build on this existing literature by examining the relationship between particular psychiatric disorders and nonfatal legal intervention injury using clinically objective measures from a large, population-based healthcare database of patient discharge records throughout California. Chapter 3, specifically, examines the relationship overall and whether it varies by racial identity. To our knowledge, research has not previously explored variation by race/ethnicity, despite the varying prevalence of psychiatric disorders[82,83] and inequitable distribution of legal intervention injury across racial/ethnic groups.[5,6] Further, certain types of disorders may be more strongly associated with increased risk of injury by law enforcement,[80,81] and while a clear

understanding of which disorders are most influential for injury may help inform the development of targeted prevention strategies, the majority of existing work has not been able to untangle this. Lastly, this work will estimate the overall relationship between particular disorders and nonfatal legal intervention injury – which takes into account both risk of exposure to law enforcement and risk of injury during encounter. In contrast, studies have most often used agency records, comparing use of force/injury outcomes between individuals with and without disorders *only* among those who encounter officers; thus, not accounting for disparate risk of law enforcement encounter (which may be particularly salient for individuals suffering from psychiatric disorders). Estimating the overall association, rather than the encounter-conditional association, allows us to understand the overall influence of mental and substance use disorders on injury caused by law enforcement and may highlight alternative public health and policy strategies to reducing injury in this potentially high-risk group.

1.5 Experiences of Police Violence Among Young People

Although exposure to law enforcement and police violence is not as common among youth as adults, children and adolescents may be particularly harmed by experiences of police violence because early-life exposure to trauma – especially during critical developmental periods – has been shown to have lasting adverse effects over the life course.[19,20] Further, the burden of police violence among youth may vary by demographic characteristics, indicating potentially inequitable consequences. Although children are generally perceived by society as innocent and in need of protection, existing research suggests that these protections are no afforded equally to all youth. For example, literature documents the racialized construction of both Black boys and girls as older, less innocent, and in need of less protection compared to White boys and girls.[84–86] Research has also reported the disproportionate policing of Black youth.[21,22] Thus, there is a need to examine the distribution of police violence among children and adolescents specifically.

Existing literature on the burden of police violence, and in particular law enforcement-perpetrated injuries, among youth specifically is limited. To date, literature has documented mechanisms of exposure to policing (e.g., stop-and-frisk, witnessing police violence, etc.), the nature and distribution of encounters, as well as certain adverse consequences among youth.[22,25] Although limited, this work has consistently reported that racially marginalized young people are much more likely to be exposed to policing and to experience harsher outcomes during encounters (e.g., excessive use of force, injury, death).[4,5,22,25] Research also suggests that exposure to police violence is associated with racial/ethnic inequities in downstream adverse health outcomes among children and adolescents, including poor mental health, substance use, and sleep deprivation.[22,87–89] Chapter 4 of this dissertation examines the temporal and demographic distributions of legal intervention injuries among young people treated in hospitals throughout California. This builds on prior research, which has often pooled across demographic characteristics or focused only on certain subgroups (e.g., boys), by examining rates of legal intervention injuries among youth, 19 years and younger, at the intersections of age, sex, and race/ethnicity.

Chapter 2: Mental and Substance Use Disorder Prevalence Among Legal Intervention Injury Patients

2.1 Introduction

While incidents of police use of force in the United States (US) are not new, use of force by law enforcement has gained significant attention as a public health issue in the US.[29,61] Research aimed at assessing the burden and nature of law enforcement use of force, and particularly identifying groups at high risk of experiencing use of force, is important for ensuring that officers and agencies are held accountable and for informing public health and policy strategies. While use of force does not always lead to injury, and injuries caused by law enforcement account for a small proportion of injuries overall in the US, the number of injuries caused by law enforcement – particularly nonfatal injuries – is substantial. Between 2001 and 2016, there were almost 6,500 deaths due to injury caused by law enforcement in the US and almost 1.3 million nonfatal injuries due to law enforcement treated in US hospitals.[3,32] Furthermore, the age-adjusted rates of both fatal and nonfatal injury perpetrated by law enforcement have increased over this time period[3,32] Public health research to date on police use of force has largely focused on national trends and racial/ethnic disparities in fatal incidents.[4,6,34,36,57,58,60,90] Far less is known about nonfatal injuries despite their much higher frequency and health system burden.

Recent high-profile deaths caused by law enforcement of individuals suffering from mental illness suggest a potential link between mental disorder and injury due to law enforcement.[62–64] Approximately 25 percent of firearm-related deaths caused by law enforcement in the US between 2015 and 2017 involved individuals with suspected mental illness.[91] However, little research has examined this intersection among nonfatal injuries. Improved understanding of contact between law enforcement and individuals with mental illness is critical given that law enforcement personnel are often the first responders to mental health crises.[71] Further, this phenomenon may extend to individuals experiencing substance use disorders, which are associated with similar behavioral symptoms and social consequences, and often co-occur with mental disorders.[65,69]

Mental and substance use disorders may influence the risk of injury by law enforcement both directly (i.e., through associated behavioral symptoms) and indirectly (e.g., through downstream social factors).[69] Individuals with certain disorders are more likely to encounter law enforcement through an increased risk of criminal victimization;[74] increased risks of criminal offending and violent behavior;[75–77] and because law enforcement personnel are often first responders to mental health crises.[71] Risk of victimization and criminal/violent behavior may be either directly related to disorder-associated symptoms, or indirectly related to disorders through downstream social consequences, such as unemployment, poverty, and homelessness.[78,79] Symptoms associated with mental and substance use disorders may also increase the risk of injury during a police encounter. For example, individuals with severe mental disorders such as psychoses can experience delusions, hallucinations, and agitated body movements, among other symptoms.[92] Similarly, substance use disorders are characterized by disturbances in perception, judgement, and psychomotor behavior.[65]

Such symptoms may lead to behaviors that are perceived as resistant/hostile during encounters rather than as a result of disease and may therefore increase the likelihood of use of force.

To date most research on the co-occurrence of mental and substance use disorders and police use of force has relied on law enforcement agency data,[14–17] which may suffer from misclassification due to reliance on officer perceptions and reporting of disorder status and use of force.[10–12] These studies have also typically included few law enforcement jurisdictions, which limits generalizability of findings.[14–17] To our knowledge, only two US-based epidemiologic studies have assessed the prevalence of specific mental and substance use disorder diagnoses among individuals injured by law enforcement.[80,81] While they reported co-occurrence between mental and substance use disorder and injuries caused by law enforcement, one was limited to only 31 firearm-related injuries in Seattle, WA, between 2010 and 2014[81] and the other included 836 injuries in Illinois, 2000–2009, which either resulted in hospitalization or were treated in outpatient trauma centers.[80] Thus, the findings may not be generalizable to other populations. Furthermore, the study by Holloway-Beth and colleagues utilized general assault injury cases for comparison rather than a general population – given that individuals with certain mental and substance use disorders have increased risk of violent victimization,[74] general assault injury cases likely overestimate the prevalence of disorders in the general population from which police use of force injury cases arise. Lastly, neither study examined nonfatal injuries separately.

In this study, we aimed to assess the overall association between specific mental and substance use disorders and nonfatal injury caused by law enforcement using California-wide inpatient hospital and emergency department records from 2005 to 2014. We assessed the extent to which the prevalence of nonaffective psychoses, anxiety disorders, mood disorders, suicidal ideation, alcohol use disorders, and drug use disorders were overrepresented among nonfatal legal intervention injury cases compared to the general US population. Examining the overall association using a large population-based dataset is an important first step that can help inform strategies for reducing injury perpetrated by law enforcement.

2.2 Data and Methods

2.2.1 Data Description

We used statewide data from the California Office of Statewide Health Planning and Development on all inpatient hospitalizations and emergency department visits in California, between January 1, 2005 and December 31, 2014. These data exclude patient encounters at federal hospitals (e.g., active-duty military and Veteran's Affairs hospitals) because these facilities are not required to report to the state. However, our data likely capture a vast majority of emergency department and inpatient hospital encounters throughout the state because only 16 (4.3%) of the 375 hospitals in California are federal hospitals.[93–95]

International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) external cause of injury codes (e-codes) and diagnostic codes were used to identify nonfatal legal intervention injuries and particular mental and substance use disorder diagnoses, respectively (Table 2.1). Under ICD-9-CM legal intervention injuries are defined as "injuries inflicted by police or other law-enforcing agents, including military on duty, in the course of arresting or attempting to arrest lawbreakers,

suppressing disturbances, maintaining order, and performing other legal action."[42] Psychiatric disorders are documented in hospital discharge data under various circumstances, including: 1) during mental health crises and other situations in which disorders are the primary reason for care (e.g., alcohol intoxication); 2) as part of the medical history-taking process (e.g., during patient chart review); 3) if the disorder(s) are related to or have any bearing on the complexity of care (e.g., a complicating factor that needs to be considered in the patient's treatment plan); and 4) during the process of diagnosing a patient's condition (e.g., a healthcare provider may note that a patient's chest pain could be physical manifestations of a psychiatric disorder).[96–99] Thus, hospital administrative data are likely to capture more severe psychiatric conditions (e.g., those resulting in psychiatric crises or those more likely to be a complicating factor for the delivery of acute care) than those that are less severe or well-managed.

Patients were classified as having a nonfatal legal intervention injury if any of the five possible e-codes present in the patient record included one of the ICD-9-CM legal intervention injury e-codes and they did not die in the hospital (N = 5,267 for inpatient cases, N = 84,832 for emergency department cases). Nonfatal legal intervention injury cases were identified as having a particular mental or substance use disorder if any of the twenty-five possible diagnostic codes present in the patient record, at the time of their injury, included one of the ICD-9-CM mental or substance use disorder diagnostic codes specified in Table 2.1. Legal intervention injury cases first seen in the emergency department but later admitted to the hospital were only included in the inpatient hospitalization data.

Analyses were restricted to adult nonfatal legal intervention injury cases 18 years and older, in order to compare disorder prevalence estimates with general US adult population-based estimates from the National Comorbidity Survey Replication (NCS-R).[100–102] The NCS-R is a nationally representative survey that captured specific mental and substance use disorders among adults in the US from 2001–2003, which map onto Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) and ICD-10 criteria and definitions.[103] Adults, ages 18 years and older, accounted for 91.5 percent of all nonfatal legal intervention injury cases in California over the study period.

2.2.2 Statistical Analysis

For each mental and substance use disorder studied, we calculated the percent of nonfatal legal intervention injury cases with a documented disorder diagnosis in their inpatient or emergency department discharge record. To account for important demographic characteristics associated with law enforcement encounter and use of force,[4,36,90,104] we also standardized prevalence estimates by age, sex, and race/ethnicity for injury cases with complete demographic data (N = 5,170 (98.2%) of inpatient cases, N = 82,266 (97.0%) of emergency department cases). The US Census population from the year 2000 was used as the standard because it closely aligns with the NCS-R survey years (2001-2003). For both the crude and standardized prevalence estimates, we calculated prevalence difference (PD) estimates and 95% confidence intervals (CI) for statistical inference, comparing them to the NCS-R estimates. For nonaffective psychoses and suicidal ideation, we used 2001-2003 NCS-R 12-month prevalence estimates and standard errors for the prevalence difference and 95% CI calculations – the most recent estimates available.[100,102] For anxiety disorders, mood disorders, alcohol use disorders, and drug use disorders, we used 2007 updated NCS-R 12-month prevalence estimates and standard errors, which incorporated the latest diagnostic, demographic, and raw

variable information.[101] Results were stratified by inpatient status (i.e., inpatient hospital vs. emergency department treatment) because disorder prevalence may vary by injury severity and inpatient hospitalization may indicate more severe injury.

Recognizing that individuals may have been treated for nonfatal legal intervention injuries on multiple occasions over the study period, we performed a sensitivity analysis on the subset of patients present in our data only once. While multiple visits for nonfatal legal intervention injury are likely rare, we could not distinguish individual patients in approximately 20% of injury records because the unique patient identifier was missing (see Supplemental Material for further details). Among nonfatal legal intervention injury cases with a unique patient identifier, only 6.3% and 4.9% of emergency department cases and inpatient cases, respectively, were treated on multiple occasions (Table 2.4). However, to avoid counting the same injury patient with a mental disorder more than once, and for correct statistical inference, we conducted a sensitivity analysis where we restricted to patients with only one nonfatal legal intervention injury over the study period.

In addition, to assess the potential role that selection of legal intervention injury patients with mental or substance use disorders into the hospital system may play in explaining findings, we examined injury severity, comparing injury patients with and without disorders. Literature suggests that interactions between law enforcement and individuals with mental disorders are often resolved in one of three ways: admission to a psychiatric hospital, arrest, or informal resolution.[105] While hospitalization seems to be the least common,[105] we were concerned that individuals with mental disorders and minor injuries may be more likely to be brought into the hospital system – motivated by the mental disorder symptoms rather than by the injury – whereas those who do not have a mental disorder and suffer minor injuries during an encounter may be unlikely to be brought into the hospital system for treatment. We assigned injury severity scores (ISS) for each nonfatal legal intervention injury patient using the International Classifications of Diseases Program for Injury Categorization (ICDPIC) tool in Stata, a validated tool for capturing injury severity.[106] We categorized ISS as minor, moderate, serious, severe, or critical, and also calculated mean and median ISS.[107] The distribution of ISS was compared between nonfatal legal intervention injury patients with and without a) any substance use disorder and b) any mental disorder studied, both overall and by inpatient status. See Supplemental Material for further details on the sensitivity analysis and examination of the ISS.

Analyses were conducted using SAS version 9.3 (SAS Institute Inc., Cary, NC) and Stata version 13.1 (StataCorp, College Station, TX). The California Health and Human Services Agency and University of California, Berkeley Committees for the Protection of Human Subjects approved this study.

2.3 Results

Between 2005 and 2014, there were 90,099 adult patients treated for nonfatal legal intervention injury in California hospitals. Approximately 5.8% (N = 5,267) of cases were hospitalized. Compared to the general California and US populations, nonfatal legal intervention injury cases were disproportionately male, young, and either non-Hispanic/Latinx Black or Hispanic (Table 2.2).

Overall, mental and substance use disorders were overrepresented among nonfatal legal intervention injury patients compared to the general US population; however, results varied by disorder type and inpatient status (Table 2.3). In age-, sex-, and race/ethnicity-standardized analyses, the prevalence of nonaffective psychoses (PD: 19.2%, 95% CI: 18.0, 20.4), mood disorders (PD: 15.3%, 95% CI: 13.9, 16.7), alcohol use disorders (PD: 21.1%, 95% CI: 19.8, 22.4), and drug use disorders (PD: 29.7%, 95% CI: 28.4, 31.0) was substantially higher among inpatient legal intervention injury cases compared to the general US population. Suicidal ideation was slightly elevated (PD: 1.7%, 95% CI: 0.9, 2.5). In contrast, anxiety disorders were substantially underrepresented (PD: −12.0%, 95% CI: −13.5, −10.5).

Among nonfatal legal intervention injury cases treated in the emergency department, the prevalence of all disorders was substantially lower compared to inpatient cases. However, the pattern of associations was generally similar, with the exception of mood disorders and suicidal ideation. As among inpatient legal intervention injury cases, compared to the general US population, emergency department-treated patients had higher prevalence of nonaffective psychoses (PD: 2.8%, 95% CI: 2.4, 3.2), alcohol use disorders (PD: 8.2%, 95% CI: 7.6, 8.8), and drug use disorders (PD: 4.8%, 95% CI: 4.4, 5.2) and lower prevalence of anxiety disorders (PD: −16.5%, 95% CI: −17.9, −15.1). In contrast, mood disorders and suicidal ideation were underrepresented among emergency department legal intervention injury patients (PD: −6.4%, 95% CI: −7.2, −5.6; and PD: −2.0%, 95% CI: −2.6, −1.4, respectively). Results of the sensitivity analysis, which limited individuals to inclusion once over the study period, were consistent with those of the main analysis (Table 2.5). Specifically, the overall pattern of associations was the same as in the main analysis for both inpatient and emergency department nonfatal legal intervention injury cases, with very small changes in the magnitude and precision of prevalence difference estimates.

The distribution of injury severity, as captured by the ISS, is presented in Tables 2.6-2.8 in the Supplemental Material. Examination of injury severity showed that nonfatal legal intervention injury patients overall (emergency department and inpatient combined) who had a documented disorder experienced more severe injuries than those without a disorder (for substance use disorder, mean ISS of 2.3 vs. 1.9; for mental disorder, mean ISS of 2.3 vs. 2.0; Table 2.6). Inpatient injury cases overall experienced substantially more severe injuries than those treated in the emergency department (Tables 2.7-2.8). The distribution of ISS was similar for emergency department injury patients with and without disorders (for substance use disorder, mean ISS of 1.8 vs. 1.8; for mental disorder, mean ISS of 1.7 vs. 1.8), however it meaningfully differed for inpatient legal intervention injury patients. Specifically, inpatient cases with a documented disorder had a lower mean ISS than those without a disorder (for substance use disorder, 5.6 vs. 6.7; for mental disorder, 4.0 vs. 7.2).

2.4 Discussion

We found that certain mental and substance use disorders, particularly nonaffective psychoses, alcohol use disorders, and drug use disorders, were substantially overrepresented among adults treated for nonfatal legal intervention injury in California hospitals from 2005 to 2014, compared to the general US adult population. Nonaffective psychoses are characterized by delusions, agitated body movements, and poor executive functioning, among other symptoms.[108] Similarly, individuals with substance use disorders may experience disturbances in perception, judgement, and psychomotor behavior.[108] Thus, individuals with these disorders, when symptomatic, may exhibit

behaviors perceived as resistant or hostile during law enforcement encounters. Research suggests that psychosis and substance use disorder, both individually and particularly in combination, increase the risk of criminal offending and violent behavior.[77,109] Individuals with mental illness are also more likely to resist and slightly more likely to assault officers during encounters, which are both linked to increased injury risk.[16] Lastly, these disorders can also lead to more frequent law enforcement encounters through increased risk of victimization,[74] downstream social consequences such as poverty and homelessness,[69,78,79] and because law enforcement are often first responders to mental health crises.[71] Therefore, the combination of increased risk of a police encounter and increased risk of actual or perceived resistant behavior during encounters may result in higher injury risk for these groups.

Whereas results for mood disorders and suicidal ideation were mixed by inpatient status, the prevalence of anxiety was substantially lower among both inpatient and emergency department nonfatal legal intervention injury cases compared to the general US population. While research suggests that these disorders may also be associated with criminal offending and violence,[109] victimization,[74,110] and more frequent police encounters during crises,[71] they are generally characterized by fewer overt symptoms.[108] Thus, they may be missed and not documented by healthcare personnel more often in legal intervention injury cases, for whom injury may be the primary reason for care, and particularly if they are treated in the fast-paced emergency department environment.

Nonaffective psychoses, mood disorders, alcohol use disorders, and drug use disorders were most strongly overrepresented among inpatient nonfatal legal intervention injury cases. There may be several potential explanations for this. First, because individuals with these disorders may be more likely to exhibit behaviors that can be perceived as resistant or hostile, law enforcement officers may be more likely to use greater force, causing injuries severe enough to require inpatient hospitalization rather than treatment in outpatient emergency department settings.[16] Second, legal intervention injury patients with disorders may be more likely to be hospitalized as inpatient cases compared to those without disorders – regardless of injury severity. This may be in direct response to their disorder, as they may be hospitalized if law enforcement officials perceive them to be a danger to themselves or others.[105] While inclusion of substance use disorders in involuntary hospitalization statues varies by state, California's statutory definition contains language indicating that substance use disorders may be included.[111] Research also suggests that individuals with mental and substance use disorders are generally at greater risk of physical comorbidities, delayed or inadequate healthcare, and hospitalization.[112–117] Lastly, differences in the assignment of disorder diagnoses between inpatient hospital services and fast-paced emergency department environments may lead to under-diagnosis of mental and substance use disorders in emergency department discharge records.

Our analyses of injury severity scores support both the first and second potential explanations described above (i.e., greater risk of more severe injury among those with disorders, and selection of individuals with disorders into the inpatient setting, respectively). The finding of similar ISS across emergency department nonfatal legal intervention injury patients with and without a disorder suggests no selection of injury patients with disorders into the emergency department. That is, although it was plausible that law enforcement personnel may bring an individual experiencing mental disorder symptoms to the emergency department – motivated more so by the symptoms rather than any injury, or even due only to the symptoms and with no injury present – this analysis does not support that possibility because legal intervention injury severity did not differ in the emergency department setting by mental disorder status. However, while inpatient injury cases both

with and without a disorder had meaningfully higher ISS than those treated in the emergency department, ISS among inpatient cases varied by disorder status – specifically, it was lower among those with a disorder. Taken together, these findings suggest that while nonfatal legal intervention injury patients with a disorder do not appear to be "selected" into the hospital system as a whole, they are more likely to end up in the inpatient setting, even with more minor injuries. Thus, the particularly large differences we found in mental and substance use disorder prevalence between inpatient adult nonfatal legal intervention injury cases and the general US adult population are likely partially due to the fact that injury patients with disorders are more likely to be hospitalized compared to those without – for reasons other than injury severity.

We used general US rather than California-specific population-based prevalence estimates as a comparison in this study. To our knowledge, while other sources such as the National Survey on Drug Use and Health (NSDUH) provide state-specific estimates of broader mental disorder categories (e.g., severe mental illness and any mental illness), they do not provide estimates for specific mental disorders. However, the available estimates of mental and substance use disorder measures from the 2013–2014 NSDUH were similar for California and the US,[118] suggesting that a general US comparison group may be appropriate.

A general population comparison group may be seen as inappropriate if the study aim were to examine whether mental and substance use disorders are overrepresented among law enforcement encounters resulting in injury. However, our aim was to examine the overall association between specific disorders and nonfatal legal intervention injury, which incorporates both risk of encounter and risk of injury given encounter. While law enforcement encounter is a more proximal (and certainly necessary) cause of legal intervention injury, certain subgroups of the general population may be at increased risk of encounters. For example, individuals with severe mental illness suffering from periods of intense symptoms (e.g., a psychotic or manic episode) may be at particularly increased risk of law enforcement encounter. Thus, to estimate the overall association between mental and substance use disorders and nonfatal legal intervention injury, we need a general population comparison group to allow for this disparate likelihood of encounter.[44] Although this study does not distinguish the risk of encounter from the risk of injury given encounter for people with disorders, it is a valuable first step, with implications for policy and clinical practice. Symptoms associated with particular mental and substance use disorders likely play an important role in both pieces of this pathway. Therefore, our findings support the importance of research on interventions aimed at reducing encounters in the first place (e.g., programs that improve treatment and downstream social outcomes, such as homelessness, for individuals with disorders), as well as those aimed at reducing the use of force during encounters (e.g., improving law enforcement recognition of disorders most strongly associated with injury). Furthermore, clinician knowledge of the relationship between mental and substance use disorder and legal intervention injury has implications for mental health evaluation and treatment of patients receiving care for legal intervention injury in clinical settings. However, further research is needed to identity factors along the pathway that are most salient for public health and policy interventions.

This study has several limitations. First, while the NCS-R provides nationally representative prevalence estimates for specific mental and substance use disorders, disorders in the NCS-R were captured using a different process and for a different time period from those used among the legal intervention injury cases in this study (i.e., community-based survey, 2001–2003 vs. physician documentation and hospital coding/billing, 2005–2014). Second, misclassification of legal intervention injuries and mental and substance use disorders is possible in hospital administrative

data. However, reporting of external causes of injury (including legal intervention) is mandatory in California hospital discharge records.[119] Furthermore, studies indicate that fatal legal intervention injuries are underestimated using ICD-10 mortality codes from death certificate data;[33] limited research suggests that this may also be true for nonfatal legal intervention injuries in hospital administrative data, although more rigorous validation studies are needed.[120] Similarly, validation studies suggest that mental and substance use disorders are more likely to be underreported rather than overreported in hospital administrative data.[121] If misclassification of nonfatal legal intervention injury is nondifferential by mental and substance use disorder status (and vice versa with respect to disorder misclassification by legal intervention injury), then bias in the prevalence difference estimates presented would be towards the null. However, given the differing processes by which disorders were assessed in the NCS-R and hospital administrative data, differential misclassification of disorders is possible. Specifically, the aim of the NCS-R was to capture particular psychiatric disorders among adults throughout the US. Disorders were captured using the World Health Organization World Mental Health Composite International Diagnostic Interview – a comprehensive, fully-structured lay interview, which had good concordance with blind clinical re-interviews using the Structured Clinical Interview for DSM-IV.[103] Thus, it is possible that mental and substance use disorders among the nonfatal legal intervention injury cases in the hospital administrative data were underreported to a greater extent than among the NCS-R participants. In this case, our results would still be biased towards, rather than away from, the null. Finally, given the cross-sectional nature of the data, we cannot determine temporal ordering. Therefore, while mental and substance use disorders may contribute to legal intervention injury risk, it could also be that experiences of legal intervention injury may lead to incident or exacerbation of existing disorders.

Despite these limitations, to our knowledge, this is the first study to assess the overall association between specific MSUDs and nonfatal legal intervention injury using a large, population-based dataset in the US. Further, our study used potentially more objective clinical measures of legal intervention injury and specific mental and substance use disorder diagnoses, whereas prior research has largely relied on officer perceptions and reporting of use of force and mental status.[10–12]

Table 2.1 International Classification of Diseases, Ninth Revision, Clinical Modification legal intervention injury and mental and substance use disorder codes included in analysis.

Measure	**ICD-9-CM code(s)**
Legal intervention injury	E970-E977
Injury by firearms	E970
Injury by explosives	E971
Injury by gas	E972
Injury by blunt object	E973
Injury by cutting and piercing instrument	E974
Injury by other specified means	E975
Injury by unspecified means	E976
Late effects of injuries due to legal intervention	E977
Nonaffective psychosis	295 (all subtypes); 297 (all subtypes); 298.9
Anxiety disorder	300.0 (all subtypes); 300.21-300.23, 300.29; 300.3; 309.21; 309.81
Mood disorder	296 (all subtypes); 300.4
Suicidal ideation	V62.84
Alcohol use disorder	303 (all subtypes); 305.0 (all subtypes)
Drug use disorder	304 (all subtypes); 305.2-305.9 (all subtypes)

Table 2.2 Demographic characteristics of adult legal intervention injury cases in California, 2005-2014, and the general California and US adult populations, 2000.

Characteristic	Inpatient LI injury cases, N (%)	ED LI injury cases, N (%)	California, N (%)	United States, N (%)
Total	5,267 (100)	84,832 (100)	23,848,000 (100)	201,672,000 (100)
Age (years)				
18-24	941 (17.9)	21,360 (25.2)	3,128,000 (13.1)	24,315,000 (12.1)
25-34	1,502 (28.5)	28,701 (33.8)	5,091,000 (21.3)	38,899,000 (19.3)
35-44	1,335 (25.4)	18,947 (22.3)	5,356,000 (22.5)	44,252,000 (21.9)
45-54	942 (17.9)	11,504 (13.6)	4,264,000 (17.9)	37,196,000 (18.4)
55-64	380 (7.2)	3,434 (4.1)	2,583,000 (10.8)	24,013,000 (11.9)
65 and over	167 (3.2)	886 (1.0)	3,426,000 (14.4)	32,998,000 (16.4)
Sex				
Female	512 (9.7)	9,425 (11.1)	12,216,000 (51.2)	104,965,000 (52.0)
Male	4,755 (90.3)	75,334 (88.8)	11,632,000 (48.8)	96,707,000 (48.0)
Missing	0 (0.0)	73 (0.1)	N/A	N/A
Race/ethnicity				
Latinx/Hispanic	1,799 (34.2)	28,958 (34.1)	6,611,000 (27.7)	21,848,000 (10.8)
White	2,007 (38.1)	32,859 (38.7)	12,411,000 (52.0)	146,532,000 (72.7)
Black	1,040 (19.8)	14,595 (17.2)	1,418,000 (5.9)	21,784,000 (10.8)
AI/AN	16 (0.3)	455 (0.5)	125,000 (0.5)	1,315,000 (0.7)
Asian/PI	183 (3.5)	1,849 (2.2)	2,726,000 (11.4)	7,388,000 (3.7)
Other/multiple race	125 (2.4)	3,615 (4.3)	557,000 (2.3)	2,806,000 (1.4)
Missing	97 (1.8)	2,501 (3.0)	N/A	N/A

Abbreviations: LI: Legal intervention. ED: Emergency department. US: United States. AI/AN: American Indian or Alaska Native. Asian/PI: Asian or Pacific Islander. Other/multiple race: Other or multiple race.
Note: General California and US adult population characteristics presented are based on data from the 2000 Census and have been rounded to the nearest thousand.

Table 2.3 Prevalence and prevalence difference estimates of mental and substance use disorders comparing adult nonfatal legal intervention injury cases in California, 2005-2014, and the general US population.

Disorder	Prevalence (%), LI injury cases		Prevalence (%), US NCS-R[c]	Prevalence Difference (%)	
	Crude[a]	Standardized[b]		Crude (95% CI)	Standardized (95% CI)
Inpatient Nonfatal Legal Intervention Injury Cases					
Nonaffective psychosis	15.2	19.5	0.3	14.9 (13.8, 16.0)	19.2 (18.0, 20.4)
Anxiety disorder	4.9	7.1	19.1	-14.2 (-15.7, -12.7)	-12.0 (-13.5, -10.5)
Mood disorder	13.7	25.0	9.7	4.0 (2.8, 5.2)	15.3 (13.9, 16.7)
Suicidal ideation	4.0	5.0	3.3	0.7 (-0.09, 1.5)	1.7 (0.9, 2.5)
Alcohol use disorder	22.3	24.2	3.1	19.2 (17.9, 20.5)	21.1 (19.8, 22.4)
Drug use disorder	31.7	31.1	1.4	30.3 (29.0, 31.6)	29.7 (28.4, 31.0)
Emergency Department Nonfatal Legal Intervention Injury Cases					
Nonaffective psychosis	2.2	3.1	0.3	1.9 (1.5, 2.3)	2.8 (2.4, 3.2)
Anxiety disorder	1.1	2.6	19.1	-18.0 (-19.4, -16.6)	-16.5 (-17.9, -15.1)
Mood disorder	1.7	3.3	9.7	-8.0 (-8.7, -7.2)	-6.4 (-7.2, -5.6)
Suicidal ideation	0.7	1.3	3.3	-2.6 (-3.2, -2.0)	-2.0 (-2.6, -1.4)
Alcohol use disorder	11.0	11.3	3.1	7.9 (7.3, 8.5)	8.2 (7.6, 8.8)
Drug use disorder	7.3	6.2	1.4	5.9 (5.5, 6.3)	4.8 (4.4, 5.2)

Abbreviations: LI: legal intervention. US: United States. NCS-R: National Comorbidity Survey Replication. CI: confidence interval.

[a] Crude prevalence estimates are based on all legal intervention injury cases over the study period (inpatient: N = 5,267; emergency department: N = 84,832).

[b] Sex-, age-, and race-standardized estimates are based on legal intervention injury cases with complete demographic data over the study period (inpatient: N = 5,170; emergency department: N = 82,266). The 2000 US Census population was used as the standard.

[c] The NCS-R reported 12-month disorder prevalence estimates.

2.5 Supplemental Material

2.5.1 Sensitivity Analysis

The subset of legal intervention injury patients who were treated on only one occasion for injury over the study period was identified using the patient record linkage number, a unique identifier in the patient record. The record linkage number is an encrypted version of the patient's Social Security Number, and it was missing for 19.8% and 21.0% of inpatient and emergency department legal intervention injury cases, respectively, leaving 3,764 inpatient cases (71.5% of the 5,267 total cases) and 58,500 emergency department cases (69.0% of the 84,832 total cases) who were treated for legal intervention on only one occasion over the study period. For the subset of the study population with complete demographic data (used for standardized estimates), the record linkage number was missing for 19.4% and 20.7% of inpatient and emergency department incidents, respectively, leaving 3,714 inpatient cases (71.8% of the 5,170 total cases) and 56,595 emergency department cases (69.2% of the 82,266 total cases) who were treated for legal intervention on only one occasion and had complete demographic data.

To assess the extent to which experiencing legal intervention injury on multiple occasions occurs, we examined the proportion of patients with a record linkage number who were treated for an injury on more than one occasion, and the mean number of occasions (Appendix Table 2.4). We found that a relatively small proportion of this subset (inpatient: N = 192, 4.9%; emergency department: N = 3,952, 6.3%) were treated for legal intervention injury on multiple occasions over the study period, and the average number of visits was 2.4 and 2.2 for inpatient and emergency department patients, respectively. These findings were consistent for the subset of patients who also had complete demographic data and were used in standardized analyses.

Table 2.4 Adult nonfatal legal intervention injury patients treated in California hospital, 2005-2014: Treatment on multiple occasions over the study period among those with a unique patient identifier.

All Nonfatal Legal Intervention Injury Cases (N = 90,099)		
Patients with RLN	**ED**	**Inpatient**
Total (N)	62,452	3,956
Patients treated for LI injury on more than one occasion (N, %)	3,952 (6.3%)	192 (4.9%)
Number of occasions treated for LI injury, among all patients (mean, range)	1.07 (1-14)	1.07 (1-8)
Number of occasions treated for LI injury, among patients treated on more than one occasion (mean, range)	2.15 (2-14)	2.41 (2-8)
Nonfatal Legal Intervention Injury Cases with Complete Demographic Data (N = 87,436)		
Patients with RLN	**ED**	**Inpatient**
Total (N)	60,758	3,902
Patients treated for LI injury on more than one occasion (N, %)	3,799 (6.3%)	188 (4.8%)
Number of occasions treated for LI injury, among all patients (mean, range)	1.07 (1-14)	1.07 (1-8)
Number of occasions treated for LI injury, among patients treated on more than one occasion (mean, range)	2.15 (2-14)	2.41 (2-8)

Abbreviations: RLN: record linkage number. ED: emergency department. LI: legal intervention.

Table 2.5 Prevalence and prevalence difference estimates of mental and substance use disorders comparing restricted study population of adult nonfatal legal intervention injury cases in California, 2005-2014, and the general US population.

Disorder	Prevalence (%), LI injury cases		Prevalence (%), US NCS-R[c]	Prevalence Difference (%)	
	Crude[a]	Standardized[b]		Crude (95% CI)	Standardized (95% CI)
Inpatient Nonfatal Legal Intervention Injury Cases					
Nonaffective psychosis	16.7	20.2	0.3	16.4 (15.1, 17.7)	19.9 (18.5, 21.3)
Anxiety disorder	5.1	7.4	19.1	-14.0 (-15.5, -12.5)	-11.7 (-13.3, -10.1)
Mood disorder	15.7	26.7	9.7	6.1 (4.7, 7.5)	17.0 (15.4, 18.6)
Suicidal ideation	4.4	5.6	3.3	1.1 (0.2, 2.0)	2.3 (1.4, 3.2)
Alcohol use disorder	24.0	25.2	3.1	20.9 (19.4, 22.4)	22.1 (20.6, 23.6)
Drug use disorder	33.5	32.7	1.4	32.1 (30.5, 33.7)	31.3 (29.7, 32.9)
Emergency Department Nonfatal Legal Intervention Injury Cases					
Nonaffective psychosis	2.4	3.0	0.3	2.1 (1.7, 2.5)	2.7 (2.2, 3.2)
Anxiety disorder	1.2	2.7	19.1	-17.9 (-19.3, -16.5)	-16.4 (-17.8, -15.0)
Mood disorder	1.8	3.4	9.7	-7.9 (-8.7, -7.1)	-6.3 (-7.1, -5.5)
Suicidal ideation	0.8	1.4	3.3	-2.5 (-3.1, -1.9)	-1.9 (-2.5, -1.3)
Alcohol use disorder	10.3	11.0	3.1	7.2 (6.6, 7.8)	7.9 (7.3, 8.5)
Drug use disorder	7.1	6.2	1.4	5.7 (5.3, 6.1)	4.8 (4.4, 5.2)

Abbreviations: LI: legal intervention. US: United States. NCS-R: National Comorbidity Survey Replication. CI: confidence interval.

[a] Crude prevalence estimates are based on all legal intervention injury cases over the study period (inpatient: N = 3,764; ED: N = 58,500).

[b] Sex-, age-, and race-standardized estimates are based on all legal intervention injury cases with complete demographic data over the study period (inpatient: N = 3,714; ED: N = 56,959). The 2000 US Census population was used as the standard.

[c] The NCS-R reported 12-month disorder prevalence estimates.

2.5.2 Injury Severity Score Assessment

To assess the potential role that selection of legal intervention injury patients with mental or substance use disorders into the hospital system may play in our explaining findings, we compared injury severity, captured by the ISS, among patients with and without disorders. We did not conduct statistical tests to assess whether differences in ISS across groups are statistically significant because this study used statewide data on all adult legal intervention injury patients treated in California hospitals over the study period as opposed to a population sample. Therefore, statistical inference, which allows us to draw inferences about a larger population based on a sample, is not appropriate.

Of the 90,099 legal intervention injury patients, approximately 7.3% (N = 6,580) were assigned an ISS of 0, indicating the absence of at least one of the injury diagnosis codes used by the ICDPIC tool to assign an ISS in the patient record. Further, approximately 0.2% (N = 214) were assigned an ISS of 99, indicating that either the severity or body region affected were not specified by the injury code documented in the patient record. While the ICDPIC tool incorporates most ICD-9-CM injury categories, it is not exhaustive. For example, diagnosis codes from the "Late Effects of Injuries, Poisonings, Toxic Effects and Other External Causes" category (905-909) – encompassing injuries such as "Late effect of fracture of skull and face bones" (905.0) and "Late effect of spinal cord injury" (907.2) – are not included. Other examples of excluded codes that may be particularly relevant to legal intervention injury include "Toxic effect of lacrimogenic gas" (987.5) and "Electrocution and nonfatal effects of electric current" (994.8), among others. Lastly, burns are assigned an ISS of 99, and manual review of legal intervention injury patient records assigned an ISS of 99 found that all of these records had at least one ICD-9-CM diagnosis code for burns.

To assess whether legal intervention injury patients assigned an ISS of 0 did not have any ICD-9-CM codes indicative of injury, we conducted manual review of a random sample (N = 50) of records with ISS = 0 for each of the following groups by inpatient status: patients a) with and b) without substance use disorder; and patients c) with and d) without mental disorder. We calculated the proportions of records 1) without any diagnosis codes indicative of injury, 2) with an injury diagnosis code not included in the ICDPIC tool, and 3) with a diagnosis code not explicitly capturing an injury but indicative of injury (e.g., codes for joint/muscle/limb pain). Findings suggest that while a small proportion of legal intervention injury patient records do not document any ICD-9-CM codes indicative of an injury taking place, the overwhelming majority of records do (Table 2.9). Although healthcare administrative data offer a unique opportunity to examine injuries resulting from police violence, they are not collected for research purposes and may be prone to misclassification. However, manual review of records also showed that the patterns of ICD-9-CM diagnosis codes identified as indicative of injury align with what we would expect in terms of severity by inpatient status (i.e., emergency department vs. inpatient treatment), which is reassuring. For example, diagnosis codes indicative of downstream consequences of more serious injuries (e.g., paralysis and late effects of spinal cord injury, injury to internal organs, or skull/trunk fracture) were much more common among inpatient cases, whereas codes indicative of more minor injuries such as joint/limb pain and electrocution/nonfatal effects of electric current (indicative of taser use) were more common among emergency department cases.

Table 2.6 Injury severity scores among California nonfatal legal intervention injury emergency department and inpatient cases combined, 2005-2014, by mental/substance use disorder status.

Injury Severity Score Category	Any Substance Use Disorder				Any Mental Disorder			
	Absent		Present		Absent		Present	
	N	%	N	%	N	%	N	%
Minor (1-3)	56,402	76.8	12,409	74.3	64,527	76.6	4,284	73.4
Moderate (4-8)	10,064	13.7	2,368	14.2	11,698	13.9	734	12.6
Serious (9-15)	1,030	1.4	565	3.4	1,414	1.7	181	3.1
Severe (16-24)	186	0.3	151	0.9	278	0.3	59	1
Critical (25-75)	89	0.1	41	0.2	107	0.1	23	0.4
No ICDPIC injury diagnoses (0)	5,454	7.4	1,126	6.7	6,043	7.2	537	9.2
Severity/body region not known (99)	182	0.2	32	0.2	197	0.2	17	0.3
Total	73,407	100	16,692	100	84,264	100	5,835	100
Summary Statistics[a]								
Mean	1.9		2.3		2.0		2.3	
Median	1		1		1		1	

[a] ISS scores of 0 (no ICDPIC injury diagnoses) and 99 (injury diagnoses where either severity or body region unknown) were excluded from summary statistic calculations

Table 2.7 Injury severity scores among California nonfatal legal intervention injury cases, 2005-2014, by inpatient and substance use disorder status.

Injury Severity Score Category	Emergency Department				Inpatient Hospitalization			
	No Substance Use Disorder		Substance Use Disorder		No Substance Use Disorder		Substance Use Disorder	
	N	%	N	%	N	%	N	%
Minor (1-3)	55,595	78.9	11,412	79.4	807	27.4	997	42.9
Moderate (4-8)	9,471	13.4	1,884	13.1	593	20.1	484	20.8
Serious (9-15)	478	0.7	142	1.0	552	18.8	423	18.2
Severe (16-24)	32	0.0	15	0.1	154	5.2	136	5.9
Critical (25-75)	8	0.0	3	0.0	81	2.8	38	1.6
No ICDPIC injury diagnoses (0)	4,705	6.7	885	6.2	749	25.5	241	10.4
Severity/body region not known (99)	175	0.2	27	0.2	7	0.2	5	0.2
Total	70,464	100.0	14,368	100.0	2,943	100.0	2,324	100.0
Summary Statistics[a]								
Mean	1.8		1.8		6.7		5.6	
Median	1		1		4		4	

[a] ISS scores of 0 (no ICDPIC injury diagnoses) and 99 (injury diagnoses where either severity or body region unknown) were excluded from summary statistic calculations

Table 2.8 Injury severity scores among California nonfatal legal intervention injury cases, 2005-2014, by inpatient and mental disorder status.

Injury Severity Score Category	Emergency Department				Inpatient Hospitalization			
	No Mental Disorder		Mental Disorder		No Mental Disorder		Mental Disorder	
	N	%	N	%	N	%	N	%
Minor (1-3)	63,617	79.0	3,390	79.6	910	24.6	894	56.8
Moderate (4-8)	10,872	13.5	483	11.3	826	22.4	251	15.9
Serious (9-15)	591	0.7	29	0.7	823	22.3	152	9.7
Severe (16-24)	45	0.1	2	0.0	233	6.3	57	3.6
Critical (25-75)	11	0.0	0	0.0	96	2.6	23	1.5
No ICDPIC injury diagnoses (0)	5,245	6.5	345	8.1	798	21.6	192	12.2
Severity/body region not known (99)	191	0.2	11	0.3	6	0.2	6	0.4
Total	80,572	100.0	4,260	100.0	3,692	100.0	1,575	100.0
Summary Statistics[a]								
Mean	1.8		1.7		7.2		4.0	
Median	1		1		5		1	

[a] ISS scores of 0 (no ICDPIC injury diagnoses) and 99 (injury diagnoses where either severity or body region unknown) were excluded from summary statistic calculations

Table 2.9 Manual review of nonfatal legal intervention injury patient records assigned an injury severity score of zero: Distribution of records by diagnosis codes indicative of injury.

Inpatient Status	Disorder Status	Records with ISS=0, N (%)	No codes indicative of injury		Injury code(s) not captured by ICDPIC*		Diagnosis code(s) indicative of injury**	
			N	%	N	%	N	%
ED	SUD Absent	4,705 (6.7)	8	16.0	9	18.0	33	66.0
	SUD Present	885 (6.2)	10	20.0	12	24.0	28	56.0
	MD Absent	5,245 (6.5)	12	24.0	11	22.0	27	54.0
	MD Present	341 (8.1)	11	22.0	12	24.0	27	54.0
Inpatient	SUD Absent	749 (25.5)	2	4.0	45	90.0	3	6.0
	SUD Present	241 (10.4)	5	10.0	30	60.0	15	30.0
	MD Absent	798 (21.6)	2	4.0	40	80.0	8	16.0
	MD Present	192 (12.2)	4	8.0	35	70.0	11	22.0

Abbreviations: ICDPIC: International Classifications of Diseases Program for Injury Categorization. ED: emergency department. SUD: substance use disorder. MD: mental disorder.
Note: A total of 50 records with ISS = 0 were randomly sampled and reviewed for each of the disorder groups by inpatient status.
* Examples of injury diagnosis codes not captured by ICDPIC: "Electrocution and nonfatal effects of electric current" (994.8), "Foreign body in unspecified site on external eye" (930.9), "Late effect of spinal cord injury" (907.2), and "Toxic effect of lacrimogenic gas" (987.5).
** Examples of diagnosis codes considered indicative of injury: paralytic syndromes (e.g., "Paraplegia" (344.1) and "Quadriplegia, unspecified" (344.00); particularly common among inpatient cases), joint/muscle/limb pain (e.g., "Pain in joint, shoulder region" (719.41)), and "Acute chemical conjunctivitis" (372.06), "Pain in or around eye" (379.91).

Chapter 3: The Role of Mental and Substance Use Disorders in Legal Intervention Injury Risk

3.1 Introduction

The American Public Health Association, along with other professional health organizations, has deemed police violence a critical public health problem in the United States (US).[1,31] The recent tragic police killing of George Floyd, a 46-year-old Black man, on May 25, 2020 in Minneapolis, Minnesota, is one high-profile example that has brought heightened attention to police violence and led to nationwide protests – highlighting racism as "the other pandemic" during the COVID-19 pandemic in the US.[122,123] Like Mr. Floyd, approximately 1,000 individuals are killed by law enforcement every year in the US.[2] In addition, nonfatal injuries are much more common – on average, more than 80,000 individuals are treated for nonfatal injuries caused by law enforcement in US emergency departments annually.[3] Furthermore, research has found that deaths caused by law enforcement resulted in an annual average of approximately 56,000 years of life lost (YLL) from 2015 to 2016 – greater than that associated with unintentional firearm injuries (YLL = 40,752) and similar to that due to maternal deaths (YLL = 56,490) in the US.[36]

Within the discipline of public health, most research on the determinants of police violence has focused on estimating racial/ethnic inequities in experiences of police violence.[4–6,37,124] Results from this growing body of literature support police violence as a form of structural racism, playing a role in racial inequities in law enforcement-perpetrated injuries and deaths and numerous other adverse health outcomes, including preterm birth and poor mental health, which are hypothesized to result from a physiologic stress response to experiences of police-violence.[4–7,25,34,37,124–126] For example, Krieger and colleagues found that since the 1980s fatal police violence rates among Black men aged 15-34 have been approximately three to four times the rates among same-aged White men.[4] Similar inequities between Black and White Americans have been reported for police-perpetrated injuries treated in hospitals.[5,37] Much more limited public health research has examined the role of other individual-level factors, such as mental and substance use disorders, in subsequent risk of injury caused by law enforcement. Such factors are important to investigate in order to elaborate the range of characteristics (and characteristic combinations) that increase risk or have potential to protect against police violence.

A substantial body of literature has reported mental and substance use disorders to be overrepresented among individuals in the criminal justice system, [13,67–69] as well as among encounters with law enforcement.[70–73] Mental and substance use disorders may also increase an individual's risk for experiencing police violence. First, those with disorders have been shown to be at an increased risk of violent victimization, criminal offending, and perpetrating violent behavior.[74–77] Each of these may be either directly related to disorder-associated symptoms, or indirectly associated with disorders through downstream social factors, including poverty and homelessness, and each is associated with increased exposure to the legal system, including law enforcement encounters.[69,78,79] Further, law enforcement personnel are often the first to respond to individuals experiencing mental health crises.[68] Second, when individuals with mental/substance use disorders encounter law

enforcement, symptoms associated with their disorder may increase their risk of injury (e.g., delusions, hallucinations, poor judgement, agitated body movements)[65,92] if they result in behaviors that are perceived as resistant or hostile by officers and, thus, lead to the use of force.

Existing research on the link between mental and substance use disorders and police violence in the US has found mixed results. Studies have mainly examined law enforcement agency records from a single or few agencies,[11,14–17,127] which rely on law enforcement officer perceptions and reporting of mental and substance use status and use of force/injury. This may introduce misclassification bias if officer perceptions and/or reporting of mental status and use of force are inaccurate.[10,12] Further, the use of perceived mental and substance use disorder measures aggregates over numerous disorders and makes it impossible to assess whether the risk of police violence varies by disorder type. A few studies have found that particular disorders (e.g., psychosis) may be more strongly associated with increased risk of police violence;[80,81,128] however, two studies were relatively small and one had a cross-sectional design. A clear understanding of which disorders are most salient for risk of injury by law enforcement may help inform targeted prevention strategies. In addition, most work has controlled for suspect resistance and behavior during encounters, which likely mediate the relation between mental and substance use disorders and injury by law enforcement and should therefore not be adjusted.[23,24]

Lastly, by design, the use of law enforcement agency records estimates the relation between mental and substance use disorders and injury caused by law enforcement only among those who encounter law enforcement (i.e., the encounter-conditional relationship). Comparing those with and without disorders only among individuals who encounter law enforcement does not take into account that certain groups in the US have a dramatically higher risk of encounters because of various social factors, including racial profiling and social disadvantage (e.g., poverty, lack of adequate health and social services, etc.).[41] For individuals with mental and substance use disorders, lack of access to adequate mental healthcare, consistent employment, and housing may increase their likelihood of law enforcement encounters.[71,75,79]

Two recent epidemiologic studies examined the association between particular types of mental and substance use disorders and injury caused by law enforcement, finding increased risk of injury for individuals with psychosis, conduct disorder, alcohol use disorder, and drug use disorder.[80,81] However, these studies were small, and neither examined nonfatal injuries by law enforcement separately. They also did not assess whether associations between disorders and injury by law enforcement vary by demographic characteristics such as race/ethnicity, which may be important for identifying particularly high-risk groups and developing targeted prevention strategies. The prevalence of mental and substance use disorders and access to treatment vary by race/ethnicity,[82,83] and experiences of police violence are inequitably distributed, with Black individuals bearing the greatest burden.[4,5] Further, the prevalence of other risk factors for police violence (e.g., individual racism, structural racism, poverty, etc.) differ by race/ethnicity. Thus, it is plausible that the relationship between mental and substance use disorders and injury by law enforcement may also vary by racial identity. For example, racially marginalized individuals who also suffer from certain psychiatric disorders may in particular be at increased risk for injury caused by law enforcement. Building on existing work, we examined the relationship between particular mental and substance use disorders, as well as comorbid mental and substance use disorder, and subsequent nonfatal legal intervention injury in adults using a large, diverse population-based database of all hospital visits in California, 2005-2014, both overall and by race/ethnicity.

3.2 Data and Methods

3.2.1 Data Description and Design

We used California-wide data on all inpatient hospitalizations and emergency department visits between January 1, 2005 and December 31, 2014, from the California Office of Statewide Health Planning and Development. We excluded data after 2014 to avoid the substantial diagnostic coding changes across the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) to ICD-10-CM transition, which occurred in October 2015.[129] Federally licensed facilities (e.g., active-duty military and Veteran's Affairs hospitals) are not required to report; thus, patient encounters at such facilities are not included in our data. However, in California there are 16 federal hospitals compared to 359 non-federal hospitals; thus, our data likely capture a vast majority of emergency department and inpatient hospital encounters throughout the state.[93–95] Patients first seen in the emergency department but later admitted to the hospital are only included in the inpatient hospitalization data.

A cumulative case-control design was used to examine the relationship between particular mental and substance use disorders (nonaffective psychosis, bipolar disorder, major depressive disorder, personality disorder, alcohol use disorder, drug use disorder, and comorbid mental and substance use disorder) and nonfatal injury caused by law enforcement, both overall and by race/ethnicity. Cases included all patients, 19-74 years old, treated for nonfatal injury caused by law enforcement from 2006 and forward (to ensure a full one-year exposure window). We restricted the analysis to adults because the presentation of psychiatric disorders may differ in childhood and adolescence, and accurate diagnosis of disorders is complicated by transitions across different developmental stages.[108] Parents and clinicians may also be reluctant to officially diagnose and label youth as having a psychiatric illness because of the potential negative repercussions (e.g., stigma).[130] Over 90% of patients treated for nonfatal injury by law enforcement over the study period were adults. Cases were identified via ICD-9-CM external cause of injury codes (e-codes) for legal intervention (LI) injury, documented in any of the five possible e-codes fields in the patient record (Table 3.1). The ICD-9-CM defines LI injuries as "injuries inflicted by police or other law-enforcing agents, including military on duty, in the course of arresting or attempting to arrest lawbreakers, suppressing disturbances, maintaining order, and performing other legal action."[42] For cases who had multiple visits for nonfatal LI injury over the study period, we took the first visit. This avoids duplicates of the same patient being treated for the same incident on multiple occasions and helps limit instances where experience of a prior LI injury may confound the relation between subsequent mental/substance use disorder and LI injury (to the extent that cases did not experience an LI injury before the study period).

Controls were randomly sampled from patients, ages 19-74 years old, who were treated for any nonfatal condition other than LI injury or one of the mental and substance use disorders studied. Like cases, control patients were sampled 2006 and forward to ensure a full one-year exposure window. Patients who had a visit for both a control condition and a nonfatal LI injury visit over the study period were excluded from the control series. Given that control conditions included *any* nonfatal condition other than LI injury or one of the psychiatric disorders studied, multiple visits among potential controls were common over the study period; therefore, taking the first visit (as for cases) would result in a skewed temporal distribution, where control visits are much more likely to

occur early in the study period. To avoid this skewed temporal distribution, we randomly sampled one visit for controls with multiple visits. Over the 10-year study period, this control series captured approximately 66.7% of California residents 19-74 years old (i.e., the study base giving rise to the cases) (Figure 3.1). Both cases and controls were restricted to California residents. Given the highly skewed sex distribution of nonfatal LI injury cases, each case was frequency matched on sex to a random sample of 10 controls. Adults over 74 years were excluded because while they accounted for less than 0.5% of all nonfatal LI injury patients 19 years of age and older, they were overrepresented in the control series (12.1%) compared to the general California population (7.2%).

Mental and substance use disorders were prospectively documented in the patient hospital records over the study period. To ensure temporal ordering of exposure and outcome, for each case and control patient, records were linked over the study period, and disorder exposures were identified in the year prior to (and excluding) the date of the visit for LI injury (cases) or control conditions (controls). The record linkage number, a unique patient identifier in the patient record, was used to link records over time. Exposure status for each specific mental and substance use disorder examined (nonaffective psychosis, bipolar disorder, major depressive disorder, personality disorder, alcohol use disorder, drug use disorder) was captured using ICD-9-CM diagnosis codes (Table 3.2). For each disorder, a patient was classified as having the disorder if they were seen in the hospital in the year prior and a relevant ICD-9-CM diagnosis code was documented in any of the 25 possible diagnosis code fields in the patient record. Exposure disorder categories were not mutually exclusive. Case and control patients who did not have an inpatient hospital or emergency department visit at all in the year prior were considered unexposed. Patients who had a visit for both a mental disorder and a substance use disorder in the year prior to LI injury or the control condition were classified as having comorbid mental and substance use disorder. Given that we had data starting in 2005, to ensure a full one-year exposure window for all patients, cases and controls were taken 2006 and forward.

Mental and substance use disorders are documented in emergency department and inpatient hospital discharge data under several circumstances. First, they are documented for patients experiencing a mental health crisis or in other situations when mental and/or substance use disorders are the primary reason for the hospital visit (e.g., alcohol intoxication).[71,105] Second, they may be documented as part of the medical history-taking process (either via past patient chart review or discussions with the patient or their family/other supports).[96–99] Third, disorders may be documented if they are potentially related to or have any bearing on the complexity of care for a patient (e.g., if they may be a complicating factor that needs to be taken into account in the patient's treatment plan). Relatedly, disorders may also be documented by healthcare personnel in the process of diagnosing a patient's condition.[96–99] For example, if an individual with a history of diabetes and depression/anxiety comes into the hospital for chest pain, the healthcare provider may note that the chest pain could be physical manifestations of a mental disorder. Thus, hospital administrative data is likely to capture more severe than less severe or well-managed psychiatric conditions (e.g., those resulting in psychiatric crises or those more likely to be a complicating factor for the delivery of acute care). Validation studies of psychiatric disorder diagnoses in hospital discharge data suggest high specificity (>97%) but low sensitivity (53-61%) for alcohol use disorders, drug use disorders, psychoses, and depression.[121,131] Research suggests similar validity for personality disorders in hospital data – indicating that underreporting of disorders is a greater concern than overreporting.[132] The implications of this are addressed in the discussion section below.

LI injury patient records (N = 16,206, 20.3%) and potential control records (N = 7,271,295, 10.6%) with a missing record linkage number were excluded from the analysis because psychiatric disorder exposure ascertainment was not possible. Table 3.5 in the Supplemental Material section presents demographic characteristics of cases and controls who were excluded, and the limitations of this approach are considered in the discussion section below. The final analytic sample included cases (N = 57,519) and controls (N = 575,190) with complete covariate data – excluding 1,385 cases (2.4%) and 399,933 potential controls (2.4%) with missing data on sex and/or race/ethnicity.

3.2.2 Statistical Analysis

Separate logistic regression models were used to assess the overall relation between each mental and substance use disorder exposure and the relative odds of subsequent nonfatal LI injury, controlling for age, race/ethnicity, and sex. Figure 3.2 depicts the directed acyclic graph for the hypothesized relation between mental and substance use disorders and nonfatal LI injury. Race/ethnicity and sex were modeled using indicator variables (see Table 3.6 under Supplemental Material for operationalization and reference categories). Age was modeled using restricted cubic splines, with three knots placed at the 10th, 50th, and 90th quantiles, to allow for nonlinearity in the relationship.[133] The regression model used in the analysis is as follows:

$$\ln\left(\frac{P(nonfatal\ LI\ injury)}{1-P(nonfatal\ LI\ injury)}\right) = \beta_0 + \beta_1 Disorder + \sum_{2}^{6} \beta_i Race_i + \beta_7 Sex + f(Age)$$

where the log-odds of nonfatal LI injury is a linear function of the intercept β_0, disorder status in the preceding year (exposure of interest), and covariates (race, sex, and age). The estimate of interest is given by e^{β_1}, which provides the odds ratio (OR) – the relative change in the odds of nonfatal LI injury comparing those with to those without a disorder, holding other variables constant. For statistical inference, we present 95% confidence intervals. Given that nonfatal LI injury is very rare, the estimated ORs approximate the cumulative incidence ratio – a more interpretable measure of association.

To examine whether the relationship between each disorder and nonfatal LI injury varies by race/ethnicity, we conducted stratified analyses by race/ethnicity (Latinx/Hispanic and five non-Latinx/Hispanic groups: White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race). Separate logistic regressions for each disorder exposure – as in the main overall analysis – were run within each racial/ethnic group, adjusting for age and sex.

3.2.3 Sensitivity Analyses

Individual-level socioeconomic status (SES) may also influence the risk of mental and substance use disorder (e.g., through access to mental health care)[78] and LI injury (e.g., through selection into neighborhoods with greater law enforcement presence).[47,60] Further, research suggests that features of the social and physical environment, including urbanicity, influence the risk of experiencing both psychiatric illness and injury by law enforcement, and therefore may also confound the relation between mental and substance use disorders and LI injury.[58,134,135] A substantial body of literature has considered whether the associations of SES and the environment with mental and substance use disorders are due to "social causation" (i.e., low SES/adverse environments lead to increased

disorder risk) or "social selection" (i.e., disorders result in (or limit) downward (or upward) social mobility).[78] Both of these likely explain some part of the observed relationships; however, the extent to which they do appears to vary by disorder type.[78] From a methodological standpoint, this is problematic in the absence of longitudinal data because under the social causation theory, SES/environment are confounders and should be adjusted for; however, under social selection, they mediate the relation between mental and substance use disorders and LI injury and should not be controlled (see Figure 3.6 in Supplemental Material).[23,24] Therefore, we conducted a sensitivity analysis where we also controlled for patient insurance type (only proxy available in the data for SES) and residential urbanicity. For residential urbanicity, the patient's residential Zip Code was categorized into Census Urban Areas (urbanized areas, population of 50,000 or more; urban clusters, population of 2,500-49,999; or rural, population of 2,499 or less) using the 2010 US Census Urban Area to Zip Code Tabulation Relationship File (Table 3.6).

Literature suggests that comorbidity across psychiatric disorders is common – particularly within, but also across, disorder groups (i.e., internalizing [e.g., depression], externalizing [e.g., substance use disorders], and thought disorders [e.g., psychosis]).[136] National surveys estimate that approximately 30% of individuals in the US experience psychiatric comorbidity over their lifetime.[136] Although there has been increased focus on the etiology of psychiatric comorbidity, our understanding of disorder co-occurrence is still limited. Existing research indicates several plausible explanations for co-occurrence: a) direct and indirect causal links between disorders; b) shared common causes (e.g., early life adversity); c) complex reciprocal relations between disorders (i.e., sequential effects over time); and d) disorders are in fact different manifestations of the same underlying disease.[66,136] These potential mechanisms have varied implications for estimating the relation between a particular disorder and LI injury. For example, in the causal links scenario, depending on the directionality of the relationship, comorbid disorders may either be on the causal pathway (i.e., mediators) or be a common cause of the disorder of interest and LI injury (i.e., confounders) (Figure 3.7). The extent to which each of these explanations influences co-occurrence varies depending on the disorders in questions. For example, research points to personality disorders generally preceding other disorders, however, evidence is limited.[66,136] In contrast, there may be a more complex reciprocal relation between depression and substance use disorder over the life course.[66,136] Recognizing this complexity, for disorder-specific associations (i.e., excluding the comorbid mental and substance use disorders exposure), we also ran analyses simultaneously adjusting for the other disorders. To the extent that comorbid disorders are downstream of a particular disorder of interest, this approach would underestimate the relationship between the disorder of interest and nonfatal LI injury; however, it provides a lower bound on the relationship that is perhaps more conservative in terms of confounder control.

We also hypothesized that anxiety disorders, which are internalizing disorders characterized by symptoms of fear and rumination and are one of the most common disorders in the general population,[66,83,108] would not be associated with nonfatal LI injury. Thus, as a negative control, we also conducted analyses examining the relationship between anxiety disorder (see Table 3.2 for ICD-9-CM codes included) and nonfatal LI injury. Datasets were created using SAS version 9.4 (SAS Institute Inc., Cary, NC), and analyses were run in R version 4.1.0 (R Core Team, Vienna, Austria). This study was approved by the California Health and Human Services Agency and University of California, Berkeley Committees for the Protection of Human Subjects.

3.3 Results

The majority of nonfatal LI injury cases were male (87.3%) and less than 44 years old (78.4%), and a plurality were non-Latinx/Hispanic White (43.3%); in comparison, controls were older and more likely to be White and Asian or Pacific Islander (Table 3.3). Controls were sampled such that their sex distribution matched that of the cases. The age distribution of the controls was similar to that in the general California population, although younger (19-24 years old) and older (55 and older) controls were slightly overrepresented and middle-aged controls were underrepresented (Table 3.3). Compared to the general California population, adults identifying as White (controls: 51.3% vs. California: 43.1%), Black (8.5% vs. 5.9%), and Other or multiple race (4.3% vs. 2.3%) were overrepresented among the controls. Among cases overall, hospital visits with documented drug use disorder (10.6%) and alcohol use disorder (8.8%) were the most prevalent in the year leading up to nonfatal LI injury, whereas those for major depressive disorder (2.2%) and personality disorder (1.1%) were the least common (Table 3.3); however, disorder prevalence varied by patient race/ethnicity (Figure 3.3). Although this pattern was generally similar for controls, disorders overall were much less common. Comorbid mental and substance use disorder was documented in 6.2% of nonfatal LI injury patient records and 0.7% of control patient records. Comorbidity across all disorders varied by disorder type, but in general was common, and more so among cases than controls (Table 3.4). For example, among those with nonaffective psychosis, 23.0% (N = 804) of cases and 40.2% (N = 1,795) of controls did not have a documented comorbid disorder. In comparison, among those with a documented personality disorder, only 2.9% (N = 18) of cases and 9.6% (N = 57) of controls did not have comorbidity.

Overall, mental and substance use disorders in the year prior were strongly associated with subsequent nonfatal LI injury in California adults ages 19-74 years, after adjustment for patient race/ethnicity, age, and sex (Figure 3.4). Associations were strongest for personality disorder (OR: 10.2, 95% CI: 9.1, 11.5), comorbid mental and substance use disorder (OR: 8.4, 95% CI: 8.0, 8.8), nonaffective psychosis (OR: 8.3, 95% CI: 7.9, 8.7), and bipolar disorder (OR: 7.4, 95% CI: 7.0, 7.8). The associations for drug use disorder (OR: 5.4, 95% CI: 5.2, 5.6), alcohol use disorder (OR: 5.0, 95% CI: 4.8, 5.2), and major depression (OR: 4.3, 95% CI: 4.0, 4.6) were weaker but still substantial.

The broader pattern of associations by disorder type (i.e., stronger for personality, comorbid, nonaffective psychosis, and bipolar disorders) was generally consistent within racial/ethnic groups; however the strength of associations differed by race/ethnicity (Figure 3.5). Across disorders, associations with nonfatal LI injury were strongest for Asian or Pacific Islander adults – ranging from an OR of 7.0 (95% CI: 5.3, 9.3) for alcohol use disorder to an OR of 28.8 (95% CI: 20.0, 41.4) for bipolar disorder – and weakest for Black (OR ranging from 2.7 [95% CI: 2.2, 3.3] for depression to 6.9 [95% CI: 5.0, 9.4] for personality disorder) and for American Indian or Alaska Native adults (ranging from an OR of 1.8 [95% CI: 0.6, 4.9] for depression to 8.8 [95% CI: 3.8, 20.6] for nonaffective psychosis). As an exception, the association between personality disorder and nonfatal LI injury was weakest for Other or multiple race adults (OR: 4.6, 95% CI: 2.1, 9.8).

In sensitivity analyses also adjusting for patient insurance and residential urbanicity, associations were slightly weaker but consistent in terms of general patterns both overall and by race/ethnicity (Figures 3.8 and 3.9). For disorder-specific analyses, simultaneous adjustment of other disorders resulted in much weaker associations, and the range of the magnitude of associations by race/ethnicity was much narrower, for both the main analysis specification and the sensitivity

analysis with additional control for insurance and residential urbanicity (Figures 3.10-3.13). In the main analysis specification (Figure 3.10), overall associations were strongest for nonaffective psychosis (OR: 3.2, 95% CI: 3.0, 3.4), alcohol use disorder (OR: 2.6, 95% CI: 2.5, 2.7), drug use disorder (OR: 2.6, 95% CI: 2.5, 2.7), and bipolar disorder (OR: 2.0, 95% CI: 1.9, 2.2). In contrast, personality disorder (OR: 1.4, 95% CI: 1.3, 1.7) and major depression (OR: 1.1, 95% CI: 1.0, 1.2) were associated with smaller increases in the odds of nonfatal LI injury. Generally, the weakest relations were still observed among Black and American Indian or Alaska Native adults, and patterns by race/ethnicity were consistent for nonaffective psychosis and bipolar disorder (Figure 3.11). However, patterns slightly shifted for other disorders, and associations among Asian or Pacific Islander adults were much weaker, particularly for personality disorder (OR: 0.98, 95% CI: 0.3, 3.4).

The associations between anxiety disorder and nonfatal LI injury were substantially weaker than those for all other disorders examined (Figures 3.14 and 3.15). In the main analysis, associations ranged from an OR of 1.9 (95% CI: 0.9, 3.8) among American Indian or Alaska Native adults to 4.7 (95% CI: 3.3, 6.6) among Asian or Pacific Islander adults (Figure 3.14). Associations in analyses with adjustment for other disorders were much closer to null – ranging from an OR of 0.9 (95% CI: 0.4, 2.1) among American Indian or Alaska Native adults to 1.3 (95% CI: 1.2, 1.4) among White adults, and the confidence intervals for associations among Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race adults crossed the null (Figure 3.15).

3.4 Discussion

In this cumulative case-control study we estimated the overall relationship between particular and comorbid mental and substance use disorders and subsequent nonfatal LI injury among adults in California, using a large statewide hospital database spanning from 2005 through 2014. Overall, individuals with the disorders studied (nonaffective psychosis, bipolar disorder, major depression, personality disorder, alcohol use disorder, drug use disorder, and comorbid mental and substance use disorder) had markedly higher odds of experiencing subsequent nonfatal LI injury, compared to those without disorders. We also found that the strength of associations varied by disorder type and by race/ethnicity. Given the cumulative case-control study design, we estimated ORs; however, nonfatal LI injury is very rare, thus, the reported ORs are approximate estimates of the cumulative incidence ratio – a more interpretable measure of association.

3.4.1 Overall Associations

In the main analysis, controlling for age, sex, and race/ethnicity, we observed very strong overall associations, with the OR ranging from 4.3 (major depression) to 10.2 (personality disorder). After further controlling for patient insurance (SES proxy) and residential urbanicity, associations were similar, although slightly weaker. These findings align with those of two recent epidemiologic studies, which found impulse/conduct disorders, psychosis, depression/anxiety, and substance use disorders to increase the risk of injury caused by law enforcement.[80,81] However, they are contrary to findings from studies using law enforcement agency data. These studies often reported no associations between mental/substance use status and use of force/injury by law enforcement.[14–17,127] Limitations of these studies include the use of potentially less objective measures based on officer perceptions and reporting, control for potential mediating factors (e.g., suspect resistance/behavior), and estimation of relations only among those who encounter law enforcement, rather than overall

relationships that encompass risk from disparate likelihood of law enforcement encounter and risk of injury given encounter.

Among the particular disorders studied, we found that relations were strongest for personality disorder, psychosis, and bipolar disorder, each of which may increase risk factors for legal system exposure and injury during encounters, through direct and indirect mechanisms. Personality disorders are considered to be on the externalizing spectrum of disorders that are characterized by impulsive and disruptive conduct.[137,138] For example, individuals with antisocial personality disorder experience challenges with aggressive, violent, and impulsive behavior,[69,75,138] and are more likely to encounter law enforcement.[69] Nonaffective psychoses, including schizophrenia and delusional disorders, are characterized by abnormal perceptions of reality and affect cognitive and psychomotor functioning, causing delusions, hallucinations, and disorganized thinking.[92] Research also suggests that individuals with psychosis – particularly those with more severe symptoms and/or comorbid substance use – are at increased risk of both victimization and perpetration of crime and violence.[74,75,139] Lastly, individuals with bipolar disorder experience alternating episodes of depression and mania.[140] Mania is associated with high levels of energy/agitation, risky decision making, and can trigger psychosis. Depression is associated with increased risk of suicidal ideation and behavior. Both of these states could lead to increased exposure to law enforcement (e.g., through engagement in risky behavior [mania] and during mental health crises [both]) and risk of injury during encounter (e.g., due to behaviors perceived as a risk to officers, such as resistant/hostile behavior).[140]

In addition to the potential direct links between symptoms associated with these disorders and exposure to and injury by law enforcement, disorders may also play an indirect role through their influence on downstream social factors.[78] For example, severe psychiatric disorders increase the risk of experiencing social disadvantage, including poverty, unemployment, and homelessness.[69,78,79] Each of these factors may situate individuals within disadvantaged contexts that are associated with increased risk of victimization, criminal and violent behavior, and general legal system exposure (e.g., living in communities with greater law enforcement presence),[69] and may ultimately contribute to a greater burden of injury by law enforcement. Whether acting through direct (i.e., disorder-associated symptoms directly increasing risk of encounter and/or injury) or indirect mechanisms (e.g., poverty- and homelessness-mediated relation between disorders and injury) our findings of large overall relations suggest that the disorders studied may play an important role in the risk of nonfatal injury caused by law enforcement.[141] Better understanding of which mechanisms are most salient can help identify effect prevention strategies, and we include further discussion on this below.

The main analyses also showed a particularly strong association for comorbid mental and substance use disorder. This finding is supported by existing literature which suggests that the combination of mental *and* substance use disorders in particular increases risk of both violent victimization and violence perpetration, which are linked to increased legal system exposure.[69,74,75,77] This may also be the case during law enforcement encounters, where for some individuals the co-occurrence of mental and substance use disorders may especially impede their ability to interact with officers.[16] Although the comorbid mental and substance use disorder exposure captured comorbidity explicitly, the disorder-specific exposures were not mutually exclusive and also captured a substantial amount of comorbidity across disorders overall. In disorder-specific analyses where we controlled for the presence of other disorders studied, associations were substantially weaker than in the main analysis – ranging from an OR of 1.1 (major depression) to an OR of 3.2 (nonaffective psychosis). Some of the reductions may be due to overadjustment of comorbid disorders that potentially mediate the relation between a disorder and injury by law enforcement.[23] This may be the case in particular for

personality disorders, which are more likely to develop early, and for which we saw the largest reductions in associations.[66,136] However, these analyses provide a lower bound for each relationship that is more conservative in terms of confounder control. Specifically, they account for unmeasured common causes of co-occurring disorders and nonfatal injury by law enforcement, and for comorbid disorders that are common causes of both the particular disorder of interest and nonfatal injury by law enforcement. Overall, this pattern of findings suggests that psychiatric comorbidity may play a particularly important role in risk of injury by law enforcement.

Major depressive disorder showed the weakest association with nonfatal injury by law enforcement, particularly after controlling for other disorders. This pattern was similar to our findings in the negative control analyses of anxiety disorder. Past research suggests complex, reciprocal relations between depression, anxiety, and substance use disorders.[66,136] Thus, it is possible that analyses controlling for comorbid alcohol and drug use disorders may have adjusted away true causal relations between these disorders and nonfatal injury by law enforcement.[23] However, the exact mechanisms of co-occurrence of anxiety and depression with other psychiatric disorders are still unclear.[66,136] Further, both depression and anxiety are internalizing disorders that are characterized by symptoms such as sadness, fear, and rumination, which may be less likely to increase the risk of encounter and injury by law enforcement, either directly or indirectly.[66,142] Future research utilizing longitudinal data that is able to accurately capture temporal ordering of comorbid psychiatric disorders is needed to better understand the mechanisms driving co-occurrence of disorders and their relations with nonfatal injury perpetrated by law enforcement. While we had hospital discharge records over a 10-year period, these data may not be ideal for identifying onset of psychiatric illness given that they likely only capture individuals intermittently (e.g., during mental health crises); thus, they are less likely to be a reliable source for establishing temporality of disorder onset.

3.4.2 Associations by Race/Ethnicity

The general pattern of magnitude of associations by disorder type (i.e., stronger for more severe psychiatric disorders and comorbid mental and substance use disorders) was similar by race/ethnicity; however, the strength of associations overall varied by racial identity. Across disorders, associations with nonfatal injury by law enforcement were substantially stronger for Asian or Pacific Islander adults and weaker for Black and American Indian or Alaska Native adults, compared to other groups. While this may be counterintuitive, the magnitude of relative measures of association, including the OR, is dependent on the baseline level of disease. A large body of literature reports that Black individuals experience the highest levels of injury by law enforcement in the US; American Indian or Alaska Native individuals experience greater burden of injury than other racial/ethnic groups – although estimates are less precise; and Asian and Pacific Islander individuals experience the lowest rates of injury.[4–6,37] Thus, this pattern of relative associations may reflect that structural and individual-level racism play a substantial role for Black and other racially marginalized individuals in the US – perhaps leaving less room for the influence of other risk factors, such mental and substance use disorders.

To our knowledge, this is the first study to examine whether the relationship between mental and substance use disorders and injury caused by law enforcement varies by race/ethnicity. While these findings begin to add to our understanding of the influence of psychiatric disorders and race (and their interrelations) on police violence, these relative relations provide only one piece of the picture. Specifically, they contribute insight into the relative importance of particular psychiatric disorders

(compared to other risk factors) as potential drivers of police violence within racial/ethnic groups. For example, they suggest that compared to other risk factors for police violence, nonaffective psychosis, comorbid mental and substance use disorder, and bipolar disorder may be particularly relevant for risk of injury by law enforcement among Asian and Pacific Islander adults. However, it is important to examine effect modification on both the relative and absolute scales, particularly if the aim is to identify highest risk groups that may benefit the most from preventive strategies.[143] Therefore, in future research we will also examine associations on the absolute scale (e.g., estimating cumulative incidence differences), to get a more complete understanding of the joint influence of psychiatric disorders and racial identity on police violence. For example, compared to other racial/ethnic groups, racially marginalized individuals who also suffer from certain psychiatric disorders may be at particularly increased absolute risk of injury caused by law enforcement – however, this pattern could be masked on the relative scale because of differential baseline levels of police violence.

3.4.3 Limitations and Conclusions

This study has several limitations. First, we used a hospital-based control group, which raises concern for selection bias. However, the data used represented a large, diverse control series to sample from – which, when pooled, captured almost 70% of California residents 19-74 years old at one point or another over the study period. For comparison, response rates for certain national surveys, including the National Health and Nutrition Examination Survey[144] and the National Health Interview Survey,[145] are similar. Second, although reporting of external causes of injury (including legal intervention) is mandatory in California hospital discharge records,[119] misclassification of LI injuries in hospital administrative data is possible. Validation studies have found that fatal LI injuries are underreported in death certificate data.[33,34] We know of no studies that examined the accuracy of nonfatal LI injuries in hospital administrative data; however, a few studies have found excessive use of force by police to be underreported in emergency department physician documentation.[120,146] If this misclassification is nondifferential by mental/substance use disorder status, then this could bias associations towards the null. Differential misclassification by disorder status could be plausible if, for example, psychiatric disorders prohibit LI injury patients from being able to accurately describe the altercation leading to their injury. In this scenario bias would also pull associations towards, rather than away from, the null.

Similarly, there is likely misclassification of mental and substance use disorders in hospital discharge data. Research has found high specificity but low sensitivity for the disorders studied; therefore, underreporting of disorders (false negatives) is likely a greater concern than overreporting (false positives).[121,131,132] If this is nondifferential with respect to nonfatal LI injury, then estimates could be biased towards the null. Differential misclassification of disorders by case status may be possible if, for example, LI injury cases have more severe/untreated psychiatric illness that is more likely to result in a psychiatric evaluation in the hospital setting and thus be captured. However, if underreporting of disorders is of greater concern, then this should also bias associations towards the null. Of all the disorders studied, personality disorders may be the most under-diagnosed in the hospital setting, given that time constraints prohibit thorough evaluations and that personality disorder diagnostic criteria include an "enduring pattern" of symptoms, which is difficult to assess when patients are only seen intermittently.[132,138] Research has also found disparities in disorder diagnoses by race/ethnicity, which could have biased the race-specific associations reported in this study. For example, research suggests that psychosis diagnoses are disproportionately assigned to

Black compared to White individuals.[147] Lastly, a broader issue around psychiatric disorder diagnoses is the categorization of disorders by the current diagnostic system, which places an emphasis on distinct disorders rather than on the dimensional nature of psychopathology.[66,136,137]

Third, we had to exclude cases (20.3%) and potential controls (10.6%) with a missing record linkage number (unique identifier) from the study because we were unable to link their records to ascertain mental/substance use disorder status. Because this identifier is based on the patient's Social Security Number, exclusion likely disproportionately affected groups without a Social Security Number (e.g., undocumented populations); therefore, our results may not be generalizable to these subpopulations. Fourth, patient health insurance was the only proxy available for individual-level SES in the hospital data; thus, to the extent that the "social causation" theory was relevant for our study population, there may be residual confounding by SES. Lastly, one additional concern is bias from the selection of LI injury cases who have mental and substance use disorders into the hospital system. That is, spurious associations between disorders and nonfatal LI injury could be introduced if individuals with psychiatric disorders who experience minor LI injuries are brought into the hospital system (motivated by their disorder rather than injury), whereas those who do not have psychiatric disorders and suffer minor injuries during an encounter are less likely to be brought in for treatment. However, examination of differences in injury severity scores among LI injury patients by disorder status in Chapter 2 showed that while LI injury patients with disorders seem to be somewhat selected into inpatient settings (i.e., inpatient hospitalization), they are not more likely to be selected into the hospital system overall (i.e., emergency room and inpatient combined). Specifically, injury severity scores were similar for emergency department injury patients with and without disorders (for substance use disorder, mean ISS of 1.8 vs. 1.8; for mental disorder, mean ISS of 1.7 vs. 1.8), but differed for inpatient LI injury patients – where cases with a disorder had lower mean scores than those without (for substance use disorder, 5.6 vs. 6.7; for mental disorder, 4.0 vs. 7.2). In this study we did not condition on inpatient status; thus, this type of selection could not have biased results.

Despite these limitations, we were able to use a large and diverse population-based dataset to examine the overall role of particular mental and substance use disorders, as well as comorbid mental and substance use disorder, in the risk of nonfatal injury by law enforcement among adults in California – the most populous state in the US. To our knowledge, this is the first study to assess whether these relations vary by race/ethnicity. Taken together, our findings indicate that mental and substance use disorders – in particular, more severe disorders (e.g., personality disorder and psychosis) and psychiatric comorbidity – may play an important role in the risk of experiencing police violence. Further, examination of variation in the strength of associations by disorder type and race/ethnicity identified groups for whom psychiatric disorders may be most influential in terms of elevating injury risk – for example, Asian or Pacific Islander adults with personality disorder, psychosis, bipolar disorder, and comorbid mental and substance use disorder – which may be relevant for the development of targeted prevention strategies aimed at reducing LI injury burden.

To build on these findings, future work should examine relations on the absolute scale and estimate population attributable risks – which take into account both exposure prevalence and strength of association – to better understand differences in associations by racial/ethnicity. To reduce police violence in this population, there is also a need for research to identify effective prevention strategies. Our estimated associations capture the overall influence of psychiatric disorders on nonfatal injury caused by law enforcement, through both direct and indirect mechanisms. Thus, research should consider strategies aimed at both structural social changes and organization-level

changes. Structural changes (e.g., improved social conditions and resources for individuals with psychiatric disorders) may improve disorder management as well as downstream social factors that likely mediate these relations.[69,75,78,79] Organization-level changes (e.g., agency reforms and collaborative models between law enforcement and mental health professionals) can potentially improve responses to this high-risk population during encounters.[148] Rigorous, population-based studies that are careful to not overadjust for potential mediating factors (e.g., behaviors related to psychiatric disorder symptoms) are needed to truly tease apart whether increased risk of injury by law enforcement among individuals with psychiatric disorders is more attributable to increased risk of encounter (i.e., legal system/law enforcement exposure) or increased risk of injury during encounters (i.e., differential treatment of individuals with psychiatric disorders during encounters). Findings from such studies can help inform which types of prevention strategies may be most effective.

Table 3.1 International Classification of Diseases, Ninth Revision, Clinical Modification legal intervention injury codes included in analysis.

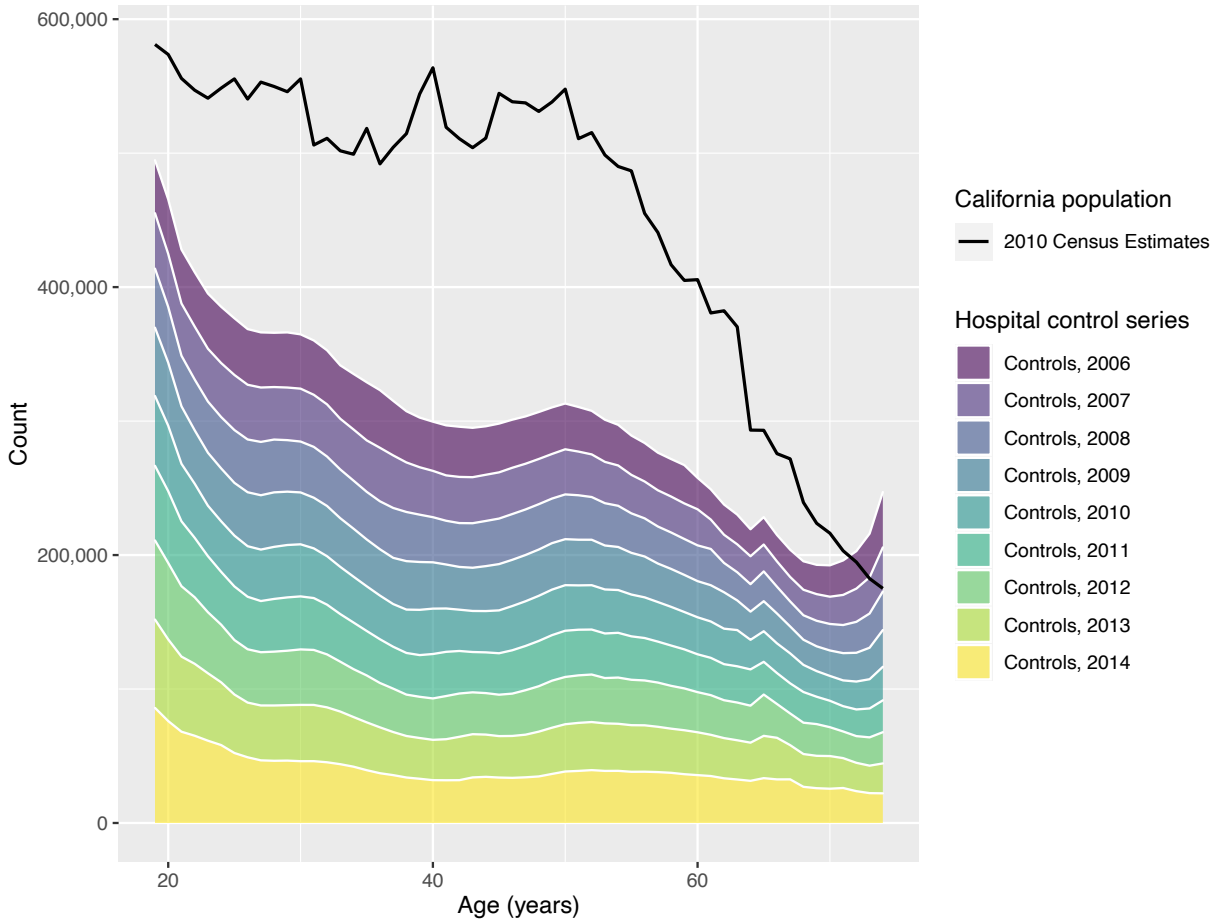
Measure	**ICD-9-CM diagnosis code**
Legal intervention injury	E970-E977
Injury by firearms	E970
Injury by explosives	E971
Injury by gas	E972
Injury by blunt object	E973
Injury by cutting and piercing instrument	E974
Injury by other specified means	E975
Injury by unspecified means	E976
Late effects of injuries due to legal intervention	E977

Table 3.2 International Classification of Diseases, Ninth Revision, Clinical Modification mental and substance use disorder codes included in analysis.

Measure	ICD-9-CM diagnosis code
Nonaffective Psychosis	
Schizophrenic disorders	295.xx
Delusional disorders	297.xx
Other nonorganic psychoses	298.xx
Psychotic disorder with delusions in conditions classified elsewhere	293.81
Psychotic disorder with hallucinations in conditions classified elsewhere	293.82
Bipolar Disorder	
Bipolar I disorder, single manic episode	296.0x
Manic disorder recurrent episode	296.1x
Bipolar I disorder, most recent episode (or current) manic	296.4x
Bipolar I disorder, most recent episode (or current) depressed	296.5x
Bipolar I disorder, most recent episode (or current) mixed	296.6x
Bipolar I disorder, most recent episode (or current) unspecified	296.7
Other and unspecified bipolar disorders	296.8x
Other and unspecified episodic mood disorder	296.9x
Mood disorder in conditions classified elsewhere	293.83
Cyclothymic disorder	301.13
Major Depressive Disorder	
Major depressive disorder single episode	296.2x
Major depressive disorder recurrent episode	296.3x
Dysthymic disorder	300.4
Personality Disorder	
Paranoid personality disorder	301.0
Affective personality disorder	301.1x (except 301.13)
Schizoid personality disorder	301.2x
Explosive personality disorder	301.3
Obsessive-compulsive personality disorder	301.4
Histrionic personality disorder	301.5x
Dependent personality disorder	301.6
Antisocial personality disorder	301.7
Other personality disorders (e.g., Borderline)	301.8x
Unspecified personality disorder	301.9
Alcohol use disorder	
Alcohol dependence syndrome	303.xx
Non-dependent alcohol abuse	305.0x
Drug use disorder	
Drug dependence	304.xx
Non-dependent drug abuse (excluding tobacco use disorder)	305.2x-305.9x
Anxiety disorder	
Anxiety states (including generalized anxiety disorder)	300.0x
Phobic disorders	300.2x
Obsessive-compulsive disorders	300.3
Separation anxiety disorder	309.21

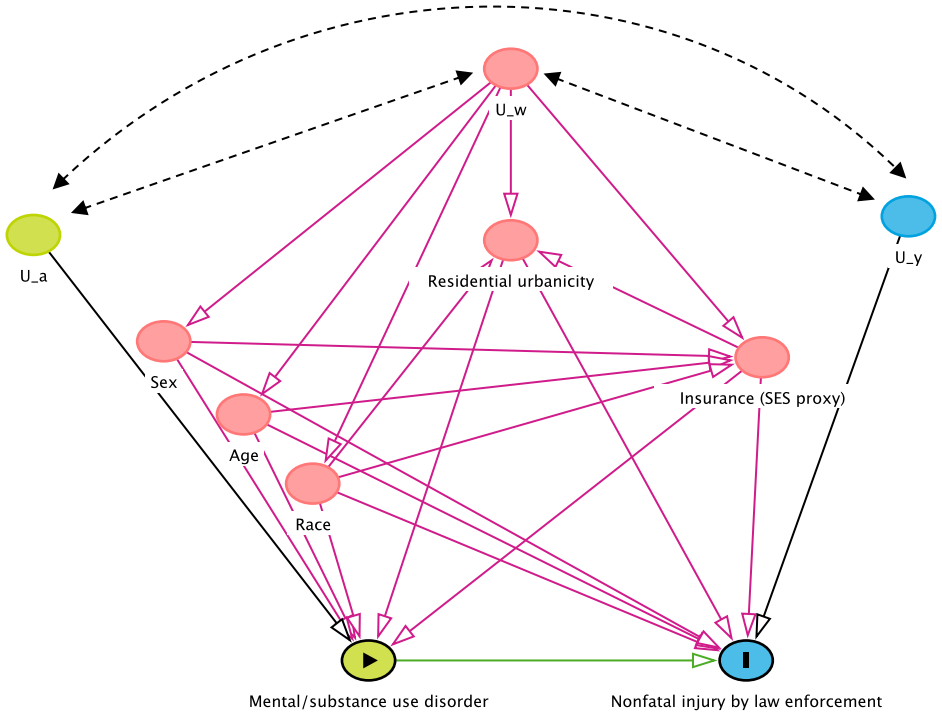
Note: Codes with an "x" indicate that all disorder subtypes within that category were included.

Figure 3.1 California residents, 19-74 years of age, captured by the statewide hospital control series after de-duplication over the study period, by age and study year.



Note: The 2010 Census California population estimates by age are plotted with the black line and overlay the statewide hospital control series, which is fully de-duplicated over the study period (i.e., for each potential control patient with multiple visits, a random visit was sampled) and shown by age and year of hospital visit. The de-duplicated hospital control series from which study controls were sampled, when pooled across study years, captured a relatively large proportion (approximately 66.7%) of the California population, both overall and by age. When pooled over the study period, potential hospital controls older than 70 years outnumber the 2010 Census estimate for California adults in this age group (shown by the crossing of the 2010 Census Estimates black line with the summed hospital controls plot area). This is because as Californians moved through time and aged over the study period, older Californians were more likely to require emergency department or inpatient hospital care and were thus disproportionately captured in the hospital data.

Figure 3.2 Directed acyclic graph depicting the hypothesized relation between mental and substance use disorders and nonfatal legal intervention injury.



Note: There are likely unmeasured/unknown factors that are shared by the exposure (U_a), outcome (U_y), and confounders (U_w).

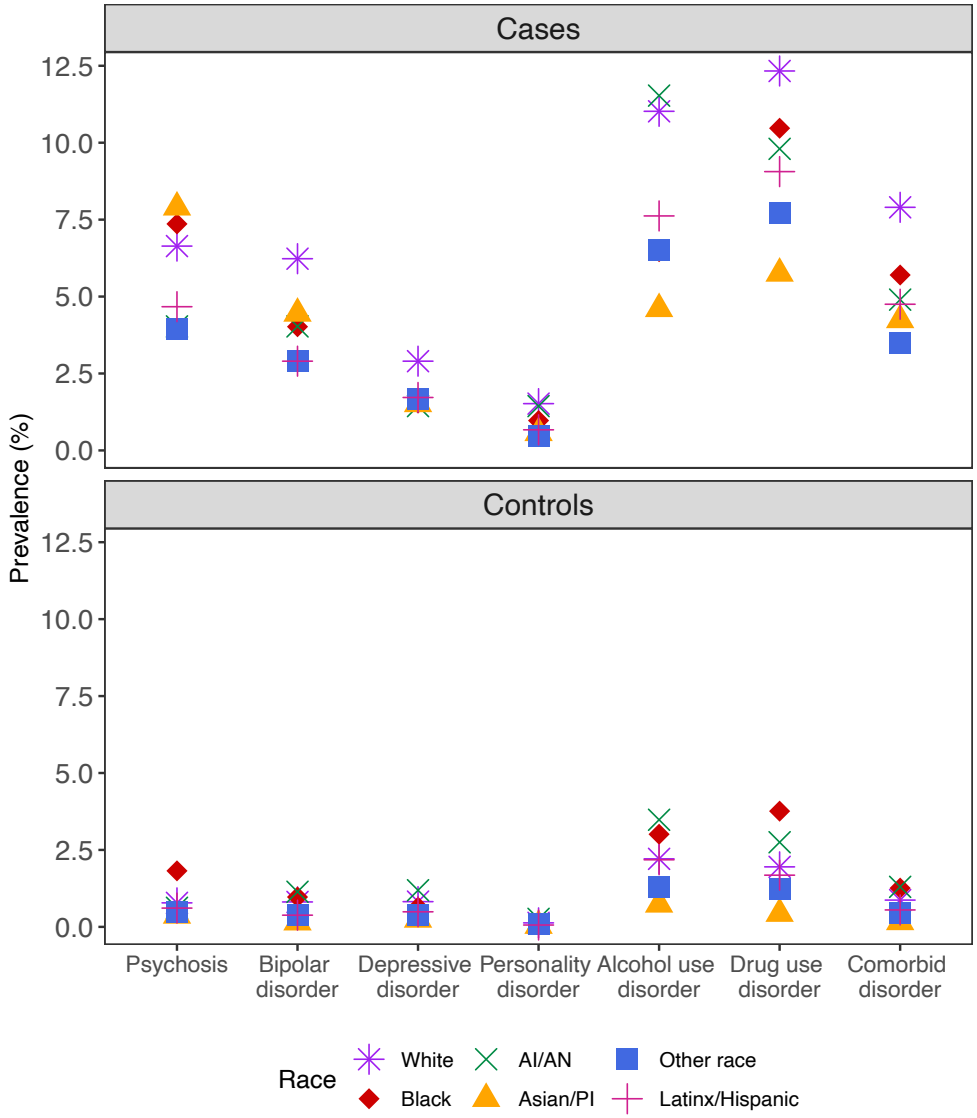
Table 3.3 Characteristics of adult nonfatal legal intervention injury cases and sampled statewide hospital controls in California, 2005-2014, and of the general adult California population.

Characteristic	Cases, N (%)	Controls, N (%)	California, N (%)
Total	57,519 (100)	575,190 (100)	25,411,867 (100)
Sex			
Female	7,297 (12.7)	72,970 (12.7)	12,741,235 (50.1)
Male	50,222 (87.3)	502,220 (87.3)	12,670,632 (49.9)
Age (years)			
19-24	12,027 (20.9)	85,766 (14.9)	3,347,080 (13.2)
25-34	19,569 (34.0)	111,876 (19.5)	5,317,877 (20.9)
35-44	13,542 (23.5)	102,501 (17.8)	5,182,710 (20.4)
45-54	8972 (15.6)	108,851 (18.9)	5,252,371 (20.7)
55-64	2,831 (4.9)	92,990 (16.2)	4,036,493 (15.9)
65-74	578 (1.0)	73,206 (12.7)	2,275,336 (9.0)
Race/ethnicity			
White	24,893 (43.3)	295,071 (51.3)	10,943,882 (43.1)
Black	10,864 (18.9)	49,037 (8.5)	1,511,998 (5.9)
American Indian or Alaska Native	347 (0.6)	1,926 (0.3)	116,110 (0.5)
Asian or Pacific Islander	1,392 (2.4)	46,941 (8.2)	3,590,784 (14.1)
Other or multiple race	2,409 (4.2)	24,733 (4.3)	576,047 (2.3)
Latinx/Hispanic	17,614 (30.6)	157,482 (27.4)	8,673,046 (34.1)
Mental/substance use disorder			
Drug use disorder[a]	6,104 (10.6)	10,794 (1.9)	--
Alcohol use disorder[a]	5,047 (8.8)	12,169 (2.1)	--
Psychosis[a]	3,495 (6.1)	4,470 (0.8)	--
Bipolar disorder[a]	2,645 (4.6)	3,656 (0.6)	--
Major depressive disorder[a]	1,259 (2.2)	3,732 (0.6)	--
Personality disorder[a]	626 (1.1)	596 (0.1)	--
Comorbid mental & substance use disorder	3,581 (6.2)	4,273 (0.7)	--

[a] Disorder categories are not mutually exclusive.

Note: Controls were sampled to match the sex distribution among the cases. California frequencies are based on 2010 Census data. The racial categories were operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other race do not include patients identifying as Latinx/Hispanic. The Other race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories.

Figure 3.3 Mental and substance use disorder prevalence among adult nonfatal legal intervention injury cases and sampled statewide hospital controls in California, 2005-2014, by race/ethnicity.

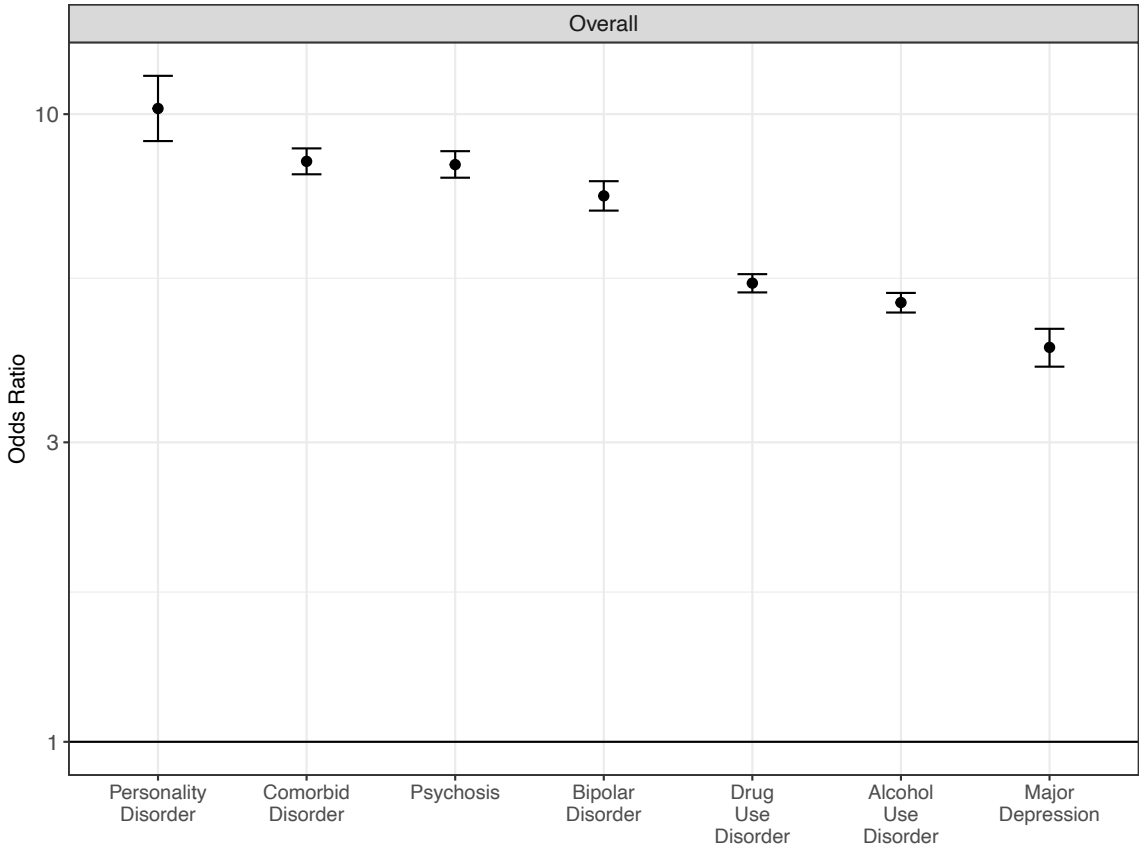


Abbreviations: AI/AN: American Indian or Alaska Native. Asian/PI: Asian or Pacific Islander.
Note: Within each race category, by case status, the proportion of individuals with each disorder exposure is depicted. For example, 7.9% of Asian or Pacific Islander nonfatal legal intervention injury cases had a documented psychosis disorder in the year prior to their injury. Disorder categories are not mutually exclusive. The racial categories were operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other race do not include patients identifying as Latinx/Hispanic. The Other race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories.

Table 3.4 Patterns of comorbidity among adult nonfatal legal intervention injury cases and sampled statewide hospital controls in California, 2005-2014, with particular mental and substance use disorders.

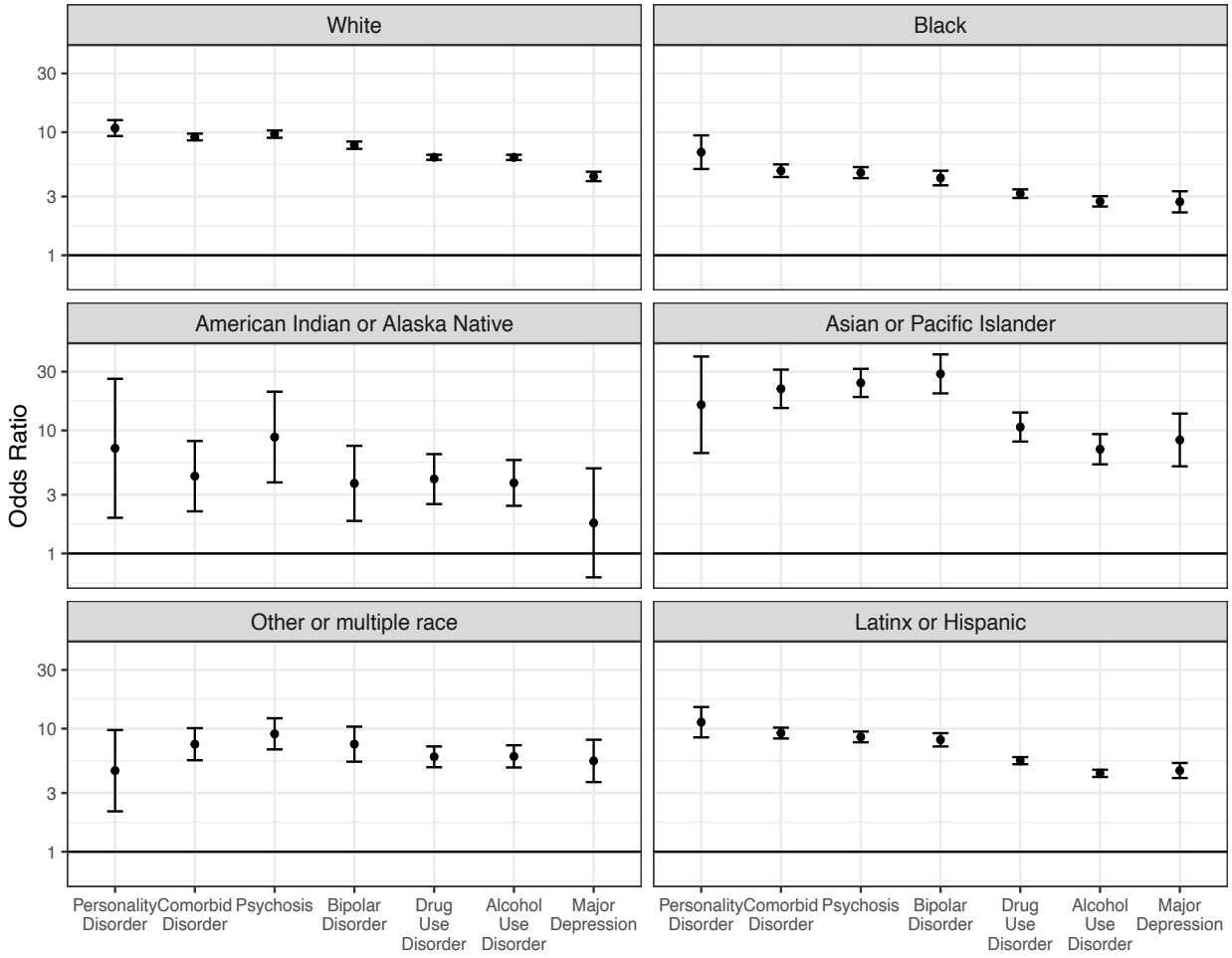
	Psychosis	**Bipolar Disorder**	**Major Depression**	**Personality Disorder**	**Alcohol Use Disorder**	**Drug Use Disorder**
Comorbidity Status	**Cases (N, %)**					
Total	3,495 (100.0)	6,301 (100.0)	1,259 (100.0)	626 (100.0)	5,047 (100.0)	6,104 (100.0)
No comorbidity	804 (23.0)	1,592 (25.3)	191 (15.2)	18 (2.9)	1,927 (38.2)	2,129 (34.9)
Comorbid mental disorder(s) only	413 (11.8)	1,001 (15.9)	123 (9.8)	109 (17.4)	624 (12.4)	1,479 (24.2)
Comorbid substance use disorder(s) only	1,056 (30.2)	1,400 (22.2)	405 (32.2)	55 (8.8)	1,018 (20.2)	1,018 (16.7)
Comorbid mental and substance use disorders	1,222 (35.0)	2308 (36.6)	540 (42.9)	444 (70.9)	1,478 (29.3)	1,478 (24.2)
	Controls (N, %)					
Total	4,470 (100.0)	3,656 (100.0)	3,732 (100.0)	596 (100.0)	12,169 (100.0)	10,794 (100.0)
No comorbidity	1,795 (40.2)	1,176 (32.2)	1,744 (46.7)	57 (9.6)	7,615 (62.6)	5,477 (50.7)
Comorbid mental disorder(s) only	623 (13.9)	597 (16.3)	319 (8.5)	129 (21.7)	1,064 (8.7)	1,827 (16.9)
Comorbid substance use disorder(s) only	1,048 (23.4)	808 (22.1)	1,010 (27.1)	67 (11.2)	2,108 (17.3)	2,108 (19.5)
Comorbid mental and substance use disorders	1,004 (22.5)	1,075 (29.4)	659 (17.7)	343 (57.6)	1,382 (11.4)	1,382 (12.8)

Figure 3.4 Overall associations of particular mental and substance use disorders with nonfatal legal intervention injury among adults in California, 2005-2014 – main analysis, adjusted for demographic characteristics.



Note: The "Comorbid Disorder" category comprised comorbid mental and substance use disorder. In the disorder-specific analyses, disorder categories were not mutually exclusive. Estimates are adjusted for patient race, age, and sex.

Figure 3.5 Associations of particular mental and substance use disorders with nonfatal legal intervention injury among adults in California, 2005-2014, by race/ethnicity – main analysis, adjusted for demographic characteristics.



Note: The "Comorbid Disorder" category comprised comorbid mental and substance use disorder. In the disorder-specific analyses, disorder categories were not mutually exclusive. Estimates are adjusted for patient age and sex. The racial categories were operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other race do not include patients identifying as Latinx/Hispanic. The Other race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories.

3.5 Supplemental Material

3.5.1 Supplemental Methods

Table 3.5 Demographic characteristics of adult nonfatal legal intervention injury cases and statewide potential hospital controls in California, 2006-2014, with a missing record linkage number.

Characteristic	Cases Missing RLN, N (%)	Potential Controls Missing RLN, N (%)
Total	16,206 (100.0)	7,271,295 (100.0)
Sex		
Female	1,113 (6.9)	4,614,772 (63.5)
Male	15,091 (93.1)	2,656,098 (36.5)
Missing	2 (0.0)	425 (0.0)
Age (years)		
19-24	5,099 (31.5)	1,583,769 (21.8)
25-34	5,965 (36.8)	2,405,073 (33.1)
35-44	3,186 (19.7)	1,554,739 (21.4)
45-54	1,464 (9.0)	861,152 (11.8)
55-64	416 (2.6)	552,927 (7.6)
65-74	76 (0.5)	313,635 (4.3)
Race/ethnicity		
White	4,182 (25.8)	1,293,456 (17.8)
Black	2,099 (13.0)	296,310 (4.1)
American Indian or Alaska Native	47 (0.3)	13,489 (0.2)
Asian or Pacific Islander	344 (2.1)	410,037 (5.6)
Other or multiple race	722 (4.5)	316,454 (4.4)
Latinx/Hispanic	8,092 (50.0)	4,732,533 (65.1)
Missing	720 (4.4)	209,016 (2.9)

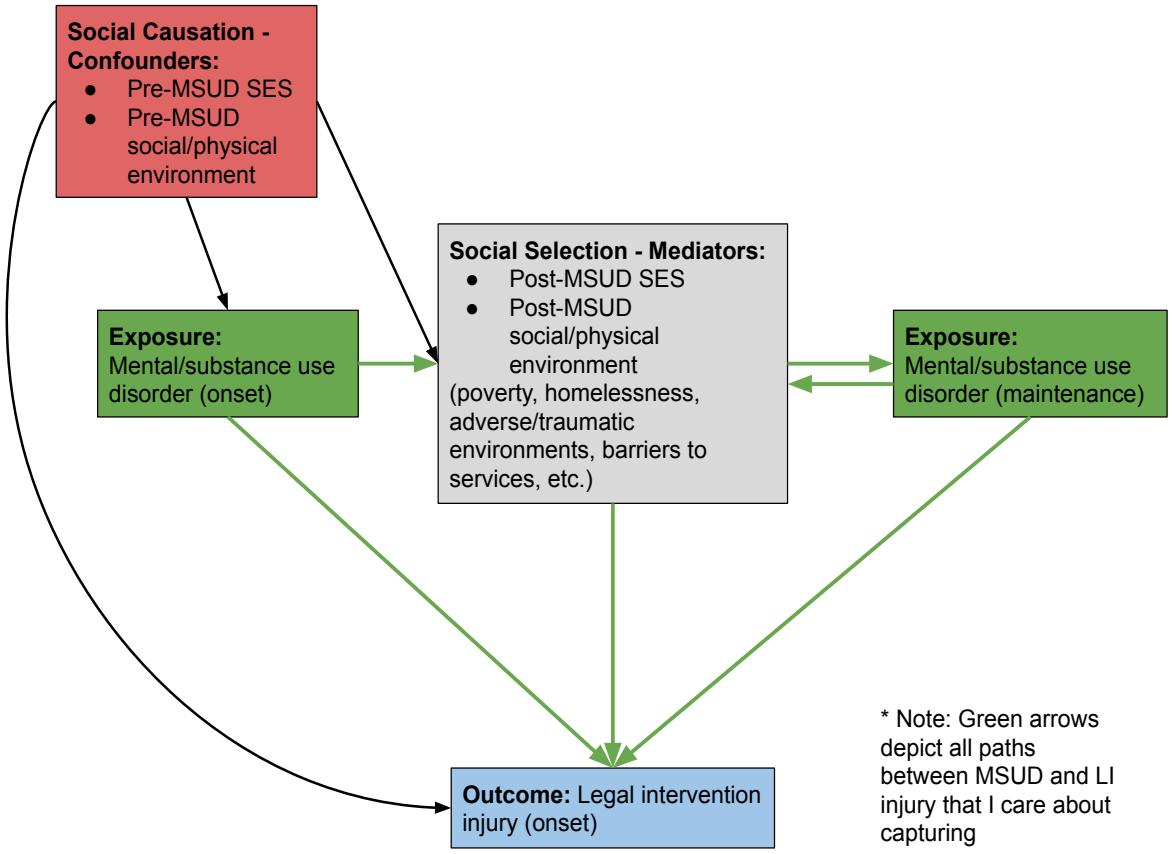
Abbreviations: RLN: Record linkage number.

Table 3.6 Operationalization and reference categories of categorical covariates included in the main and sensitivity analyses.

Measure	**Levels**
Race/ethnicity	Non-Latinx/Hispanic White (reference) Non-Latinx/Hispanic Black Non-Latinx/Hispanic American Indian or Alaska Native Non-Latinx/Hispanic Asian or Pacific Islander Non-Latinx/Hispanic Other or multiple race Latinx/Hispanic
Sex	Female (reference) Male
Health insurance type	Private insurance (reference) Medicare Medi-Cal Other government insurance Worker's compensation Self-pay Other
Residential urbanicity	Urbanized area (reference) Urban cluster Rural

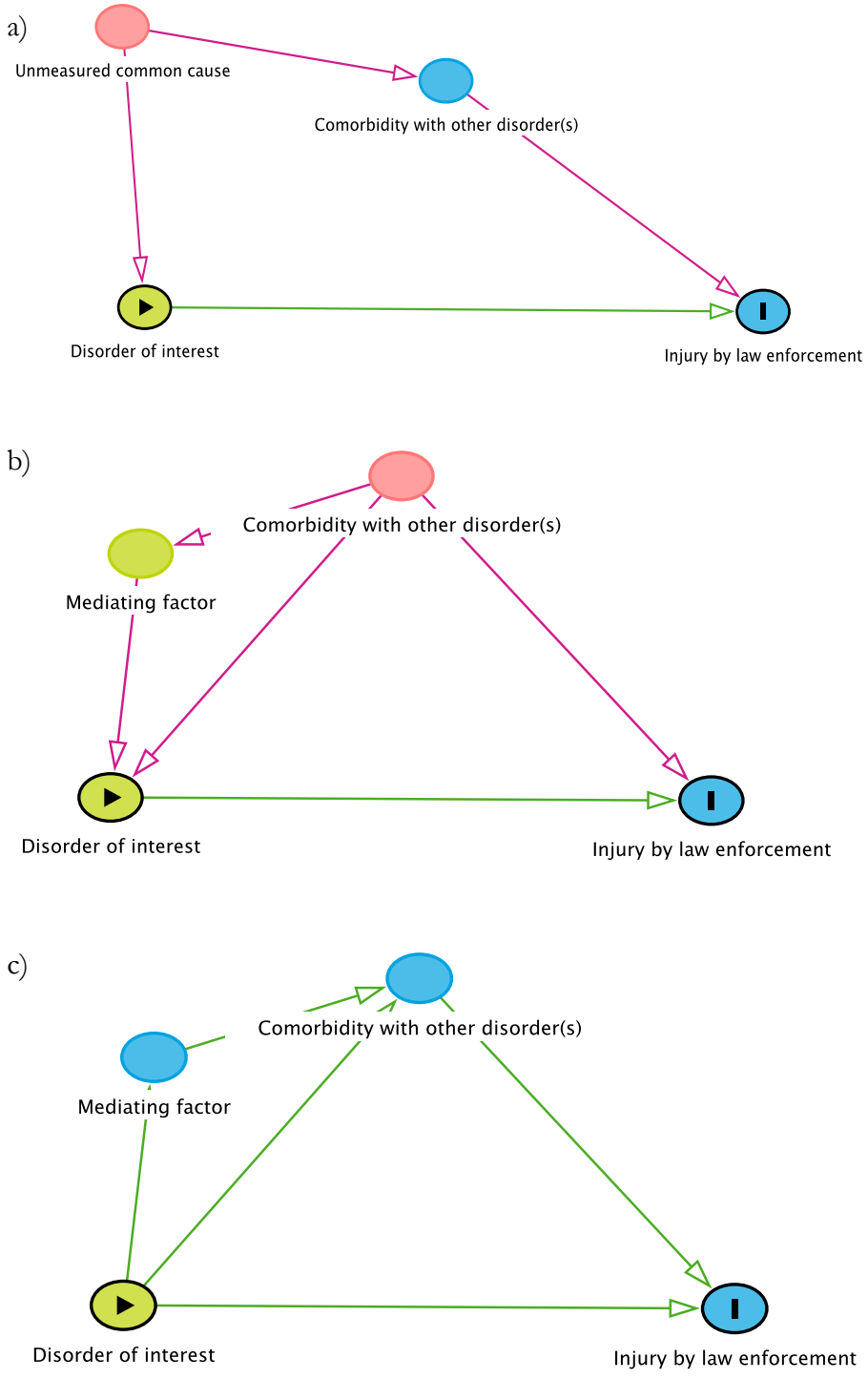
Note: Patient race/ethnicity, sex, health insurance type, and residential Zip Code (used to assign residential urbanicity) are from the patient discharge record.

Figure 3.6 Conceptual model depicting socioeconomic status and environment as potential confounders ("social causation") and as mediators ("social selection") in the relation between mental and substance use disorders and nonfatal legal intervention injury.



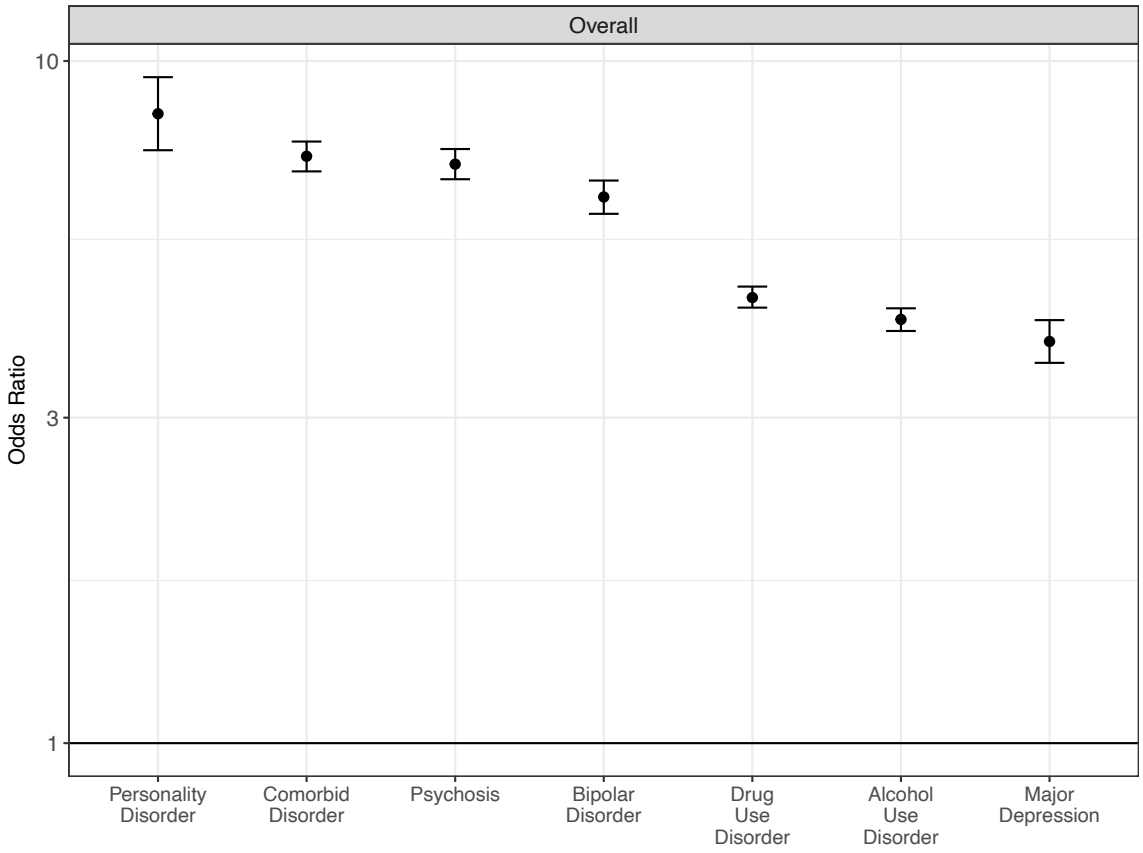
Abbreviations: MSUD: mental and substance use disorder. LI: legal intervention.

Figure 3.7 Plausible mechanisms of comorbidity across disorders – a) common causes, b) comorbid disorder a direct/indirect cause of disorder of interest, and c) disorder of interest a direct/indirect cause of comorbid disorder – and relation with nonfatal legal intervention injury.



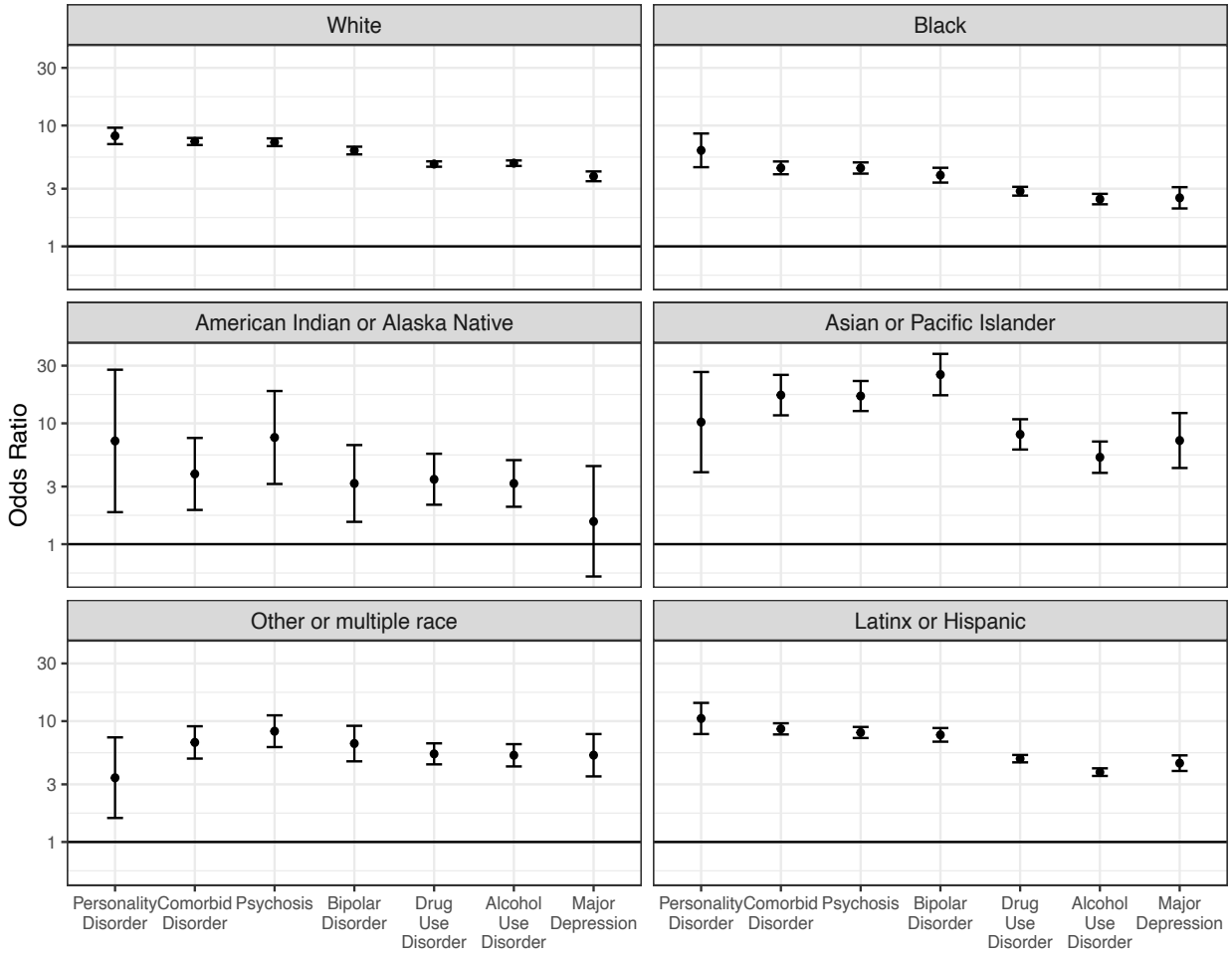
3.5.2 Sensitivity Analysis Results

Figure 3.8 Overall associations of particular mental and substance use disorders with nonfatal legal intervention injury among adults in California, 2005-2014 – sensitivity analysis, adjusted for additional sociodemographic characteristics.



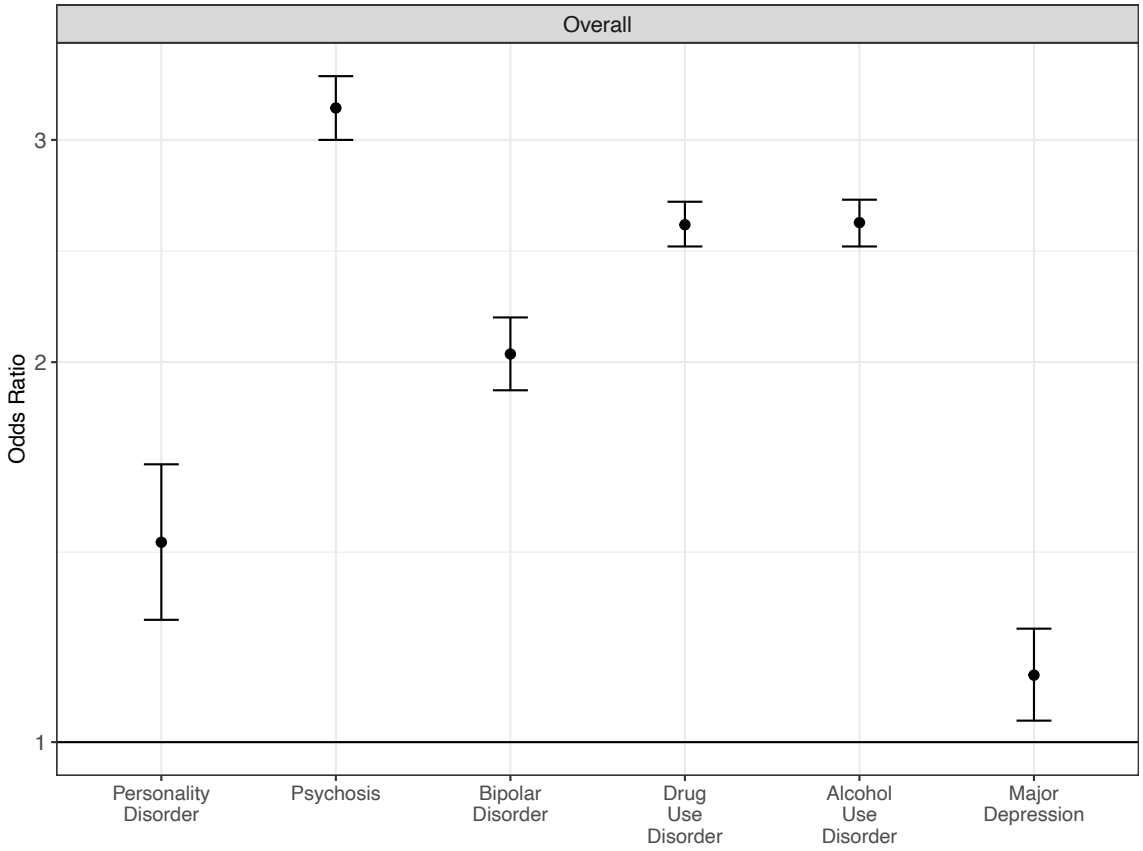
Note: The "Comorbid Disorder" category comprised comorbid mental and substance use disorder. In the disorder-specific analyses, disorder exposure categories were not mutually exclusive. The estimates are adjusted for patient race, age, sex, insurance, and residential urbanicity.

Figure 3.9 Associations of particular mental and substance use disorders with nonfatal legal intervention injury among adults in California, 2005-2014, by race/ethnicity – sensitivity analysis, adjusted for additional sociodemographic characteristics.



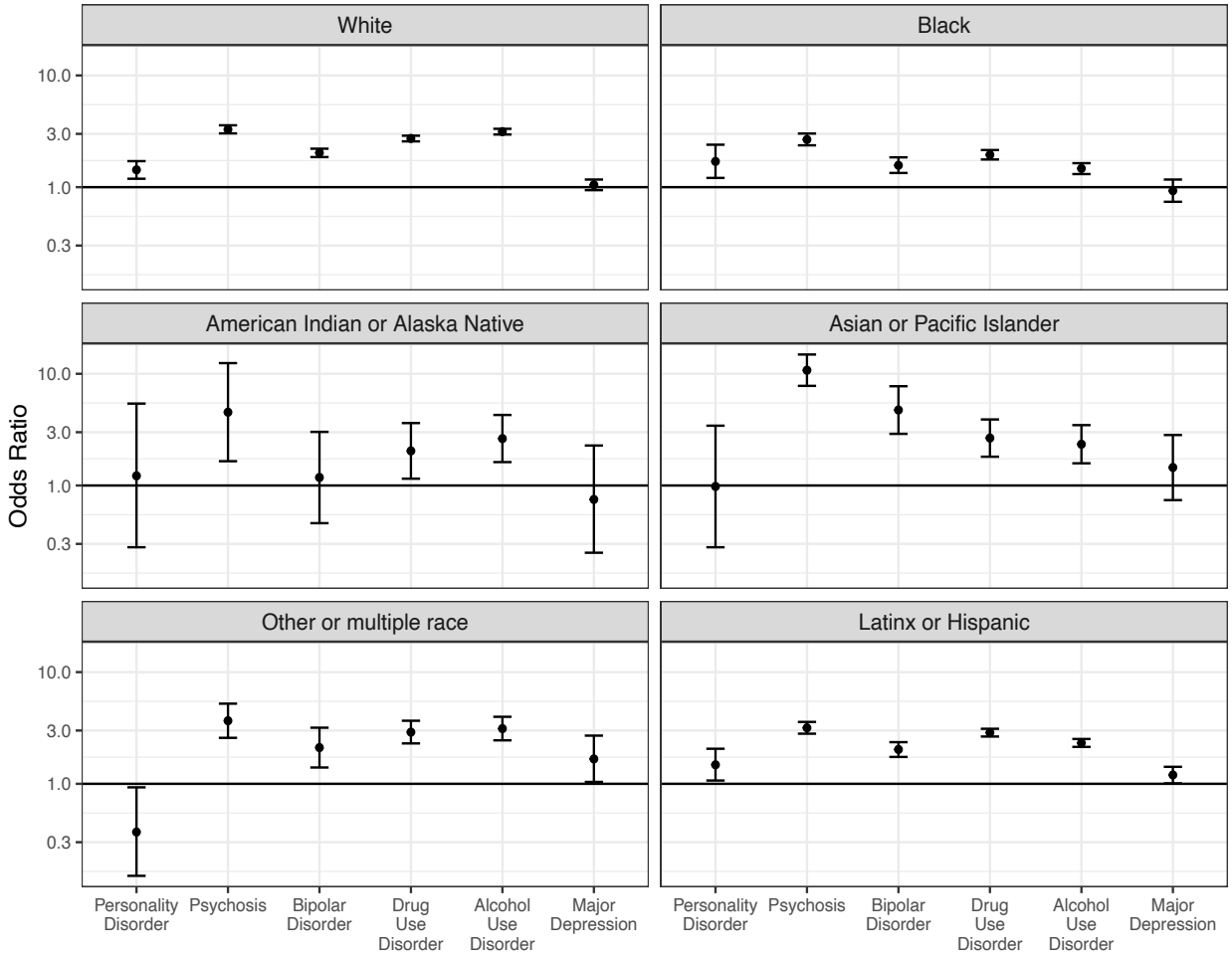
Note: The "Comorbid Disorder" category comprised comorbid mental and substance use disorder. In the disorder-specific analyses, disorder exposure categories were not mutually exclusive. The estimates are adjusted for patient age, sex, insurance, and residential urbanicity. The racial categories were operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other race do not include patients identifying as Latinx/Hispanic. The Other race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories.

Figure 3.10 Overall associations of particular mental and substance use disorders with nonfatal legal intervention injury among adults in California, 2005-2014 – sensitivity analysis, adjusted for psychiatric comorbidity.



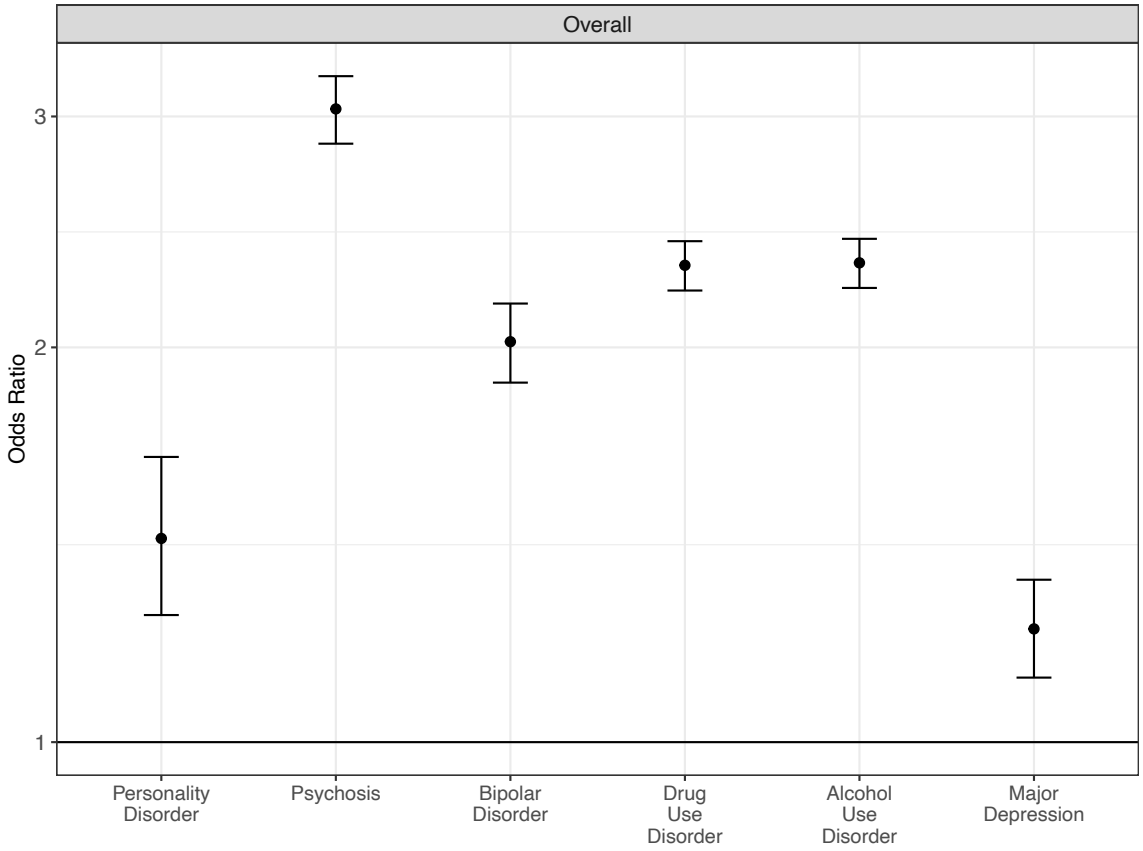
Note: In the disorder-specific analyses, disorder exposure categories were not mutually exclusive. The estimates are adjusted for patient race, age, sex, and the other mental and substance use disorders studied (e.g., the association between psychosis in the prior year and subsequent nonfatal legal intervention injury is adjusted for personality disorder, bipolar disorder, drug use disorder, alcohol use disorder, and major depression).

Figure 3.11 Associations of particular mental and substance use disorders with nonfatal legal intervention injury among adults in California, 2005-2014, by race/ethnicity – sensitivity analysis, adjusted for psychiatric comorbidity.



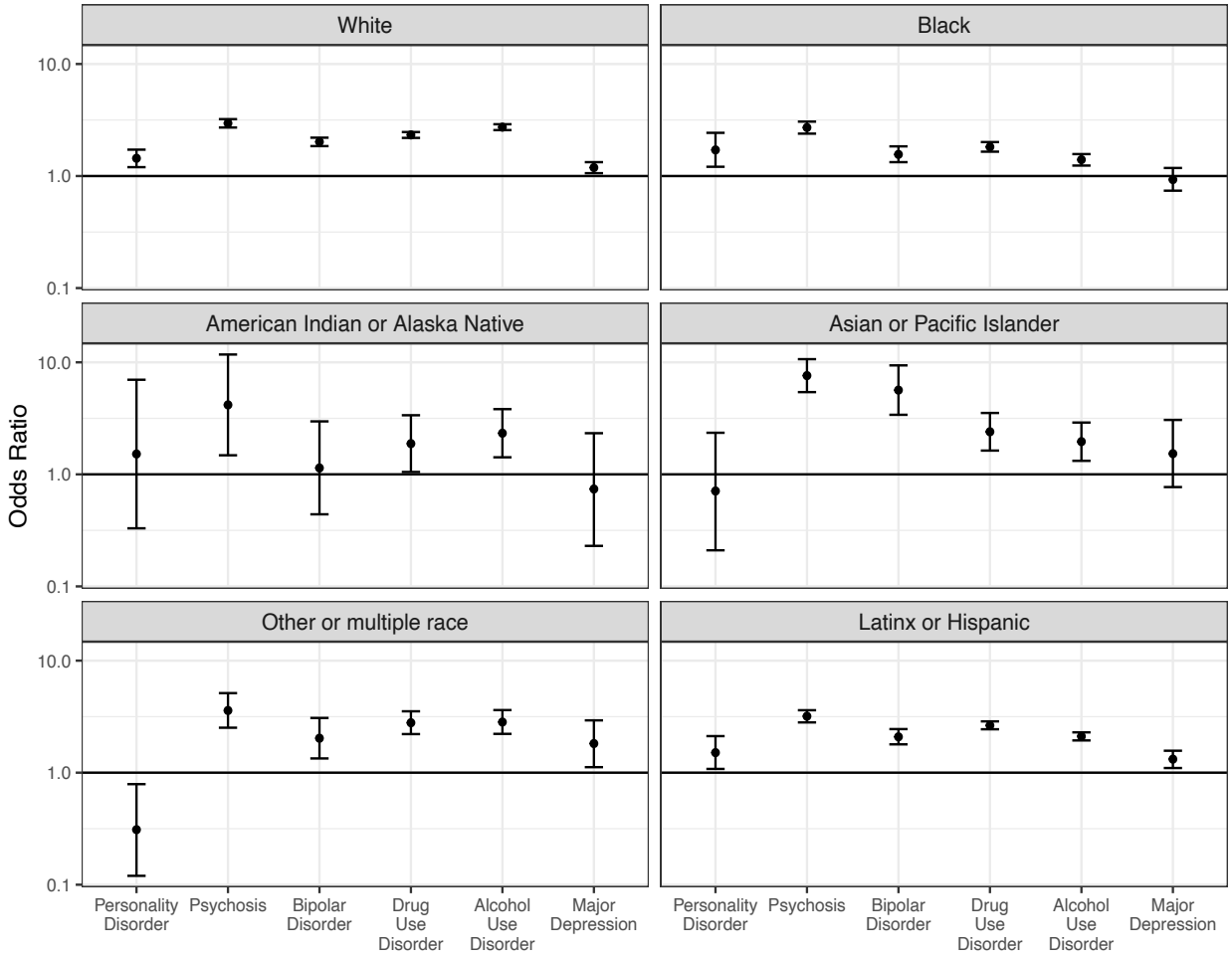
Note: In the disorder-specific analyses, disorder exposure categories were not mutually exclusive. The estimates are adjusted for patient age, sex, and the other mental and substance use disorders studied (e.g., the association between psychosis in the prior year and subsequent nonfatal legal intervention injury is adjusted for personality disorder, bipolar disorder, drug use disorder, alcohol use disorder, and major depression). The racial categories were operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other race do not include patients identifying as Latinx/Hispanic. The Other race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories.

Figure 3.12 Overall associations of particular mental and substance use disorders with nonfatal legal intervention injury among adults in California, 2005-2014 – sensitivity analysis, adjusted for additional sociodemographic characteristics and psychiatric comorbidity.



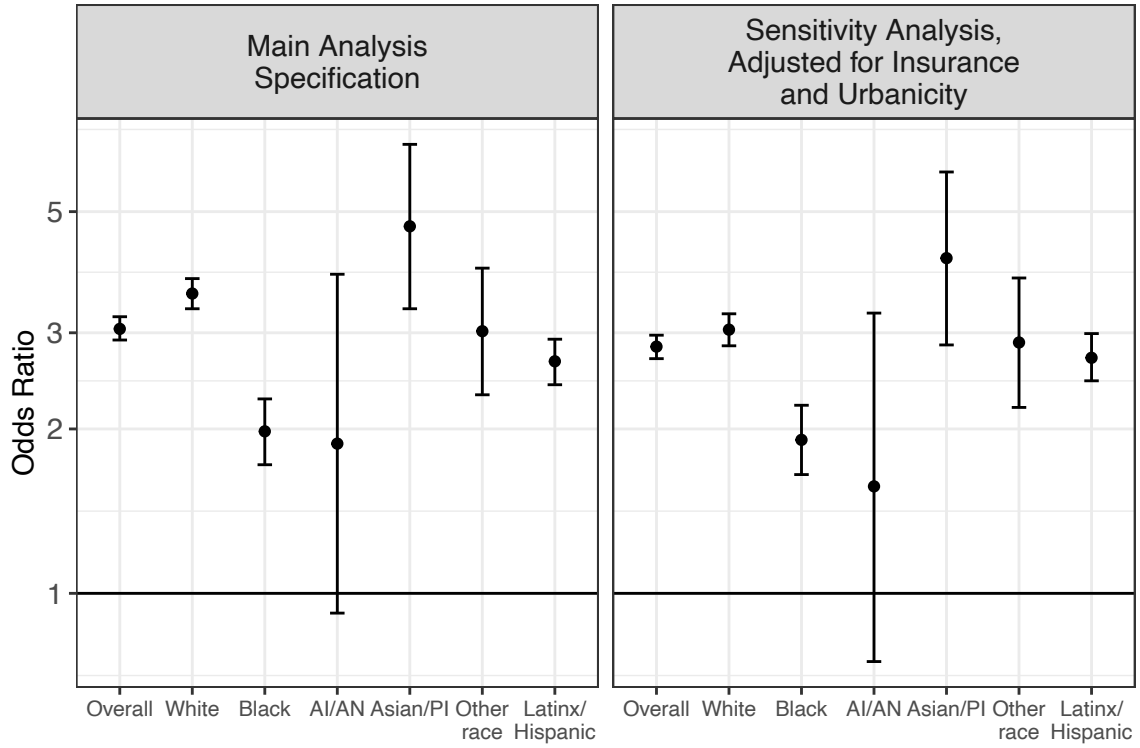
Note: In the disorder-specific analyses, disorder exposure categories were not mutually exclusive. The estimates are adjusted for patient race, age, sex, insurance, residential urbanicity, and the other mental and substance use disorders studied (e.g., the association between psychosis in the prior year and subsequent nonfatal legal intervention injury is adjusted for personality disorder, bipolar disorder, drug use disorder, alcohol use disorder, and major depression).

Figure 3.13 Associations of particular mental and substance use disorders with nonfatal legal intervention injury among adults in California, 2005-2014, by race/ethnicity – sensitivity analysis, adjusted for additional sociodemographic characteristics and psychiatric comorbidity.



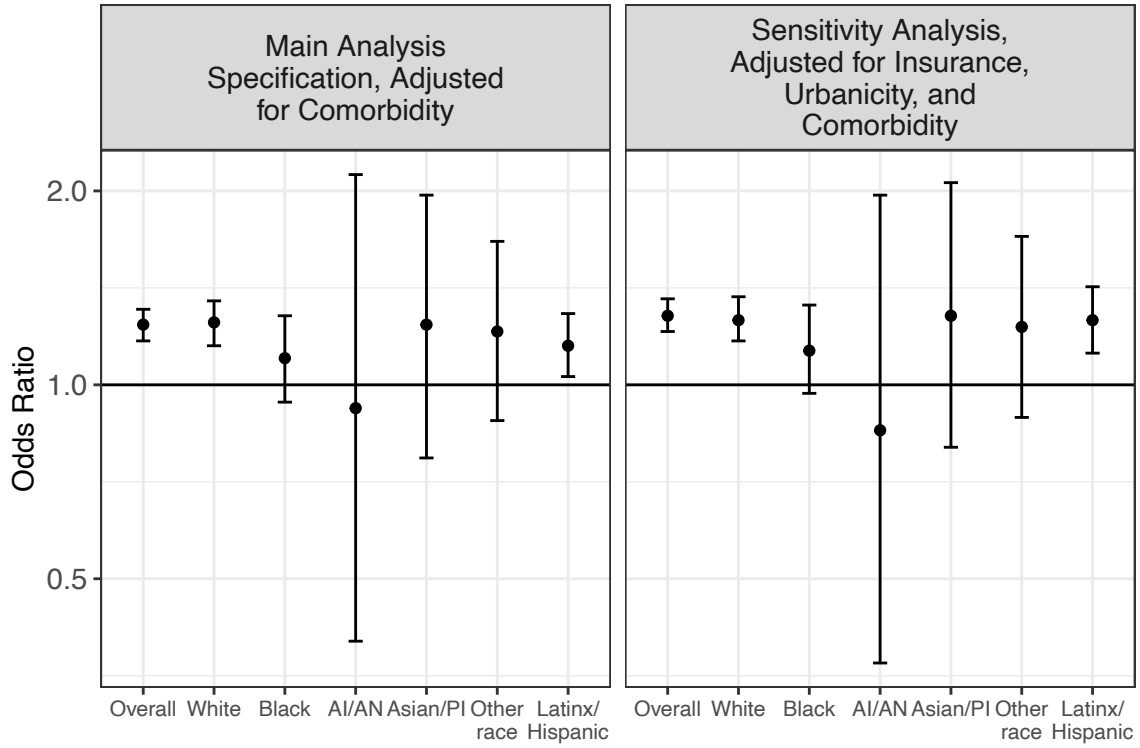
Note: In the disorder-specific analyses, disorder exposure categories were not mutually exclusive. The estimates are adjusted for patient age, sex, insurance, residential urbanicity, and the other mental and substance use disorders studied (e.g., the association between psychosis in the prior year and subsequent nonfatal legal intervention injury is adjusted for personality disorder, bipolar disorder, drug use disorder, alcohol use disorder, and major depression). The racial categories were operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other race do not include patients identifying as Latinx/Hispanic. The Other race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories.

Figure 3.14 Negative control analysis for the association between anxiety disorder and nonfatal legal intervention injury among adults in California, 2005-2014, overall and by race/ethnicity – not adjusted for psychiatric comorbidity.



Abbreviations: AI/AN: American Indian or Alaska Native. Asian/PI: Asian or Pacific Islander.
Note: The anxiety disorder exposure category was not mutually exclusive from other psychiatric disorders. In the main analysis specification, the pooled estimate ("Overall") is adjusted for patient race, age, and sex; the race group-specific estimates are adjusted for patient age and sex. In the sensitivity analysis specification, the pooled estimate ("Overall") is adjusted for patient race, age, sex, insurance, and residential urbanicity; the race group-specific estimates are adjusted for patient age, sex, insurance, and residential urbanicity. The racial categories were operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other race do not include patients identifying as Latinx/Hispanic. The Other race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories.

Figure 3.15 Negative control analysis for the association between anxiety disorder and nonfatal legal intervention injury among adults in California, 2005-2014, overall and by race/ethnicity – adjusted for psychiatric comorbidity.



Abbreviations: AI/AN: American Indian or Alaska Native. Asian/PI: Asian or Pacific Islander.
Note: The anxiety disorder exposure category was not mutually exclusive from other psychiatric disorders. In the main analysis specification, the pooled estimate ("Overall") is adjusted for patient race, age, sex, and other the mental and substance use disorders studied; the race group-specific estimates are adjusted for patient age, sex, and the other mental and substance use disorders studied. In the sensitivity analysis specification, the pooled estimate ("Overall") is adjusted for patient race, age, sex, insurance, residential urbanicity, and the other mental and substance use disorders studied; the race group-specific estimates are adjusted for patient age, sex, insurance, residential urbanicity, and the other mental and substance use disorders studied. The racial categories were operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other race do not include patients identifying as Latinx/Hispanic. The Other race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories.

Chapter 4: Legal Intervention Injury Among Young People: Inequities and Trends in California

4.1 Introduction

In 2018 the American Public Health Association published a policy statement declaring police violence a critical public health problem in the United States (US).[1] Since then, several other professional health organizations, including the American Academy of Pediatrics and Pediatricians Against Racism and Trauma, have released guidance on stemming the harms of structural racism and police violence, with a particular focus on their effects among youth.[31,149] However, every year approximately 1,000 individuals in the US continue to be killed by law enforcement,[2,91] and tens of thousands are treated in US hospitals for nonfatal injuries perpetrated by law enforcement.[3] Public health research on police violence has grown substantially in recent years; however, to date, most work has examined patterns and potential risk factors overall or specifically among adults and men.[4,6,37,57,150] Although exposure to law enforcement is less common among young people, experiences of police violence among children and adolescents may be particularly harmful given a substantial body of literature that has documented the lasting adverse effects of early-life exposures to trauma.[18–20] This, in combination with research showing the disproportionate policing of Black youth, warrants the documentation of police violence in young people's lives.[21,22]

To date, limited research has assessed exposures to policing and police violence among youth in the US. Recent studies have documented the mechanisms through which youth come into contact with law enforcement – ranging from direct contact (e.g., stop-and-frisk) to vicarious contact (e.g., witnessing police violence) – and the distribution of such encounters.[22,25] For example, in one study of a national sample of urban adolescents, almost 1 in 5 youth reported ever being personally stopped by police.[22] Research has also found that encounters with police and experiences of police violence among younger people are inequitably distributed by race/ethnicity, disproportionately affecting racially minoritized youth and young adults.[4,5,22,25,36,151] In addition to stark racial inequities in law enforcement contacts and consequent injuries and deaths caused by law enforcement,[4,5,36] police violence has been linked to several adverse health outcomes among youth, including poor mental health, substance use, and sleep deprivation.[7,87–89,125,152] Thus, experiences of police violence may contribute to inequities in a number of health outcomes among young people.

While the body of literature on the prevalence and health consequences of policing among youth in the US is growing, most research has aggregated across youth of all ages and has not captured the experiences of multiply marginalized youth (e.g., Black girls). To add to the body of work on police violence among young people, we examined the demographic and temporal distributions of legal intervention injuries among youth, 19 years and younger, using a healthcare database of all patients treated in California hospitals between 2005 and 2017. To estimate inequities, we assessed patterns overall and by age, sex, race/ethnicity, and at their intersections. We also examined the means of injury (e.g., by firearm vs. non-firearm), the types of injuries experienced by youth, and the setting where the injury took place.

4.2 Data and Methods

4.2.1 Data Description and Design

For this study we used data on all emergency department visits and inpatient hospitalizations in California between January 1, 2005 and December 31, 2017 from the California Office of Statewide Health Planning and Development. Patient encounters at federal hospitals (e.g., active-duty military and Veteran's Affairs hospitals) are not captured in these data because such facilities are not required to report data to the state. However, of the 375 hospitals in California only 16 (4.3%) are federally licensed; therefore, these data likely capture the vast majority of hospital encounters throughout the state.[93–95] Patients, 19 years and younger, with an *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) or ICD-10-CM external cause of injury code (e-code) for "legal intervention injury" in their discharge record were included in this analysis. Patients with missing data on race/ethnicity (N = 450, 2.8%) and sex (N = 22, 0.1%) were excluded from relevant subgroup analyses. For denominator data, annual US Census population estimates for California from 2005-2017 were used to calculate person-years (PYs) at risk.

ICD-9-CM (2005 through September 2015) and ICD-10-CM (October 2015 through 2017) e-codes for "legal intervention injury" (LI injury) were used to identify the occurrence and means of injuries caused by law enforcement (Table 4.1). Patients were classified as experiencing LI injury if any of the five possible e-codes listed in the patient record included one of the LI injury e-codes. Under ICD-9-CM LI injury is defined as "injury inflicted by the police or other law-enforcing agents, including military on duty, in the course of arresting or attempting to arrest lawbreakers, suppressing disturbances, maintaining order, and other legal action."[42] In contrast, under ICD-10-CM it is defined as "any injury sustained as a result of an encounter with any law enforcement officer, 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."[153] To ensure consistent case definition over the study period, patients 18-19 years old who had an ICD-10-CM "officer injured" e-code documented (N = 116, 0.7%) – an indicator suggesting that the injured youth was an officer – were excluded from the analysis (see Sensitivity Analysis section below for further details).

In the patient discharge record, we captured the place where injury occurred using ICD-9-CM and ICD-10-CM place of external cause of injury e-codes (Table 4.2) and the types of injuries experienced by youth using ICD-9-CM diagnosis codes (Table 4.3). Place of injury occurrence was identified by examining all five possible e-code fields, and types of injuries experienced were captured using all 25 possible diagnosis code fields in the patient record. Self-reported sex (female, male, other sex), race (White, Black, American Indian or Alaska Native, Asian or Pacific Islander, Other race), and ethnicity (Latinx/Hispanic, Non-Latinx/Hispanic), also came from the patient discharge record. We combined race and ethnicity responses into six race categories: Latinx/Hispanic of any race and five non-Latinx/Hispanic groups (White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race). For patient sex, the "other sex" category was only available in the inpatient hospital data, 2005-2016; of the 518 inpatient LI injury cases, none identified as "other sex" in the patient record. Age in the patient record was calculated based on the emergency department service date or inpatient hospital admission date and the patient's self-reported date of birth.

4.2.2 Statistical Analysis

We calculated pooled and annual rates (per 100,000 person-years [PYs]) of LI injury overall, by age, sex, and race, and at their intersections – where the numerators comprised young people treated for LI injury from the hospital data, and the denominators were annual US Census-based estimates of PYs contributed. For pooled rates, LI injury counts and PYs contributed were summed over the study period for the numerators and denominators, respectively. We estimated rate ratios (RR) and rate differences (RD) to examine inequities in injury by demographic characteristics and report 95% confidence intervals for statistical inference. Analyses did not account for multiple incidents of LI injury experienced by the same young person because the record linkage number in the patient record – a unique patient identifier that is an encrypted version of the patient's Social Security Number – was missing in 47.5% of the LI injury records. However, in the subset of LI injury patients with the unique identifier present, only 3.9% had multiple hospital visits for LI injury; thus, not accounting for clustering within young person was unlikely to meaningfully influence statistical inference.

We also examined the distribution of injuries treated as inpatient versus in the emergency department (proxy for severity), the means of LI injury (e.g., firearm vs. non-firearm), the place where the injury occurred (e.g., in school, prison/jail, etc.), and types of injuries experienced by youth (e.g., fracture, open wound, etc.). Types of injuries were only examined among the subset of injury cases between 2005 and 2014 because of the substantial changes in injury diagnosis codes over the ICD transition.[129] There were also changes in ICD coding across the transition for the place where injury occurred, resulting in more detailed e-codes under ICD-10-CM that identified schools and prisons/reform schools separately from other institutions. Thus, we conducted two analyses – one using the broad e-code categories defined under ICD-9-CM, over the entire study period, and another using more specific categories under ICD-10-CM, restricting to data only after the transition (October 2015 through 2017). This allowed us to examine schools and prisons/reform schools – places that may be particularly salient to our study population – separately.

To avoid small cell counts, we do not report results with fewer than 15 injury cases. SAS version 9.4 (SAS Institute Inc., Cary, NC) was used to for dataset assembly, and R version 3.6.1 (R Core Team, Vienna, Austria) was used to run analyses and create plots. Research ethics approval for this study was granted by the California Health and Human Services Agency and University of California, Berkeley Committees for the Protection of Human Subjects.

4.2.3 Sensitivity Analysis

We conducted a sensitivity analysis to assess whether our results were robust to changes in LI injury e-codes across the ICD transition, which took place on October 1, 2015. ICD-10-CM is much more detailed than ICD-9-CM, which raises the possibility of misclassification if healthcare personnel or billers/coders were initially unfamiliar with ICD-10-CM.[129,154] For any youth with an "officer injured" e-code documented after the transition, we used varied approaches to confirm documented age and injury e-code in the patient record (see Supplemental Material). Based on these checks, and the fact that the minimum age requirement to become an officer in California is 18 years,[155] we excluded youth 18-19 years old with an "officer injured" e-code after the ICD transition from our main analysis. However, some law enforcement jurisdictions in California – particularly larger ones (e.g., Los Angeles, San Diego) – require a minimum age of 20 or 21 for becoming an officer.[156,157]

Thus, our sensitivity analysis included all LI injury cases, even those 18-19 years old with an "officer injured" e-code, to account for potential misclassification of the injured youth as an officer after the ICD transition. While these cases accounted for less than one percent of cases over the whole study period, they accounted for approximately seven percent of LI injury cases after the ICD transition.

4.3 Results

Between 2005 and 2017, 15,967 young people ages 19 years or younger were treated for LI injury in a California hospital, and California young people ages 19 or younger contributed a total of 134,156,751 PYs at risk. A vast majority were Latinx/Hispanic, Black, or of other or multiple races, male, and between the ages of 15 and 19 (Table 4.4). Although patients younger than 15 years of age were far less common, over 1,300 (more than 100 per year) were treated for LI injuries over the 13-year study period. Most patients (N = 15,449, 96.8%) were treated in an emergency department. LI injuries due to non-firearm means (e.g., blunt objects, sharp objects, etc.) accounted for 95.9% of incidents (Table 4.5). Overall, the most common types of injuries documented were "superficial injuries" (e.g., abrasions) or contusions (61.3%), open wounds of the head, neck, or trunk (15.6%), other/unspecified injuries (13.4%), and dislocations, sprains, or strains (11.6%) (Table 4.6). This pattern varied only slightly across demographic groups. The majority of patient records (N = 11,186, 70.0%) documented the place where injury occurred as "other" or "unspecified," whereas specific places such as school/other institutions (N = 795, 5.0%) and institutional residences (e.g., prison/jail, reform school; N = 664, 4.2%) were documented with much less frequency (Tables 4.7 and 4.8).

The LI injury rate overall and by demographic characteristics, pooled across study years, and relative and absolute inequities in rates are presented in Table 4.4. The overall rate of hospital-treated LI injury among young people in California was 11.9 per 100,000 PYs. Black youth experienced a dramatically higher rate of LI injury than youth of other races; compared to White youth, they experienced almost four times the rate (RR = 3.8 [95% CI: 3.6, 4.0]), or 29.0 additional LI injuries per 100,000 PYs (27.6, 30.5). Youth of other or multiple races also experienced a higher rate of LI injury than White youth (RR = 1.5 [1.4, 1.6], RD = 4.8 per 100,000 PYs [3.8, 5.9]). Asian or Pacific Islander youth had a much lower rate than all other youth, whereas American Indian or Alaska Native and Latinx/Hispanic youth experienced rates slightly higher than that among White youth. Boys overall had a substantially higher rate of LI injury than girls (RR = 7.5 [7.2, 7.9], RD = 17.9 per 100,000 PYs [17.5, 18.2]), and youth 15-19 years old experienced a dramatically higher injury rate than younger youth.

LI injury rates by sex and race for 10-14-year-old and 15-19-year-old youth are reported in Table 4.9, alongside their absolute and relative inequities. Black boys, ages 15-19 years, experienced the highest rate overall (200.9 per 100,000 PYs), which was 3.5 (95% CI: 3.3, 3.7) times the rate (or 143.2 additional LI injuries per 100,000 PYs [134.8, 151.6]) as same-aged White boys. Similarly, 15-19-year-old boys of other or multiple races experienced twice the rate (1.8, 2.1), or 54.9 additional LI injuries per 100,000 PYs (46.4, 63.4) as White boys. Compared to girls of all other races, Black girls, ages 15-19, experienced substantially higher rates of LI injury; compared with White girls, they experienced over four times the rate (RR = 4.3 [3.7, 4.9]), or 28.0 additional injuries per 100,000 PYs (24.3, 31.7). Relative inequities between Black and White youth were even greater among 10-14-year-olds. Black boys had over five times the LI injury rate of White boys (22.2 vs. 4.3 per 100,000 PYs). Notably,

the rate among 10-14-year-old Black girls was greater than rates among all other groups, except Black boys; it was more than twice (RR = 2.2 [1.7, 2.9]) and six (RR = 6.7 [4.8, 9.5]) times the rates among White boys and White girls, respectively. Counts among youth less than 10 years of age were too low to report by sex and race.

LI injury rates and relative and absolute inequities over time are presented in Figures 4.1-4.6. Annual rates of LI injury generally increased 2005-2009 and decreased thereafter, returning to below 2005 levels by the end of the study period, both overall and across demographic groups. As an exception, the trajectory for Black boys increased sharply 2005-2007, remained high until 2011, and did not return to 2005 levels until 2015 (Figure 4.2). Although absolute inequities between Black and White boys returned to the 2005 level by 2017, relative inequities increased over the study period because of the sharper increase and slower decline among Black boys (RR in 2005 vs. 2017: 2.5 [2.1, 3.1] vs. 4.2 [3.1, 5.5]) (Figures 4.3 and 4.4). Additionally, the trajectory for Black girls was closer to White boys and Latinx/Hispanic boys than to those for girls of any other race, and their rate of LI injury was higher than those of White boys and Latinx/Hispanic boys by 2017 (Figures 4.2-4.4).

The results from the sensitivity analysis, which included youth 18-19 years old who had an "officer injured" LI injury e-code documented in their patient record, were consistent with those of the main analysis. These results are presented in the Supplemental Material section.

4.4 Discussion

In this study, we found that between 2005 and 2017 Black youth in California experienced a dramatically higher burden of injuries caused by law enforcement than youth of other races. Analyses at the intersections of race, sex, and age showed that youth experiencing multiple marginalization, including Black boys and Black girls, were at particular risk and that relative racial inequities were even greater at younger ages. Lastly, while rates of injury caused by law enforcement generally increased but returned to 2005 levels by the end of the study, trajectories varied by race and sex, and relative racial inequities in rates increased over the study period.

The findings of starkly higher rates of injury among Black youth and youth identifying as Other or multiple race compared to White youth, are consistent with existing quantitative and qualitative literature on the inequitable burden of law enforcement violence by race/ethnicity. This work has shown that racially minoritized individuals, and in particular those identifying as Black, – of all ages[6,37,44,45,158] and also specifically younger people[4,5,22,25,36,124,159,160] – disproportionately experience police violence, including intrusive police stops, use of force, injuries, and deaths. Thus, this study contributes to the literature on police violence as a form of structural racism – through both inequitable exposures to the criminal legal system (including legal intervention) *and* harsher outcomes during encounters – that has driven and continues to produce health inequities in the US.[19,122,161,162]

We also found that relative inequities in law enforcement-perpetrated injuries between Black and White youth (for both girls and boys) were even greater at younger ages. To our knowledge, this finding is novel given that existing research on police violence among youth has generally pooled across youth of all ages. Research has linked the disproportionate policing of Black children to racialized dehumanization and to the consequent social constructions of their being viewed as older

and more dangerous than their peers.[84–86,163] Thus, while injuries caused by law enforcement are much less common at younger ages, these findings reflect that Black children are not afforded the same basic protections as other children, and as a consequence they are much more likely to be harmed by police violence.[84,86]

Our analyses highlighted the unique experience of Black girls. Not only did they experience a much greater burden than girls of other races overall, at younger ages (10-14 years), they had higher rates than all except Black boys. Further, by 2017, Black girls overall had a higher rate than White boys and Latinx/Hispanic boys. The limited literature that has examined girls' experiences with policing and police violence has found that Black girls have a greater risk of being stopped by and frisked by police and of harsh language and force threatened or used against them compared to White girls.[22] Research on the racialized "adultification" of Black girls finds that they are perceived as older, less innocent, and in need of less protection when compared with White girls, leading to heightened rates of school discipline and harsher punishment in the juvenile legal system.[25,86,164] Specifically, Black girls as young as 5-years-old are perceived as more adult-like than same aged White girls.[86]

Over the study period, rates of injury caused by law enforcement among California youth increased, and then returned to below 2005 levels, with Black youth experiencing a sharp and sustained increase. We also found that relative inequities in injury rates between Black and White youth increased across study years. While this study is descriptive, these patterns in rates and inequities align with the Great Recession in the US, which started in late 2007 and had long-lasting repercussions well beyond the end of the recession in mid-2009, when the economy started to recover.[165] Research suggests that individual- and neighborhood-level measures of lower socioeconomic status are associated with increased risk of police violence.[47,48,60,166] While families across California experienced economic hardships throughout and after the recession, low income and Black families were most affected, resulting in widening inequities in economic wellbeing.[167] Future research should explicitly examine the potential effects of the Great Recession on injuries perpetrated by law enforcement among youth.

Overall, the inequitable patterns of injury caused by law enforcement by race/ethnicity identified in this study are likely driven by a combination of structural- and individual-level factors. For example, at a structural level, "tough on crime" policies, such as the War on Drugs, and "zero-tolerance" policies in schools have inequitably targeted and harmed Black communities throughout the US.[26,168] Further, racist policies and institutional practices have historically contributed to and continue to drive residential segregation and disinvestment in communities of color, leading to a lack of opportunities and high poverty,[169] which is strongly associated with exposure to legal intervention and injury during encounters.[47,166] In addition, individual factors, such as interpersonal racism, play a role in exposure to legal intervention and outcomes during encounters.[41] Given these potential explanations, we did not adjust for any factors that may be downstream of race/ethnicity (e.g., poverty, exposure to legal intervention) to avoid overadjustment of potential mediating factors.[23,24,44,170] In fact, a recent study found that the mixed findings of Black-White inequities in police use of force outcomes at the population level compared to among only those who encounter law enforcement are explained by the fact that encounter-conditional analyses, by design, do not account for the disproportionate risk of police exposure for Black individuals in the US.[44]

While administrative health data offer a unique opportunity to examine injuries caused by law enforcement when no other comprehensive data sources are available – particularly among young people – they have limitations. We aimed to examine the places where young people experienced LI

injuries. Although reporting of e-codes is mandatory in California hospital discharge data,[119] we found that the overwhelming majority of patient records did not specify the location of injury occurrence – either by not documenting any "Place of occurrence of the external cause" e-code or by reporting the place as "unspecified" or "other specified." This may be because either the necessary information was not documented in the patient record by healthcare personnel or because the appropriate e-codes were not assigned in the coding/billing process.[171] Given the potential utility of this information for informing intervention strategies (e.g., removing school resource officers), we hope to draw attention to the importance of accurately documenting young people's experiences of injuries by law enforcement in medical records, including the place of injury occurrence. Recently, Boyd and colleagues developed a pediatric framework that recommends well-child templates used by clinicians include questions about police interactions to better document exposures and potential consequences, and to connect youth to appropriate services and support systems.[151] This is one critical step towards accurate and improved data sources on adverse police exposures among youth, to better inform clinical and public health interventions.

This study has several additional limitations. First, research has documented that administrative ICD data (i.e., death certificate data) underreport cases of fatal LI injury.[33,34] For example, Feldman and colleagues found that LI homicides were more likely to be misclassified as non-LI fatal assaults among Black Americans.[34] If this is also the case in hospital administrative data then the racial inequities reported in this study may be underestimated. While, to our knowledge, no formal validation studies have assessed the validity of LI injuries in hospital administrative data, a few descriptive studies suggest that experiences of excessive use of force by police are underreported in emergency department physician documentation.[120,146] Second, our study period spanned the transition from ICD-9-CM to ICD-10-CM codes. Although we restricted the main analysis to ensure a consistent case definition across the study period and found that results were similar in sensitivity analyses, rates in post-transition years may have been influenced by ICD coding changes. Third, our data only captured injuries treated in California hospitals, which are possibly a more severe subset of injuries caused by law enforcement overall. Less severe injuries are likely to be more common; thus, inequities in police violence overall may be even greater given the disproportionate policing of racially minoritized youth.[22]

In this study, we documented the demographic and temporal distributions of emergency department and inpatient hospital visits for injuries caused by law enforcement among California youth. To date, most research on injuries and deaths caused by law enforcement has either focused exclusively on boys and men or pooled across sex.[4,6] By using a large, California-wide hospital database spanning 13 years, we were able to examine experiences of injuries at the intersections of race, sex, and age and identify the high burden of injuries experienced by both Black boys and girls. Taken together, these findings contribute to the growing literature on police violence as a critical public health issue and a pathway through which structural racism operates in young people's lives. To further this work, future research should examine experiences of youth in contexts outside of California and assess the potential acute and long-term implications of experiencing police violence at such young ages – paying particular attention to examine effects at the intersections of age, race/ethnicity, and sex.

Table 4.1 International Classification of Diseases, 9th or 10th Revision, Clinical Modification legal intervention injury external cause of injury codes included in analysis.

Measure	**ICD-9-CM codes**	**ICD-10-CM codes**
Legal intervention injury	E970-E977	Y350-Y354, Y358-Y359
Injury by firearms	E970	Y350XXA, Y350XXD
Injury by explosives	E971	Y351XXA, Y351XXD
Injury by gas	E972	Y352XXA, Y352XXD
Injury by blunt object	E973	Y353XXA, Y353XXD
Injury by cutting and piercing instrument	E974	Y354XXA, Y354XXD
Injury by other specified means	E975	Y358XXA, Y358XXD
Injury by unspecified means	E976	Y359XXA, Y359XXD
Late effects/sequela of injuries due to legal intervention	E977	Y350XXS, Y351XXS, Y352XXS, Y353XXS, Y354XXS, Y358XXS, Y359XXS

Note: For the main analysis, patients 18-19 years old with an "officer injured" legal intervention injury ICD-10-CM e-code (indicated by a "1" in the 5th digit of the e-code) were excluded.

Table 4.2 International Classification of Diseases, 9th or 10th Revision, Clinical Modification place of external cause of injury occurrence codes included in analysis.

Place where injury occurred	**ICD-9-CM codes**	**ICD-10-CM codes**
Private residence	E8490	Y920
Street/highway/road	E8495	Y924
School/other institution/public administrative area	E8496	Y922 (except Y9223), Y925
School-specific	N/A	Y9221
Institutional residence	E8497	Y921, Y9223
Prison/reform school-specific	N/A	Y9214, Y9215
Farm	E8491	Y927
Industrial/construction area	E8492, E8493	Y926
Sports/recreation	E8494	Y923, Y9283
Other place	E8498	Y9281, Y9283, Y9284-Y9286, Y9289
Unspecified place	E8499	Y929

Note: School/other institution/public administrative area includes public/private schools, businesses, restaurants, churches, airports, and post offices, among others; Institutional residence includes jails/prisons, reform schools, hospitals, children's homes, and nursing homes, among others; Sports/recreation includes amusement parks, sports arenas, resorts, and public parks/playgrounds, among others; Other place includes wilderness areas, parking lots, train tracks, and other public places, among others.

Table 4.3 International Classification of Diseases, 9th Revision, Clinical Modification injury diagnosis codes included in analysis.

Type of injury	**ICD-9-CM codes**
Skull, spine, or trunk fracture	800-809
Limb fracture	810-829
Intracranial injury	850-854
Internal injury of chest, abdomen, or pelvis	860-869
Dislocation, sprain, or strain	830-848
Open wound of head, neck, or trunk	870-879
Open wound of limb	880-897
Superficial injury or contusion	910-924
Other or unspecified injury	900-909, 925-995

Table 4.4 Legal intervention injury rate, overall and by demographic characteristics, and relative and absolute inequities, among youth aged 0-19 years in California, 2005-2017.

Group	LI injury, N (%)	PYs at Risk	Rate per 100,000 PYs	Rate Ratio (95% CI)	RD per 100,000 PYs (95% CI)
Total	15,967 (100.0)	134,156,751	11.9	--	--
Race					
White	3,902 (24.4)	37,786,191	10.3	Reference	Reference
Black	3,035 (19.0)	7,714,576	39.3	3.8 (3.6, 4.0)	29.0 (27.6, 30.5)
American Indian or Alaska Native	68 (0.4)	549,663	12.4	1.2 (0.9, 1.5)	2.0 (-0.9, 5.0)
Asian or Pacific Islander	281 (1.8)	14,909,847	1.9	0.2 (0.2, 0.2)	-8.4 (-8.8, -8.1)
Other or multiple race	849 (5.3)	5,596,794	15.2	1.5 (1.4, 1.6)	4.8 (3.8, 5.9)
Latinx/Hispanic	7,382 (46.2)	67,599,680	10.9	1.1 (1.0, 1.1)	0.6 (0.2, 1.0)
Sex					
Boys	14,154 (88.6)	68,677,042	20.6	7.5 (7.2, 7.9)	17.9 (17.5, 18.2)
Girls	1,791 (11.2)	65,479,709	2.7	Reference	Reference
Age					
0-4 years	49 (0.3)	32,804,404	0.1	Reference	Reference
5-9 years	45 (0.3)	32,396,485	0.1	0.9 (0.6, 1.4)	0.0 (-0.1, 0.1)
10-14 years	1,227 (7.7)	33,777,497	3.6	24.3 (18.3, 33.1)	3.5 (3.3, 3.7)
15-19 years	14,646 (91.7)	35,178,365	41.6	278.7 (210.7, 376.9)	41.5 (40.8, 42.2)

Abbreviations: LI: legal intervention. PYs: person-years. RD: rate difference. CI: confidence interval.
Note: The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. 450 (2.8%) and 22 (0.1%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded from relevant subgroup analyses.

Table 4.5 Means of legal intervention injury among emergency department and inpatient hospital legal intervention injury patients aged 0-19 years in California, 2005-2017.

Legal intervention injury means	**N**	**%**
Total LI injury cases	15,967	100.0
Firearm	657	4.1
Explosive	22	0.1
Gas	177	1.1
Blunt object	980	6.1
Cutting/piercing instrument	689	4.3
Other specified means	11,570	72.5
Unspecified means	1,782	11.2
Late effects of LI injury	190	1.2
Multiple means	98	0.6

Abbreviations: LI: legal intervention.
Note: After transition to ICD-10-CM (October 2015) the legal intervention injury by other specified means category explicitly lists legal intervention involving manhandling and legal intervention injury involving conducted energy device (i.e., Taser), in addition to "other specified means."

Table 4.6 Types of injuries experienced by emergency department and inpatient hospital legal intervention injury patients aged 0-19 years in California, 2005-2014.

Group	LI injury, N	Skull, spine or trunk fracture N (%)	Limb fracture N (%)	Intracranial injury[a] N (%)	Internal injury[b] N (%)	Dislocation, sprain or strain N (%)	Head, neck or trunk wound N (%)	Limb wound N (%)	Superficial injury or contusion N (%)	Other/ unspecified[c] N (%)
Total	13,855	267 (1.9)	534 (3.9)	218 (1.6)	83 (0.6)	1,610 (11.6)	2,162 (15.6)	1,409 (10.2)	8,491 (61.3)	1,852 (13.4)
Race										
White	3,450	57 (1.7)	134 (3.9)	54 (1.6)	15 (0.4)	363 (10.5)	531 (15.4)	317 (9.2)	2,207 (64.0)	455 (13.2)
Black	2,631	45 (1.7)	103 (3.9)	40 (1.5)	15 (0.6)	398 (15.1)	374 (14.2)	313 (11.9)	1,433 (54.5)	377 (14.3)
AI/AN	49	*	*	*	*	*	*	*	33 (67.4)	*
Asian/PI	245	*	*	*	*	25 (10.2)	47 (19.2)	40 (16.3)	145 (59.2)	31 (12.7)
Other/multiple race	755	*	26 (3.4)	*	*	66 (8.7)	115 (15.2)	88 (11.7)	499 (66.1)	82 (10.9)
Latinx/Hispanic	6,328	137 (2.2)	244 (3.9)	99 (1.6)	41 (0.7)	699 (11.1)	1,015 (16.0)	601 (9.5)	3,945 (62.3)	849 (13.4)
Sex										
Boys	12,328	251 (2.0)	487 (4.0)	200 (1.6)	78 (0.6)	1,314 (10.7)	2,021 (16.4)	1,329 (10.8)	7,606 (61.7)	1,646 (13.4)
Girls	1,506	16 (1.1)	46 (3.1)	18 (1.2)	*	294 (19.5)	139 (9.2)	78 (5.2)	870 (57.8)	205 (13.6)
Age										
0-4 years	37	*	*	*	*	*	*	*	*	*
5-9 years	43	*	*	*	*	*	*	*	18 (41.9)	*
10-14 years	1,055	*	61 (5.8)	16 (1.5)	*	176 (16.7)	72 (7.2)	66 (6.3)	647 (61.3)	127 (12.0)
15-19 years	12,720	255 (2.0)	469 (3.7)	200 (1.6)	82 (0.6)	1,423 (11.2)	2,078 (16.3)	1,340 (10.5)	7,819 (61.5)	1,698 (13.4)

* Not reportable because cell count <15.

Abbreviations: LI: legal intervention. AI/AN: American Indian or Alaska Native. Asian/PI: Asian or Pacific Islander.

[a] Excludes skull fracture

[b] Internal injury of chest, abdomen, or pelvis

[c] Other/unspecified injury includes: injury to blood vessels; burns; nerve or spinal cord injuries; late effects of injury, poisoning, toxic effect, and other external causes; crushing injuries; injury from effects of foreign body entering through orifice; traumatic complications and unspecified injuries; other and unspecified effects of external causes; poisoning by drugs, medicinal and biological substances; and toxic effects of nonmedicinal substances

Note: This analysis was restricted to 2005-2014, to avoid crossing the ICD-9-CM to ICD-10-CM transition. Thus, LI injury counts differ from those in the main analysis. The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. 397 (2.9%) and 21 (0.2%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded from relevant analyses.

Table 4.7 Place where external cause of injury occurred among emergency department and inpatient hospital legal intervention injury patients aged 0-19 years in California, 2005-2017: broader ICD-9-CM-based categories across entire study period.

Place were injury occurred	**N**	**%**
Private residence	694	4.4
Street/highway/road	1,958	12.3
School/other institution/public administrative area	795	5.0
Institutional residence	664	4.2
Farm	*	*
Industrial/construction area	21	0.1
Sports/recreation area	107	0.7
Other place	3,839	24.0
Unspecified place	7,347	46.0
Missing place of occurrence ICD code	598	3.8

*Not reportable because cell count <15.
Note: School/other institution/public administrative area includes public/private schools, businesses, restaurants, churches, airports, and post offices, among others; Institutional residence includes jails/prisons, reform schools, hospitals, children's homes, and nursing homes, among others; Sports/recreation includes amusement parks, sports arenas, resorts, and public parks/playgrounds, among others; Other place includes wilderness areas, parking lots, train tracks, and other public places, among others. 57 (0.4%) patients had multiple place of injury occurrence ICD e-codes listed in the patient record.

Table 4.8 Place where external cause of injury occurred among emergency department and hospital legal intervention injury cases aged 0-19 years in California: ICD-10-CM-based specific categories, restricted to October 2015 through December 2017.

Place where injury occurred	**N**	**%**
Private residence	58	4.0
Street/highway/road	113	7.7
School	32	2.2
Other institution/public administrative area	33	2.3
Prison/reform school	32	2.2
Other institutional residence	18	1.2
Farm	0	0.0
Industrial/construction area	0	0.0
Sports/recreation area	*	*
Other place	303	20.8
Unspecified place	362	24.8
Missing place of occurrence ICD code	504	34.5

*Not reportable because cell count <15.
Note: Other institution/public administrative area includes businesses, restaurants, churches, airports, and post offices among others; Other institutional residence includes hospitals, children's homes, and nursing homes, among others; Sports/recreation includes amusement parks, sports arenas, resorts, and public parks/playgrounds, among others; Other place includes wilderness areas, parking lots, train tracks, and other public places, among others. 4 (0.3%) patients had multiple place of injury occurrence ICD e-codes listed in the patient record.

Table 4.9 Legal intervention injury rate by race and sex among youth a) 10-14 years old and b) 15-19 years old, and relative and absolute inequities in California, 2005-2017.

Group	LI injury, N (%)	PYs at Risk	Rate per 100,000 PYs	Rate Ratio (95% CI)	RD per 100,000 PYs (95% CI)
a. Youth 10-14 years old					
White boys	194 (15.8)	4,952,390	3.9	Reference	Reference
Black boys	211 (17.2)	1,019,475	20.7	5.3 (4.3, 6.5)	16.8 (13.9, 19.6)
AI/AN boys	*	73,312	*	*	*
Asian/PI boys	17 (1.4)	1,934,920	0.9	0.2 (0.1, 0.4)	-3.0 (-3.7, -2.4)
Other/multiple race boys	50 (4.1)	671,817	7.4	1.9 (1.4, 2.6)	3.5 (1.4, 5.7)
Latinx/Hispanic boys	440 (35.9)	8,606,648	5.1	1.3 (1.1, 1.6)	1.2 (0.5, 1.9)
White girls	60 (4.9)	4,687,482	1.3	Reference	Reference
Black girls	84 (6.8)	977,520	8.6	6.7 (4.8, 9.5)[a]	7.3 (5.5, 9.2)[a]
AI/AN girls	*	69,439	*	*	*
Asian/PI girls	*	1,835,736	*	*	*
Other/multiple race girls	*	651,011	*	*	*
Latinx/Hispanic girls	106 (8.6)	8,297,747	1.3	1.0 (0.7, 1.4)	0.0 (-0.4, 0.4)
b. Youth 15-19 years old					
White boys	3,189 (21.8)	5,527,108	57.7	Reference	Reference
Black boys	2,314 (15.8)	1,151,913	200.9	3.5 (3.3, 3.7)	143.2 (134.8, 151.6)
AI/AN boys	51 (0.3)	81,377	62.7	1.1 (0.8, 1.4)	5.0 (-12.3, 22.3)
Asian/PI boys	236 (1.6)	2,087,693	11.3	0.2 (0.2, 0.2)	-46.4 (-48.9, -43.9)
Other/multiple race boys	714 (4.9)	634,115	112.6	2.0 (1.8, 2.1)	54.9 (46.4, 63.4)
Latinx/Hispanic boys	6,275 (42.8)	8,610,782	72.9	1.3 (1.2, 1.3)	15.2 (12.5, 17.9)
White girls	439 (3.0)	5,154,900	8.5	Reference	Reference
Black girls	397 (2.7)	1,087,283	36.5	4.3 (3.7, 4.9)[a]	28.0 (24.3, 31.7)[a]
AI/AN girls	*	77,569	*	*	*
Asian/PI girls	19 (0.1)	1,973,368	1.0	0.1 (0.1, 0.2)	-7.6 (-8.5, -6.7)
Other/multiple race girls	70 (0.5)	621,640	11.3	1.3 (1.0, 1.7)	2.7 (0.0, 5.5)
Latinx/Hispanic girls	506 (3.5)	8,170,617	6.2	0.7 (0.6, 0.8)	-2.3 (-3.3, -1.4)

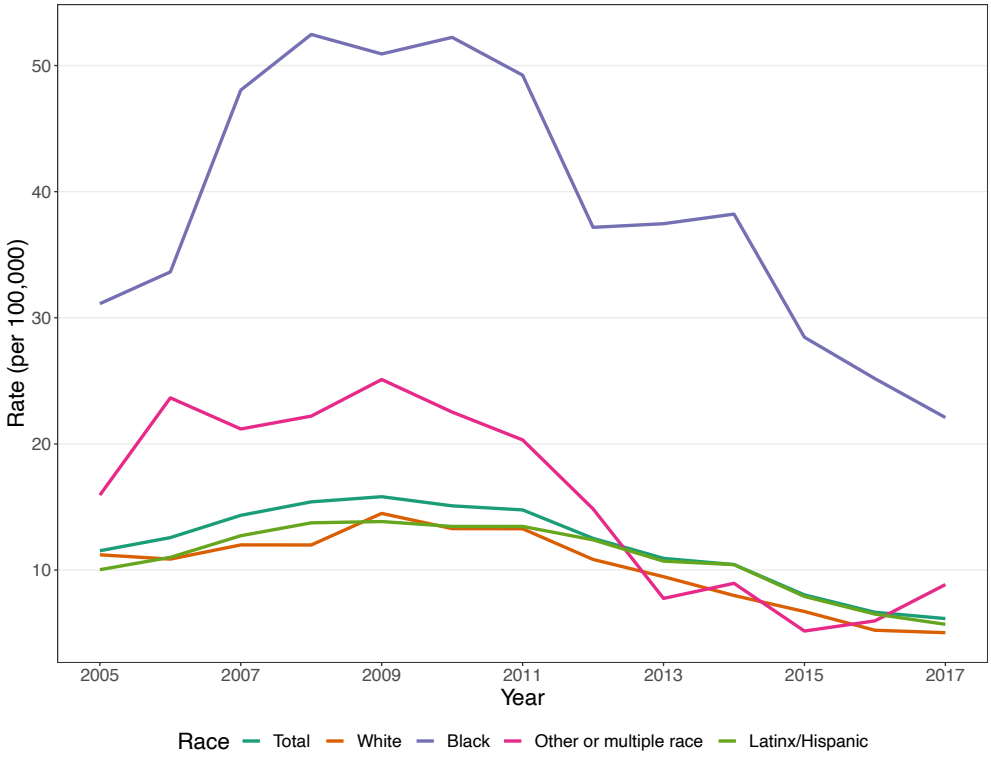
* Not reportable because cell count <15.

[a] Black girls 10-14 years old vs. White boys as reference: RR = 2.2 (1.7, 2.9), RD = 4.7 per 100,000 person-years (2.8, 6.6); Black girls 15-19 years old vs. White boys as reference: RR = 0.6 (0.6, 0.7), RD = -21.2 per 100,000 persons-years (-25.3, -17.1).

Abbreviations: LI: legal intervention. PYs: person-years. RD: rate difference.

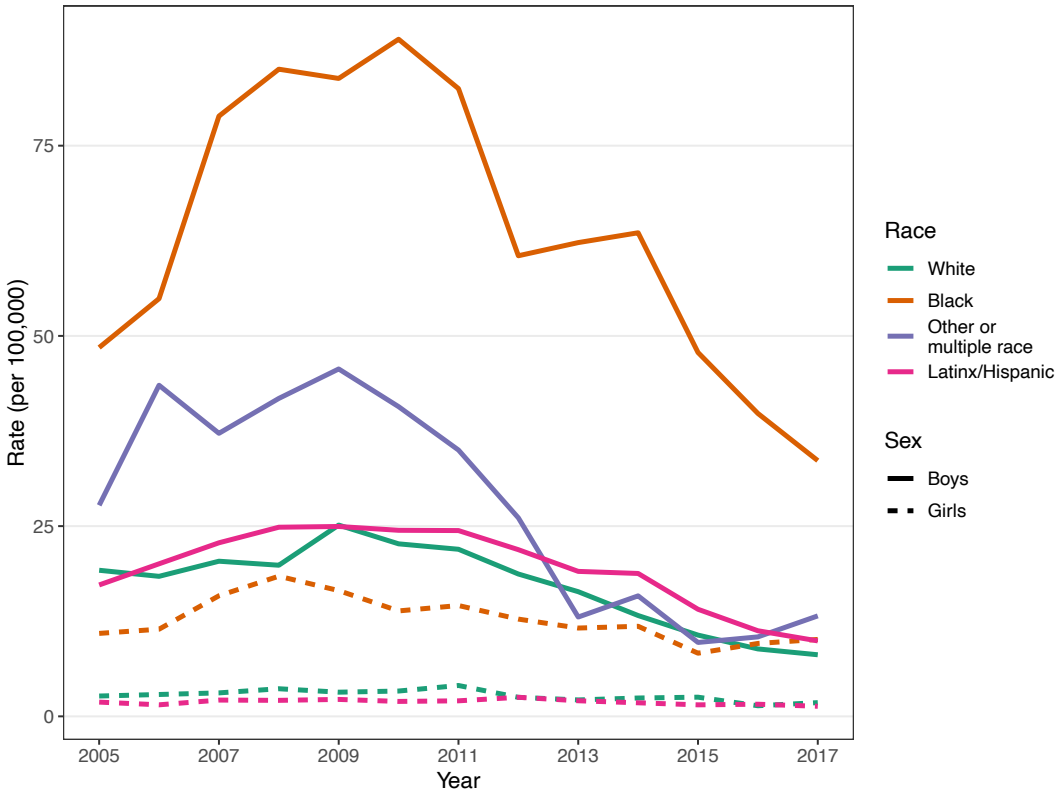
Note: Counts among youth younger than 10 years were too low to report by sex and race. The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or Multiple Race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. 39 (3.2%) and 2 (0.2%) 10-14-year-old legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded; 408 (2.8%) and 20 (0.1%) 15-19-year-old legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded.

Figure 4.1 Trends in the annual rate of legal intervention injury among youth 0-19 years of age by race in California, 2005-2017.



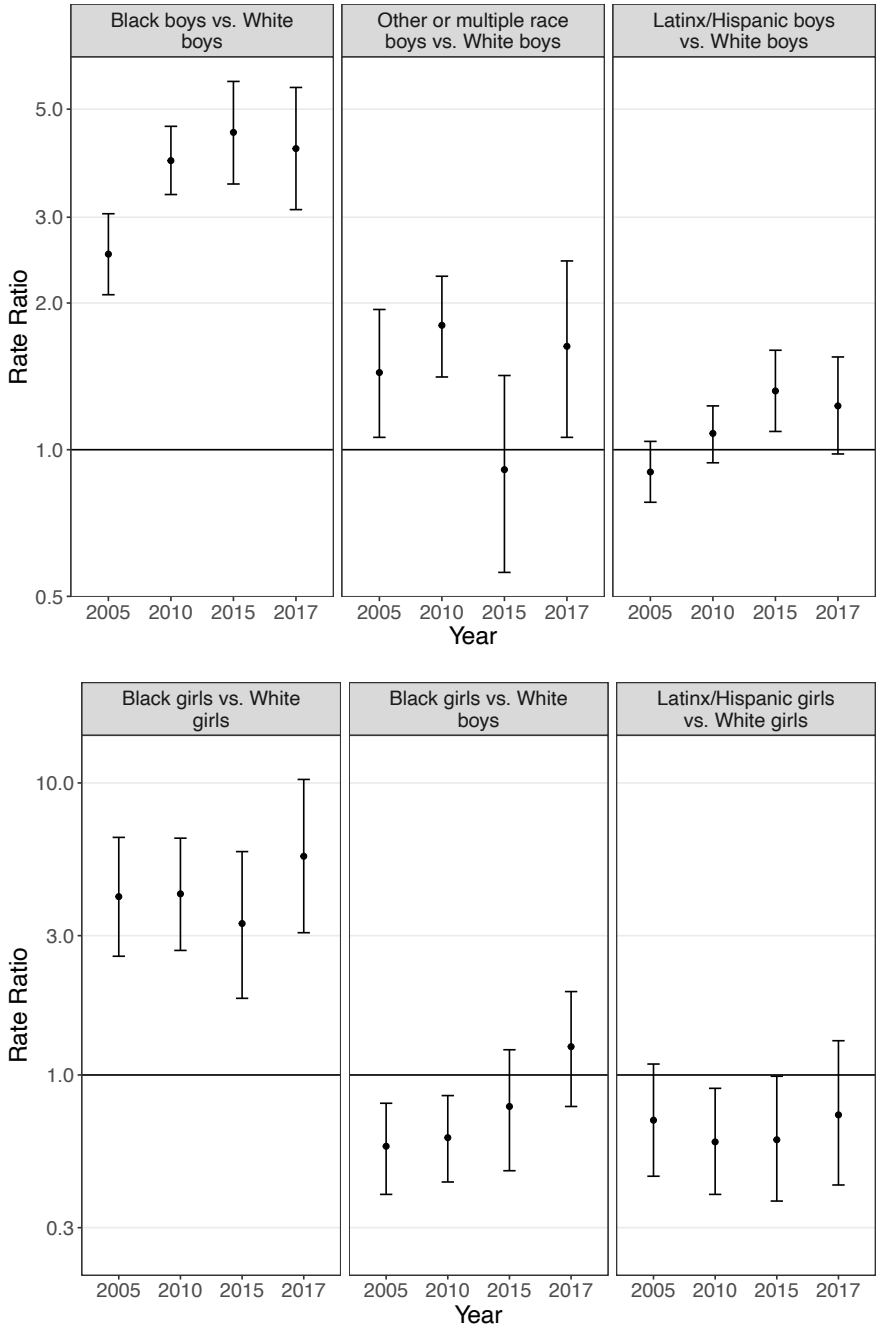
Note: Rates are per 100,000 person-years. The racial categories are operationalized such that White, Black, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. Annual counts were too low (<15) to report rates for American Indian or Alaska Native and Asian or Pacific Islander youth. 450 (2.8%) legal intervention injury patients missing data on race/ethnicity were excluded.

Figure 4.2 Trends in the annual rate of legal intervention injury among youth 0-19 years of age by race and sex in California, 2005-2017.



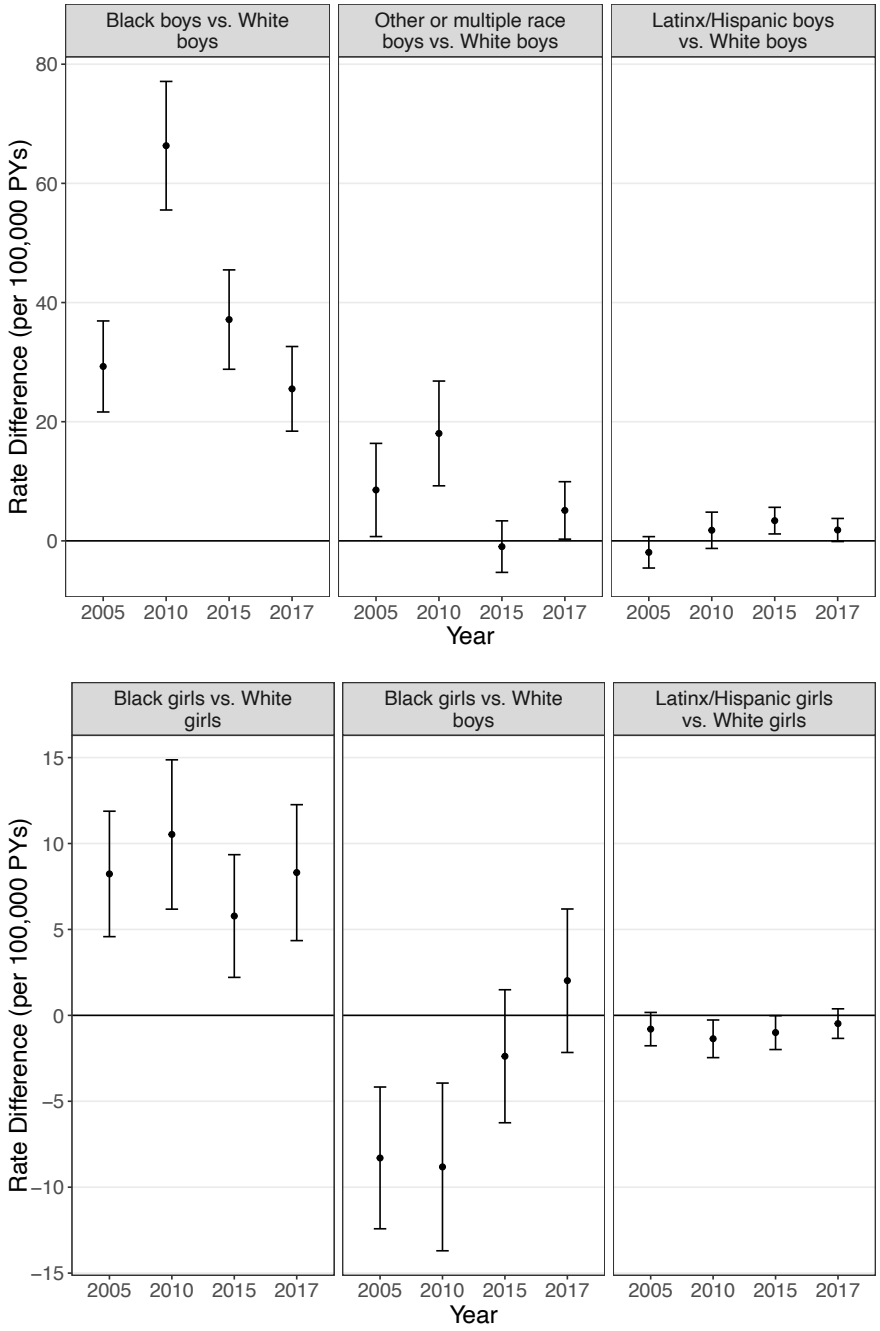
Note: Rates are per 100,000 person-years. The racial categories are operationalized such that White, Black, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. Annual counts were too low (<15) to report rates for American Indian or Alaska Native and Asian or Pacific Islander boys and girls, and for Other or multiple race girls. 450 (2.8%) and 22 (0.1%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded.

Figure 4.3 Relative inequities in the rate of legal intervention injury over time among boys and girls 0-19 years of age by race in California, 2005-2017.



Note: The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. Annual counts were too low (<15) to report inequities over time for American Indian or Alaska Native and Asian or Pacific Islander boys and girls, and for Other or multiple race girls. 450 (2.8%) and 22 (0.1%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded.

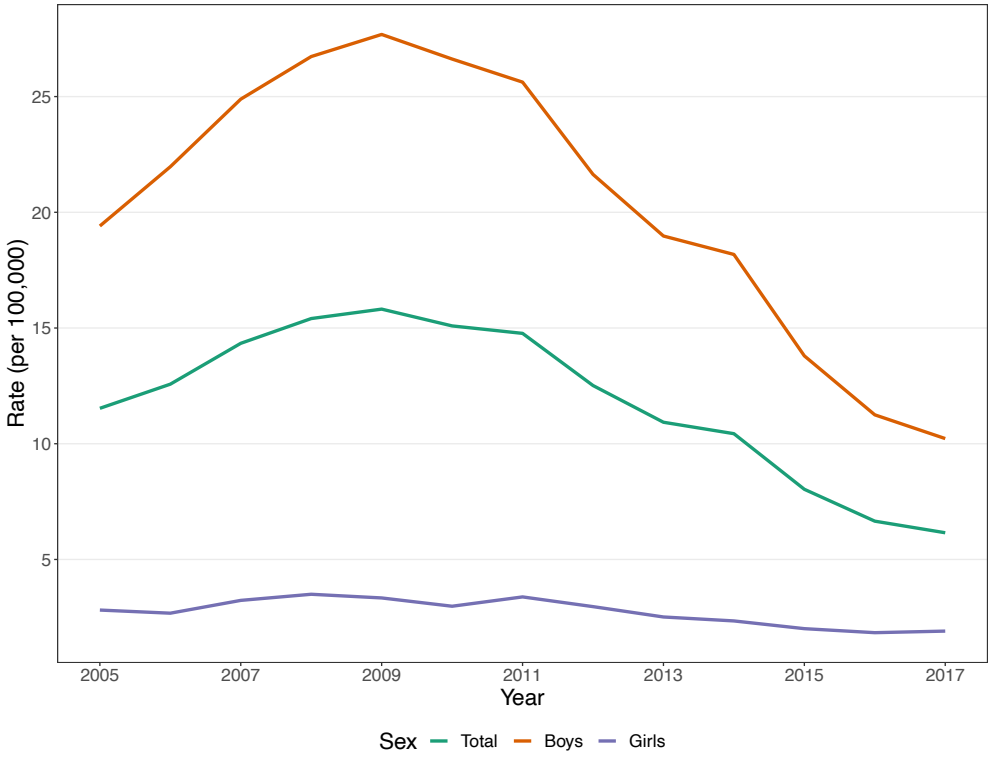
Figure 4.4 Absolute inequities in the rate of legal intervention injury over time among boys and girls 0-19 years of age by race in California, 2005-2017.



Abbreviations: PYs: person-years.

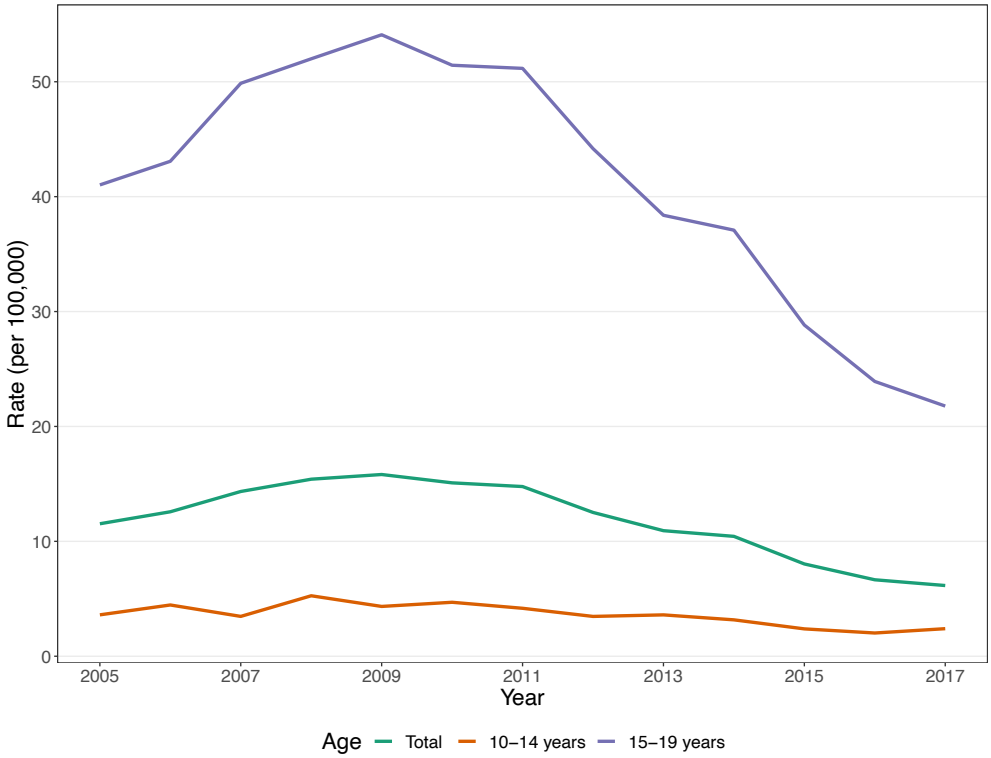
Note: The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. Annual counts were too low (<15) to report inequities over time for American Indian or Alaska Native and Asian or Pacific Islander boys and girls, and for Other or multiple race girls. 450 (2.8%) and 22 (0.1%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded.

Figure 4.5 Trends in the annual rate of legal intervention injury among youth 0-19 years of age by sex in California, 2005-2017.



Note: Rates are per 100,000 person-years. 22 (0.1%) legal intervention injury patients missing data on sex were excluded.

Figure 4.6 Trends in the annual rate of legal intervention injury among youth 0-19 years of age by age in California, 2005-2017.



Note: Rates are per 100,000 person-years. Annual counts were too low (<15) to report rates for 0-4 and 5-9 years aged youth separately (or combined).

4.5 Supplemental Material

4.5.1 Sensitivity Analysis

The definition of LI injury changed across the ICD transition; thus, we conducted a sensitivity analysis to assess whether results were robust to changes in ICD coding. ICD-10-CM includes LI injury e-codes specific to injuries experienced by law enforcement officials whereas e-codes under ICD-9-CM are specific to injuries "inflicted by the police or other law-enforcing agents." Under ICD-10-CM, we identified 315 youth with an "officer injured" LI injury e-code in their record, and 116 (36.8%) were 18-19 years old. Given that the minimum age requirement to become an officer in California is 18 years, but older in some jurisdictions, and that the transition to ICD-10-CM introduced a much more detailed coding system (that healthcare personnel or billers/coders may have initially been unfamiliar with), we conducted several checks to confirm the documented age and LI injury e-code for these youth.

To confirm age, for each of the 315 "officer injured" LI injury cases who had a record linkage number in the data (unique patient identifier, N = 164 (52.1%)), we linked across all of their ED and inpatient hospital records over the study period (for any medical condition). We then compared their documented age and admission date across all of their patient records for evidence of age misclassification at the time of their LI injury visit. Specifically, we compared the difference in years between admission date for the LI injury and each of their other conditions to the difference in years of age documented at the time of LI injury and each of their other conditions. Any records where the absolute value of the difference between these values was greater than one were flagged for manual review. A difference of less than one could simply be due to when a patient's birth date is in relation to the time of the year the visit occurred; however, a difference of greater than one may indicate some misclassification in age at one of their patient visits. Of the 164 "officer injured" records with linkage across multiple patient visits, only five were flagged for review.

To identify records where an LI injury may not have occurred, we checked for evidence of an injury diagnosis being documented in the patient record using ICD diagnosis codes for injuries. Of the 315 "officer injured" records, 29 (9.2%) did not have an ICD-10-CM injury diagnosis code. Upon further manual review, only six of these records did not have any ICD-10-CM code documented in the patient record that suggested an injury could have occurred. ICD codes that we considered suggestive of an injury taking place included codes for pain or swelling in various body parts, electrocution (e.g., due to Tasers), nose bleeds, post-concussion symptoms, among others. While this did not explicitly confirm that law enforcement was involved in causing the documented injuries, the presence of injury diagnosis ICD codes in LI injury patient records is reassuring.

Given these checks, coupled with the fact that healthcare personnel or billers/coders may have initially been unfamiliar with the LI injury coding changes under ICD-10-CM (potentially misclassifying youth with LI injuries as officers rather than suspects or bystanders) and research suggesting that LI injuries are more likely to be underreported in administrative data,[33,34,120] we felt it reasonable for our main analysis to only exclude youth LI injury patients with an "officer injured" e-code if they were older than 17 (and thus, met the minimum age requirement to serve as law enforcement in California). However, certain jurisdictions (e.g., Los Angeles, San Diego, San Francisco) set the minimum age requirement for officers to 20-21 years;[155–157] therefore, we

conducted a sensitivity analysis, 2005-2017, that included all LI injury patients 19 years or younger, even those with an LI injury e-code that specified "officer injured" under ICD-10-CM.

Table 4.10 Legal intervention injury rate, overall and by demographic characteristics, and relative and absolute inequities, among youth aged 0-19 in California, 2005-2017 – sensitivity analysis.

Group	LI injury, N (%)	PYs at Risk	Rate per 100,000 PY	Rate Ratio (95% CI)	RD per 100,000 PYs (95% CI)
Total	16,083 (100.0)	134,156,751	12.0	--	--
Race					
White	3,935 (24.5)	37,786,191	10.4	Reference	Reference
Black	3,052 (19.0)	7,714,576	39.6	3.8 (3.6, 4.0)	29.2 (27.7, 30.6)
American Indian or Alaska Native	69 (0.4)	549,663	12.6	1.2 (0.9, 1.5)	2.1 (-0.8, 5.1)
Asian or Pacific Islander	285 (1.8)	14,909,847	1.9	0.2 (0.2, 0.2)	-8.5 (-8.9, -8.1)
Other or multiple race	852 (5.3)	5,596,794	15.2	1.5 (1.4, 1.6)	4.8 (3.7, 5.9)
Latinx/Hispanic	7,436 (46.2)	67,599,680	11.0	1.1 (1.0, 1.1)	0.6 (0.2, 1.0)
Sex					
Boys	14,257 (88.6)	68,677,042	20.8	7.5 (7.2, 7.9)	18.0 (17.6, 18.4)
Girls	1,804 (11.2)	65,479,709	2.8	Reference	Reference
Age					
0-4 years	49 (0.3)	32,804,404	0.1	Reference	Reference
5-9 years	45 (0.3)	32,396,485	0.1	0.9 (0.6, 1.4)	0.0 (-0.1, 0.1)
10-14 years	1,227 (7.6)	33,777,497	3.6	24.3 (18.3, 33.1)	3.5 (3.3, 3.7)
15-19 years	14,762 (91.8)	35,178,365	42.0	280.9 (212.4, 379.9)	41.8 (41.1, 42.5)

Abbreviations: LI: legal intervention. PYs: person-years. RD: rate difference.
Note: The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. 454 (2.8%) and 22 (0.1%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded from relevant subgroup analyses.

Table 4.11 Distribution of emergency department versus inpatient hospital legal intervention injury patients aged 0-19 years in California, 2005-2017 – sensitivity analysis.

Inpatient status	**N (%)**
Emergency department visit	15,553 (96.7)
Inpatient hospitalization	530 (3.3)
Total	16,083 (100)

Table 4.12 Means of legal intervention injury among emergency department and inpatient hospital legal intervention injury patients aged 0-19 years in California, 2005-2017 – sensitivity analysis.

Legal intervention injury means	**N**	**%**
Total LI injury cases	16,083	100.0
Firearm	664	4.1
Explosive	22	0.1
Gas	178	1.1
Blunt object	986	6.1
Cutting/piercing instrument	696	4.3
Other specified means	11,652	72.5
Unspecified means	1,797	11.2
Late effects of LI injury	190	1.2
Multiple means	100	0.6

Abbreviations: LI: legal intervention.
Note: After transition to ICD-10-CM (October 2015) the legal intervention injury by other specified means category explicitly lists legal intervention involving manhandling and legal intervention injury involving conducted energy device (i.e., Taser), in addition to "other specified means."

Table 4.13 Place where external cause of injury occurred among emergency department and inpatient hospital legal intervention injury patients aged 0-19 years in California, 2005-2017: broader ICD-9-CM-based categories across entire study period – sensitivity analysis.

Place were injury occurred	**N**	**%**
Private residence	702	4.4
Street/highway/road	1,973	12.3
School/other institution/public administrative area	797	5.0
Institutional residence	674	4.2
Farm	*	*
Industrial/construction area	22	0.1
Sports/recreation area	108	0.7
Other place	3,869	24.1
Unspecified place	7,371	45.8
Missing place of occurrence ICD code	626	3.9

*Not reportable because cell count <15.
Note: School/other institution/public administrative area includes public/private schools, businesses, restaurants, churches, airports, and post offices, among others; Institutional residence includes jails/prisons, reform schools, hospitals, children's homes, and nursing homes, among others; Sports/recreation includes amusement parks, sports arenas, resorts, and public parks/playgrounds, among others; Other place includes wilderness areas, parking lots, train tracks, and other public places, among others. 60 (0.4%) patients had multiple place of occurrence ICD e-codes listed in the patient record.

Table 4.14 Place where external cause of injury occurred among emergency department and hospital legal intervention injury cases aged 0-19 years in California: ICD-10-CM-based specific categories, restricted to October 2015 through December 2017 – sensitivity analysis.

Place of occurrence	**N**	**%**
Private residence	66	4.2
Street/highway/road	128	8.1
School	32	2.0
Other institution/public administrative area	35	2.2
Prison/reform school	39	2.5
Other institutional residence	21	1.3
Farm	0	0.0
Industrial/construction area	*	*
Sports/recreation area	*	*
Other place	333	21.1
Unspecified place	386	24.5
Missing place of occurrence ICD code	532	33.8

*Not reportable because cell count <15.
Note: Other institution/public administrative area includes businesses, restaurants, churches, airports, and post offices, among others; Other institutional residence includes hospitals, children's homes, and nursing homes, among others; Sports/recreation includes amusement parks, sports arenas, resorts, and public parks/playgrounds, among others; Other place includes wilderness areas, parking lots, train tracks, and other public places, among others. 7 (0.4%) patients had multiple place of occurrence ICD e-codes listed in the patient record.

Table 4.15 Legal intervention injury rate by race and sex among youth a) 10-14 years old and b) 15-19 years old, and relative and absolute inequities in California, 2005-2017 – sensitivity analysis.

Group	LI injury, N (%)	PYs at Risk	Rate per 100,000 PYs	Rate Ratio (95% CI)	RD per 100,000 PYs (95% CI)
a. Youth 10-14 years old					
White boys	194 (15.8)	4,952,390	3.9	Reference	Reference
Black boys	211 (17.2)	1,019,475	20.7	5.3 (4.3, 6.5)	16.8 (13.9, 19.6)
AI/AN boys	*	73,312	*	*	*
Asian/PI boys	17 (1.4)	1,934,920	0.9	0.2 (0.1, 0.4)	-3.0 (-3.7, -2.4)
Other/multiple race boys	50 (4.1)	671,817	7.4	1.9 (1.4, 2.6)	3.5 (1.4, 5.7)
Latinx/Hispanic boys	440 (35.9)	8,606,648	5.1	1.3 (1.1, 1.6)	1.2 (0.5, 1.9)
White girls	60 (4.9)	4,687,482	1.3	Reference	Reference
Black girls	84 (6.8)	977,520	8.6	6.7 (4.8, 9.5)[a]	7.3 (5.5, 9.2)[a]
AI/AN girls	*	69,439	*	*	*
Asian/PI girls	*	1,835,736	*	*	*
Other/multiple race girls	*	651,011	*	*	*
Latinx/Hispanic girls	106 (8.6)	8,297,747	1.3	1.0 (0.7, 1.4)	0.0 (-0.4, 0.4)
b. Youth 15-19 years old					
White boys	3,218 (21.8)	5,527,108	58.2	Reference	Reference
Black boys	2,329 (15.8)	1,151,913	202.2	3.5 (3.3, 3.7)	144.0 (135.5, 152.4)
AI/AN boys	52 (0.4)	81,377	63.9	1.1 (0.8, 1.4)	5.7 (-11.8, 23.2)
Asian/PI boys	239 (1.6)	2,087,693	11.4	0.2 (0.2, 0.2)	-46.8 (-49.3, -44.3)
Other/multiple race boys	717 (4.9)	634,115	113.1	1.9 (1.8, 2.1)	54.9 (46.3, 63.4)
Latinx/Hispanic boys	6,325 (42.8)	8,610,782	73.5	1.3 (1.2, 1.3)	15.2 (12.5, 17.9)
White girls	443 (3.0)	5,154,900	8.6	Reference	Reference
Black girls	399 (2.7)	1,087,283	36.7	4.3 (3.7, 4.9)[a]	28.1 (24.4, 31.8)[a]
AI/AN girls	*	77,569	*	*	*
Asian/PI girls	20 (0.1)	1,973,368	1.0	0.1 (0.1, 0.2)	-7.6 (-8.5, -6.7)
Other/multiple race girls	70 (0.5)	621,640	11.3	1.3 (1.0, 1.7)	2.7 (-0.1, 5.4)
Latinx/Hispanic girls	510 (3.5)	8,170,617	6.2	0.7 (0.6, 0.8)	-2.4 (-3.3, -1.4)

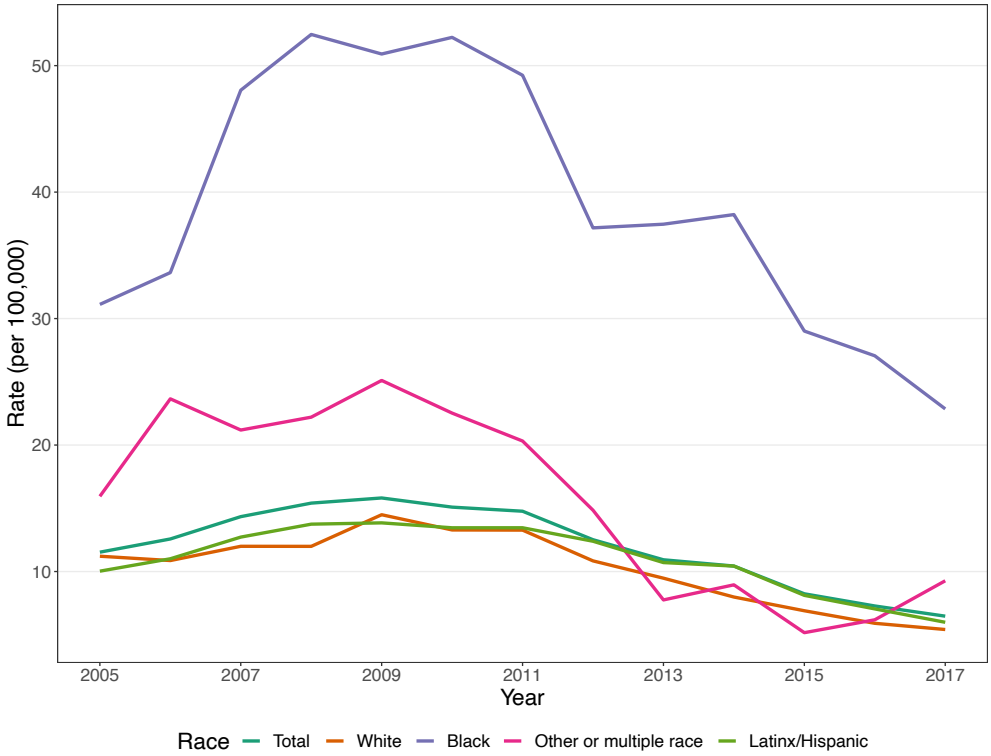
* Not reportable because cell count <15

[a] Black girls 10-14 years old vs. White boys as reference: RR = 2.2 (1.7, 2.9), RD = 4.7 per 100,000 person-years (2.8, 6.6); Black girls 15-19 years old vs. White boys as reference: RR = 0.6 (0.6, 0.7), RD = -21.5 per 100,000 person-years (-25.7, -17.4).

Abbreviations: LI: legal intervention. PYs: person-years. RD: rate difference.

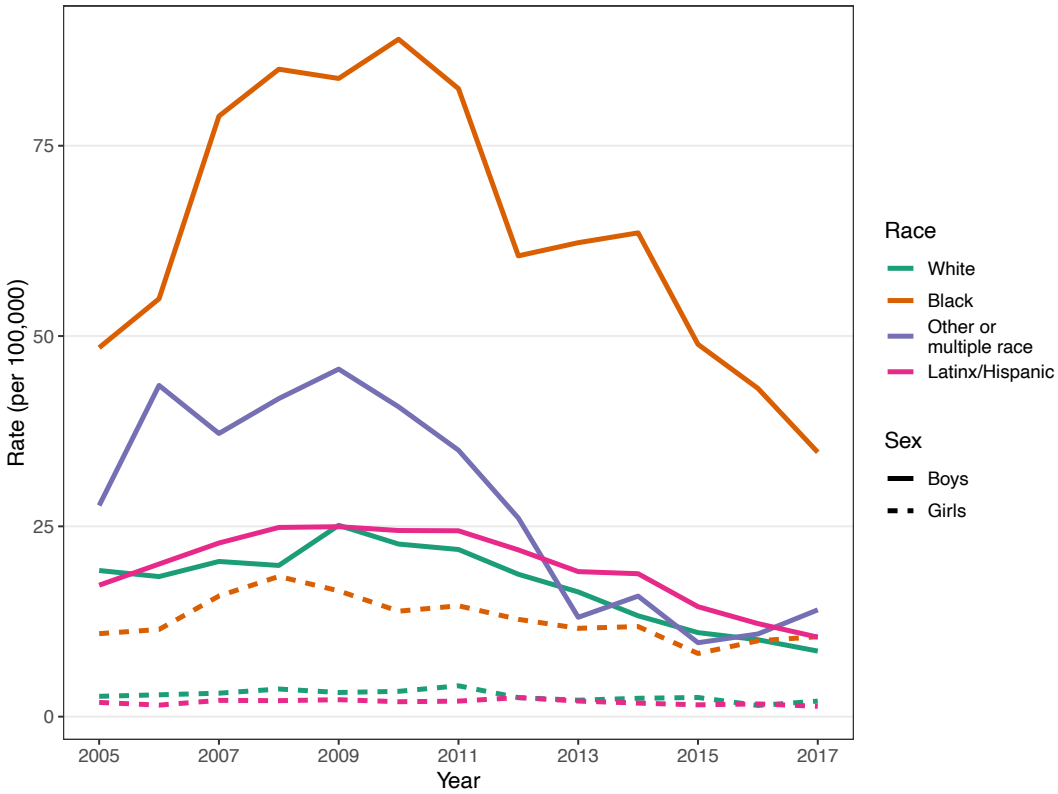
Note: Results for youth 10-14 years old did not change in the sensitivity analysis but are included here for reference. Counts among youth younger than 10 years were too low to report by sex and race. The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or Multiple Race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. 39 (3.2%) and 2 (0.2%) 10-14-year-old legal intervention injury patients missing race/ethnicity and sex, respectively, were excluded; 412 (2.8%) and 20 (0.1%) 15-19-year-old legal intervention injury patients missing race/ethnicity and sex, respectively, were excluded.

Figure 4.7 Trends in the annual rate of legal intervention injury among youth 0-19 years of age by race in California, 2005-2017 – sensitivity analysis.



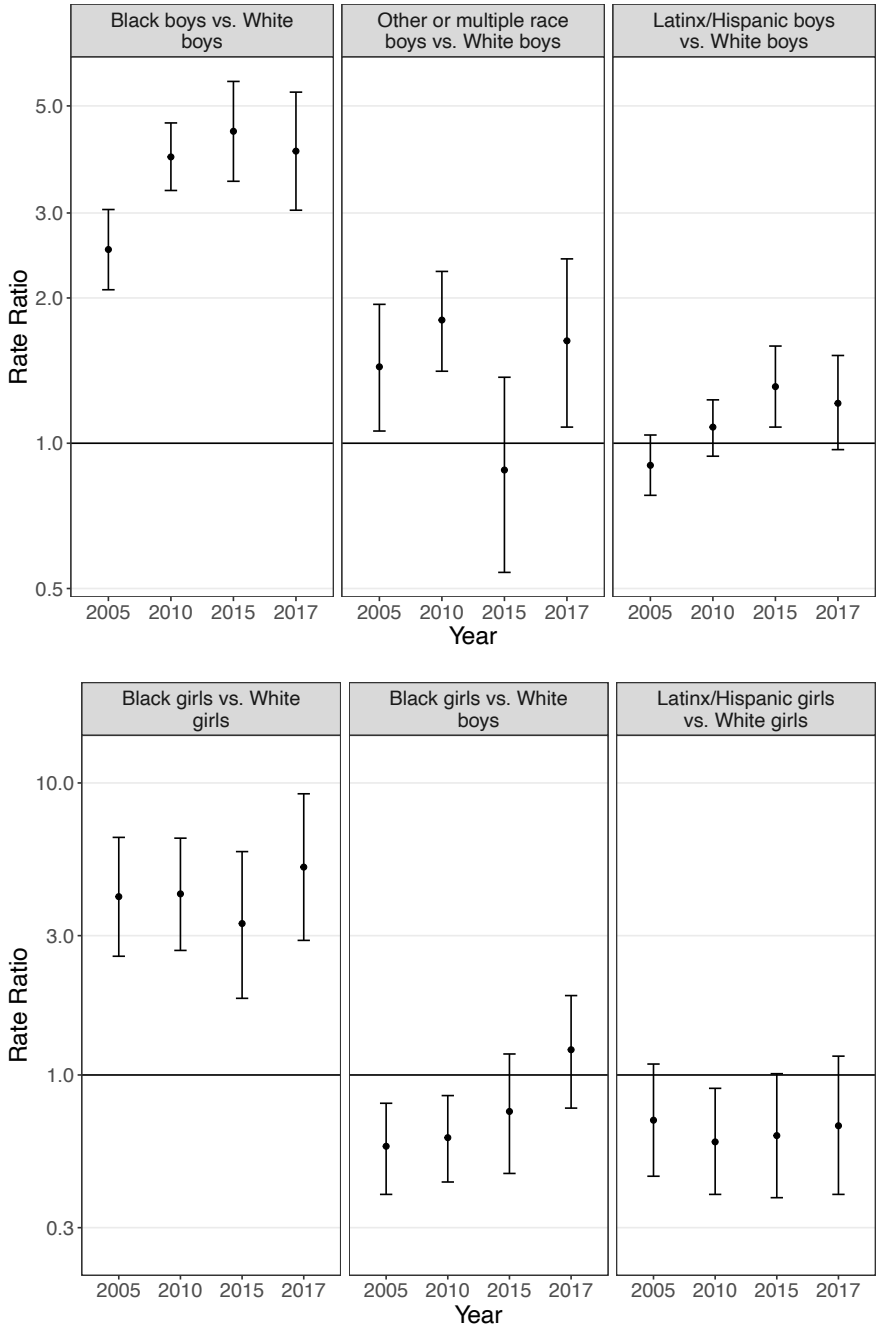
Note: Rates are per 100,000 person-years. The racial categories are operationalized such that White, Black, and Other or Multiple Race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. Annual counts were too low (<15) to report rates for American Indian or Alaska Native and Asian or Pacific Islander youth. 454 (2.8%) legal intervention injury patients missing data on race/ethnicity were excluded.

Figure 4.8 Trends in the annual rate of legal intervention injury among youth 0-19 years of age by race and sex in California, 2005-2017 – sensitivity analysis.



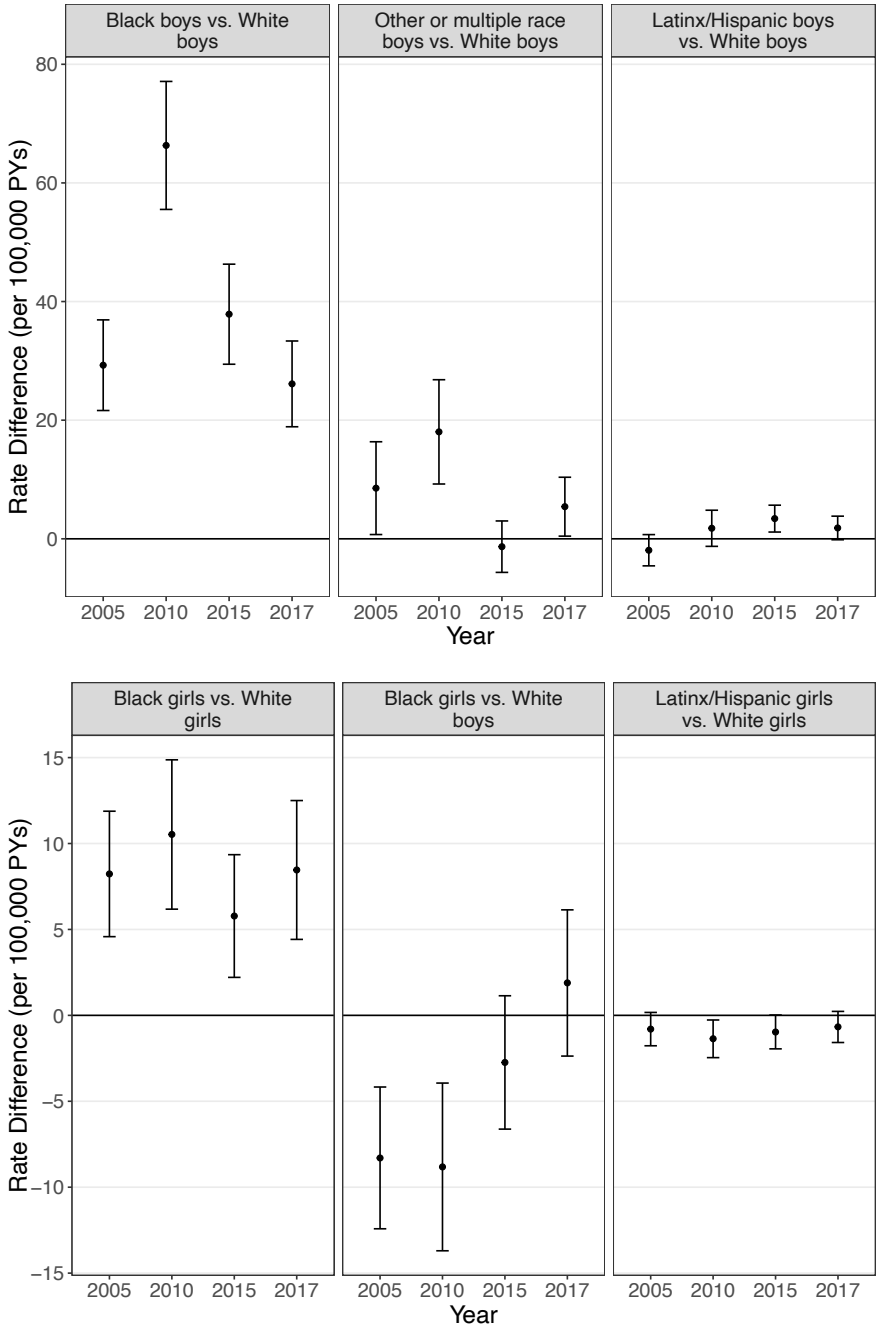
Note: Rates are per 100,000 person-years. The racial categories are operationalized such that White, Black, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. Annual counts were too low (<15) to report rates for American Indian or Alaska Native and Asian or Pacific Islander boys and girls, and for Other or multiple race girls. 454 (2.8%) and 22 (0.1%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded.

Figure 4.9 Relative inequities in the rate of legal intervention injury over time among boys and girls 0-19 years of age by race in California, 2005-2017 – sensitivity analysis.



Note: The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. Annual counts were too low (<15) to report inequities over time for American Indian or Alaska Native and Asian or Pacific Islander boys and girls, and for Other or multiple race girls. 454 (2.8%) and 22 (0.1%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded.

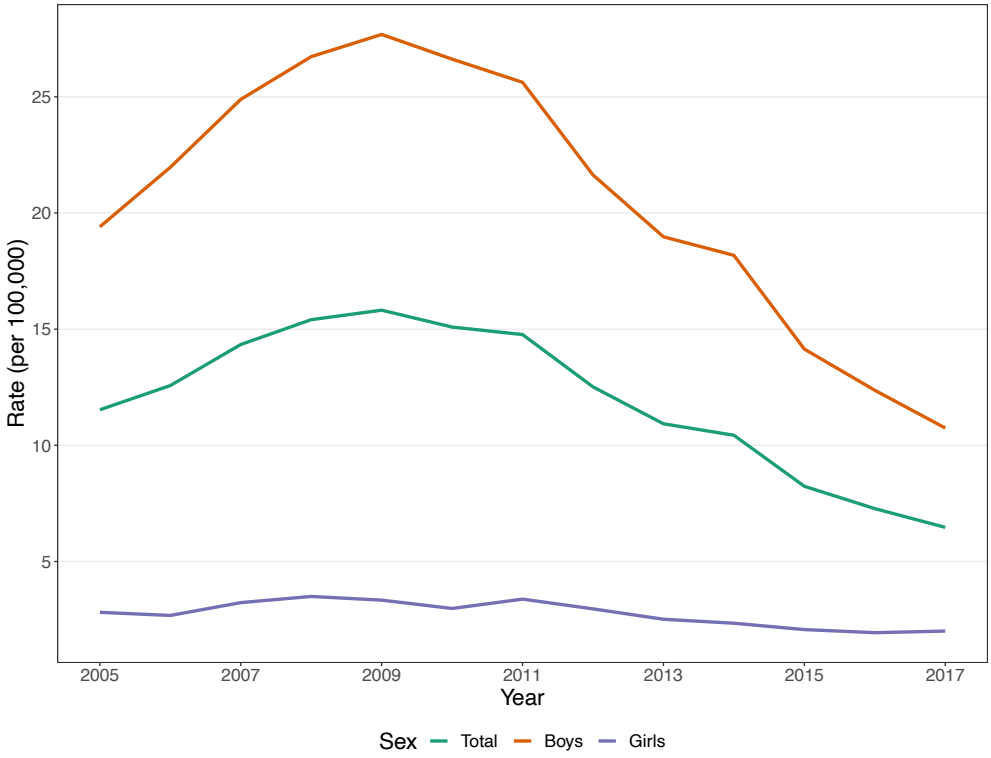
Figure 4.10 Absolute inequities in the rate of legal intervention injury over time among boys and girls 0-19 years of age by race in California, 2005-2017 – sensitivity analysis.



Abbreviations: PYs: person-years.

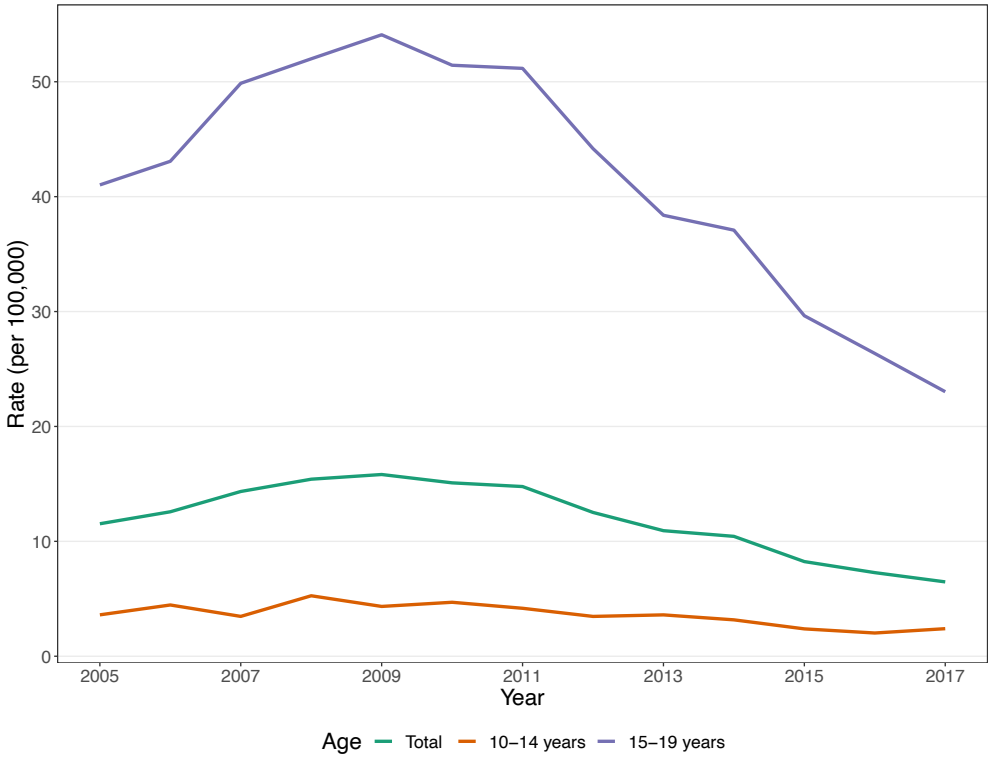
Note: The racial categories are operationalized such that White, Black, American Indian or Alaska Native, Asian or Pacific Islander, and Other or multiple race exclude patients identifying as Latinx/Hispanic. The Other or multiple race category includes patients who reported a race other than White, Black, American Indian or Alaska Native, or Asian or Pacific Islander and patients who reported more than one of these categories. Annual counts were too low (<15) to report inequities over time for American Indian or Alaska Native and Asian or Pacific Islander boys and girls, and for Other or multiple race girls. 454 (2.8%) and 22 (0.1%) legal intervention injury patients missing data on race/ethnicity and sex, respectively, were excluded.

Figure 4.11 Trends in the annual rate of legal intervention injury among youth 0-19 years of age by sex in California, 2005-2017 – sensitivity analysis.



Note: Rates are per 100,000 person-years. 22 (0.1%) legal intervention injury patients missing data on sex were excluded.

Figure 4.12 Trends in the annual rate of legal intervention injury among youth 0-19 years of age by age in California, 2005-2017 – sensitivity analysis.



Note: Rates are per 100,000 person-years. Results for youth 10-14 years old did not change in the sensitivity analysis but are included here for reference.

Chapter 5: Conclusion

Longstanding work by community leaders and activists, and more recently, the involvement and support of leading health organizations have raised concerns over police violence in the US and have highlighted the need for prevention strategies.[1,27] A growing body of literature on law enforcement use of force, and the consequent injuries and deaths caused by law enforcement also support police violence as a critical public health problem in the US.[1,4,5,28,29] Understanding the distribution, nature, and determinants of police violence is critical for identifying individuals and communities most affected and for developing intervention strategies aimed at reducing experiences of police violence – in general, but in particular incidents that lead to serious injury or death. While there has been an increase in scientific research, including from public health researchers, gaps and limitations of existing research remain. The aim of this dissertation was to build on prior work and contribute to our understanding of experiences of police violence among marginalized groups – particularly groups in which research has either been limited (e.g., young people) or in which existing research has methodological limitations (e.g., individuals suffering from psychiatric disorder).

Chapter 2 examines the extent to which particular mental and substance use disorders are over-represented among adults treated for nonfatal legal intervention injuries in hospitals throughout California, from 2005-2014, compared to the general US adult population. This work found that compared to the general population, the prevalence of nonaffective psychoses, mood disorders, alcohol use disorders, and drug use disorders was substantially higher among nonfatal legal intervention injury cases, especially among those treated in inpatient settings (i.e., admitted to the hospital rather than treated in the emergency department). Investigation of injury severity scores across legal intervention injury cases with and without the disorders studied suggested that selection of injury cases with disorders into the inpatient setting likely explains some, but not all, of the very large prevalence differences observed among inpatient cases specifically. Results were consistent in analyses with age, sex, and race standardized prevalence estimates among legal intervention injury cases, and in analyses restricted to cases who were treated for legal intervention injury only once over the study period.

Building on this cross-sectional study, Chapter 3 employs a cumulative case-control design to estimate the relations between particular mental and substance use disorders and subsequent nonfatal legal intervention injury among adults in California – both overall and by race/ethnicity. Overall, results showed that having a mental and/or substance use disorder in the year prior was strongly related to experiencing subsequent nonfatal legal intervention injury, with the strongest associations observed for personality disorder, comorbid mental and substance use disorder, nonaffective psychosis, and bipolar disorder. This study included careful consideration of confounder control, to limit overadjustment for potential mediating factors (e.g., suspect resistance/behavior, as in most prior studies); thus, main analyses only adjusted for age, sex, and race/ethnicity, which are important determinants of legal intervention injury and associated with psychiatric disorder. Sensitivity analyses further adjusted for factors supported by literature to be either potentially important confounders or mediating factors. Associations were consistent when further adjusting for patient insurance (SES proxy) and residential urbanicity (social/physical

environment), and substantially weaker, but still meaningful, in analyses also adjusting for psychiatric comorbidity. Race-specific analyses showed substantial variation in the magnitude of relative associations by racial identity, which, to our knowledge, has not been documented before. Findings suggest that relative to other risk factors for police violence, nonaffective psychosis, comorbid mental and substance use disorder, and bipolar disorder may be particularly relevant for risk of injury by law enforcement among Asian and Pacific Islander adults. However, further research assessing effect modification by racial identity on the absolute scale is needed for a clearer understanding of the joint influence of psychiatric disorders and race/ethnicity on police violence.

Chapter 4 investigates the incidence of legal intervention injuries among California young people specifically, finding stark inequities at the intersections of age, sex, and race/ethnicity. Results showed that Black boys and girls, as young as 10 years of age, experience substantially greater burden of injuries caused by law enforcement, compared to youth of other races/ethnicities, and that relative inequities are even larger at younger ages. These findings are consistent with literature which has found that Black youth are not afforded the same basic protections as youth of other races/ethnicities.[84–86] They also lend support to police violence as a form of structural racism, through inequitable exposures to the criminal legal system (including legal intervention) *and* harsher outcomes during encounters among Black youth – resulting from both structural-level (e.g., "tough on crime" and "zero-tolerance" policies) and individual-level (e.g., interpersonal racism) factors.[21,22,25] For example, War on Drugs policing, and other similar tough on crime strategies such as Broken-Windows policing (i.e., the targeting of low-level offenses such as loitering), have inequitably targeted and harmed Black and Brown communities throughout the US.[26,168] Further, racist policies and institutional practices have historically contributed to and continue to drive residential segregation and disinvestment in communities of color, leading to lack of opportunities and high rates of poverty,[169] which are strongly associated with exposure to legal intervention. Taken together, this work highlights the importance of documenting police violence, and its downstream consequences, among young people throughout the US. The findings also support the need for broader structural changes aimed at dismantling structural racism (e.g., the passage of laws and policies to create a more equitable criminal legal system), as well as the development of appropriate interventions aimed at stemming both acute and long-term harms associated with experiences of police violence among youth (e.g., connecting exposed youth to appropriate resources).

Analyses of the relations between psychiatric disorders and nonfatal legal intervention injury suggest a need for research on potential effective prevention strategies to reduce the burden of injuries by law enforcement among individuals suffering from psychiatric disorders – particularly those with severe disorders (e.g., psychosis, bipolar disorder), and comorbidity across disorders. Given that the work herein estimated overall relations that capture both risk of exposure to law enforcement and risk of injury during encounters, both broader structural interventions – for example, those targeting downstream social consequences of psychiatric disorder, such as access to employment opportunities, housing, and mental health care – and organization-level strategies (e.g., crisis response services, including Co-responder teams and Crisis Intervention Team models) should be considered. While certain collaborative models between law enforcement and mental health professionals have been investigated, this work has largely been descriptive and has focused on outcomes other than use of force/injury (e.g., linkage to mental health services, reductions in unnecessary emergency department visits and repeat law enforcement calls).[148]

Broadly, this dissertation work adds to literature on the inequitable burden of police violence, primarily experienced by marginalized groups in the US. This growing body of research lends support to more recent calls by community leaders and activists, as well as public health and medical professionals, for greater investment in individuals and communities rather than in law enforcement agencies and the broader legal system. The fundamental principle that underlies this argument is that when federal, state, and local governments invest in individuals and the communities in which they live and work, they provide the opportunities *necessary* for individuals to live healthy and productive lives. Understandably, most existing work on police violence – as in this dissertation – has focused on first examining the distribution and individual- and police agency-level determinants of police violence incidence. However, as research in this area continues to grow, future work should also investigate the potential protective effects of policies and programs aimed at investing in the well-being of individuals and communities.

Lastly, from a broader methodological perspective, this work aimed to build on prior research through the use of a large and diverse, population-based healthcare dataset with clinical measures of legal intervention injury (all chapters) and psychiatric disorder exposures (Chapters 2 and 3), rather than law enforcement agency data. These data improve inference beyond agency-specific jurisdictions, avoid potential misclassification bias resulting from inaccurate perceptions and reporting by law enforcement officers, and allow for examination of experiences among smaller population subgroups. Despite these advantages, healthcare administrative data are not without limitations (as discussed in Chapters 2-4); therefore, as other public health practitioners have argued,[61] there is a critical need for comprehensive data sources on police violence in the US, in order to continue to make progress in our understanding of the distribution, etiology, and consequences of police violence.

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