BEYOND URBAN FATALITIES: AN ANALYSIS OF SHOOTINGS BY POLICE IN THE UNITED STATES

By

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Abstract

Shootings by police are an underexamined and unequally experienced source of firearm injury, accounting for at least 1 in 20 US homicides and untold nonfatal injuries. Urban and rural areas are implicated, but the circumstances surrounding non-urban shootings are not well known, nor are the modifiable social conditions and potential policy levers for systematic and nationally inclusive injury prevention. This dissertation analyzes a novel dataset, built from the Gun Violence Archive, of all injurious shootings by US police from 2015-2020. The analyses directly compare fatal and nonfatal incidents and injuries; injuries in urban, suburban, and rural areas; and multiple levels of social and policy correlates of local injury incidence on a national scale. On average, 1,770 people were injured annually. Fifty-five percent of shootings were fatal; 45% occurred in predominantly rural zip codes. Lethality was highest in rural areas. Racial disparities in total injury burden were identified across the urban-rural continuum and exceeded estimates drawn from fatal injuries alone. Co-occurring behavioral health needs were associated with 23% of incidents and 38% higher odds of fatal injury. Permit-to-purchase (PTP) statutes and concealed carry (CCW) licensing were associated with lower county injury incidence. For each percentage increase in adults with unmet substance use needs in a state, a 25% increase in county injurious shootings was observed. To prevent injuries from shootings by police, policymakers should prioritize stronger CCW and PTP statutes, investments in programs to elevate the status of vulnerable residents, and non-policing crisis response systems. Urgent need for mandatory reporting of shootings by police persists. Future research should prioritize improving problem-definition related to behavioral health needs, firearm involvement, urban/rural manifestations, and long-term injury consequences. Intervention

research should prioritize studies of the effects of police unions, pandemic disruptions, extreme risk protection orders, and emerging crisis-response innovations on injuries from shootings by police.

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Through the course of completing this dissertation, I personally conducted in-depth reviews of more than 6,000 documented cases of injurious shootings, I heard from families who experienced deaths or injuries from shootings by police, and I spoke with current or former police who had fired shots that injured. From this, it became clear to me that none of us is far removed from the impacts of these "rare" events. The burden of injury associated with shootings by police; the inequity in their immediate and enduring harms; the pervasiveness of their consequences; the failure of established systems of governance to enable research, accountability, and improvements - these are our collective problems to solve. To the people who shared their stories of injury, loss, pain, and frustration with me – either directly or through journalists – the heart of this research and the change I hope it informs belongs to you.

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Chapter One: Introduction

Background

In 2014, a series of fatal police shootings of Black boys and young men (e.g., Tamir Rice, Laquan McDonald, Michael Brown) captured the nation's attention[2] and catalyzed the Black Lives Matter movement.[3,a] Since 2014, roughly 1,000 people have been fatally shot by police every year.[4] These deaths represent less than 3% of all fatal gun violence nationally.[5] Even so, 1 in 20 US homicides are committed by police.[6] By either measure, the controversy and tensions these deaths pique are outsized. A Pew Research Center survey of a nationally representative sample of 4,708 US adults in 2020 found that only 35% agreed that police use the right amount of force in all situations, 34% believed that police treat racial and ethnic groups equally, and 31% agreed that officers are held accountable for misconduct.[7] Public views on policing's use of force, fairness, and accountability for misconduct had all worsened since 2016.[7] Despite these public concerns, multiple structural barriers have restricted research, advocacy, and corrective action to reduce injuries from police use of force. Among such limitations are 1) the fragmented organization of policing, 2) inadequate reporting and surveillance systems to systematically document incidents of police use of force, and 3) a typically restricted focus on fatal use-of-force incidents only.

Fragmented policing

One of the most complicating factors in the study of policing, including police use of force, is the organization of law enforcement, itself. An estimated 18,000 law enforcement agencies exist in the US. These include 12,501 local police departments, 3,063 sheriff's

[a] "Black Lives Matter" would later be countered with "Blue Lives Matter," setting up a divisive, false dichotomy in the popular characterization of police use of force.

offices, 1,733 special jurisdictions (e.g., state parks, airports), 638 constables or marshals, and 50 state law enforcement agencies.[8] Differences between these agency types include jurisdiction size, funding sources, elected or hired entry into positions, and state-defined specific duties. Policing agencies are arguably one of the most public-facing forms of US government,[9] but the institution of policing is fragmented and often lacking in transparency. Required record-keeping and reporting standards, use of force authorization, and officer protections or potential consequences of misconduct are largely defined at the state level. Much heterogeneity exists.[10] This differentiation and fragmentation complicates efforts to define patterns in policing-related harms and identify broadly effective interventions.

Inadequate surveillance systems

In addition to fragmented organization and regulation, a lack of data transparency by policing agencies (here forward referred to as "police," as distinct from "local police" for the specific agency type) further complicates research and progress. Governmental data sources capturing incidents of police use of deadly force include the Federal Bureau of Investigation's Uniform Crime Reporting (UCR) Program, the National Use-of-Force Data Collection system (implemented in 2019), the Centers for Disease Control and Prevention (CDC)'s National Vital Statistics System (NVSS), and the CDC's National Violent Death Reporting System (NVDRS). Each of these sources has severe limitations. Specifically, the UCR, which relied on voluntary reporting by police jurisdictions, has been shown to greatly underestimate incidents and has now been phased out in exchange for National Use-of-Force Data Collection. The new system is also voluntary and has yet to achieve sufficient participation for reliable national estimates.[11] The NVSS underestimates use of force

fatalities due to inconsistent distinctions between homicides and legal intervention deaths on death certificates.[12,13] The NVDRS is a state-based system that is thorough and provides context but has been limited by incomplete participation until recently; the final 10 nonparticipant states began data collection in 2018.[12,14,15]

Owing to their relative comprehensiveness, inclusion of context, and minimal reporting lag, media-based sources are currently a preferred data source for research on use-of-force injuries nationally.[14] Examples include *The Guardian*'s "The Counted" (2015-2016),[16] *The Washington Post*'s "Fatal Force" (since January 1, 2015),[4] Fatal Encounters,[17] Mapping Police Violence,[18] and the Gun Violence Archive (GVA).[19] Of these sources, the GVA is unique in its specific focus on shootings, the most lethal form of deadly force, and its inclusion of nonfatal shooting injuries. However, researchers have been less apt to draw from the GVA, despite its strength as a large repository of shooting-related reporting, because the GVA maintains few abstracted variables. This limits its immediate utility for quantitative research. Additionally, the GVA's criteria for "officer involved shooting" is relatively nonspecific and requires additional case review for precise estimation of injuries resulting from shootings by police.

Defining and measuring use of deadly force

Law enforcement officers' largely discretionary use of firearms is informed by a complex patchwork of federal, state, local, and agency use-of-force policies and standards.[20] In all cases, force severity is defined by the mechanism's potential outcome, rather than the actual result. Firing a gun, for example, constitutes a use of deadly force, regardless of whether it results in a fatal injury.[10] The circumstantial legality or appropriateness of such uses of force is beyond the scope of this dissertation.

Because deadly force is defined by a mechanism's lethality, rather than the severity of the victim's injury, fatal and nonfatal injuries more closely capture the total incidence and contextual range of shootings by police in the US. However, only the National Use-of-Force Data Collection system and the GVA contain nationwide data on nonfatal, injurious shootings by police, an important subset of all uses and manifestations of deadly force. As a result, existing research excludes "hundreds, if not thousands"[21] of cases, varying by injury outcome or geographic scope. Moreover, how nonrepresentative samples - limited by voluntary reporting, locality, region, and/or outcome - differ from the whole is largely unknown.

Given these challenges in police fragmentation, inadequate national surveillance systems, and the typically restricted focus on fatal incidents, relatively little is known about when US police fire their weapons or when people are injured or killed by those actions. This dissertation seeks to improve upon the latter two of these gaps through the analysis of a newly abstracted dataset, based on six years (2015-2020) of fatal and nonfatal injurious shootings by police, identified through the GVA. The next section presents a review of existing literature and specific gaps to be addressed by the current research.

Review of Literature

Shootings by police as a health disparity

Prior studies of police use of force and shootings by police, specifically, have largely been limited to fatal outcomes, generally interpreted through an urban lens.[21–24] These studies have revealed that exposures to police use of deadly force are highly unequal. For example, an analysis of Fatal Encounters data from 2013 to 2018 by Edwards et al. found race, gender, and age to be interrelated determinants of death by police use of force. Of all

groups, Black men and boys were projected to have the highest risk of death across the lifespan. Edwards et al.'s models predicted 1 in 1,000 Black men would be killed by police over the life course, 2.5 times higher than the risk for white men. Predictions for other race-and-gender groups included: 36-81 deaths per 100,000 Native American men, 50 deaths per 100,000 Latino men, 9-23 deaths per 100,000 Asian/Pacific Islander men, 2.4-5.4 deaths per 100,000 Black women, 4.2 deaths per 100,000 Native American Women, and 2 deaths per 100,000 white or Asian women. Overall, women's life-course risk of dying by police homicide was estimated to be 20 times lower than men's. For both genders, the 25-29 age group carried the highest risk of mortality by police use of force.[25]

Of note, Edwards et al.'s models assumed that all people could be exposed to police (a prerequisite for being shot by police), which may not be true. However, this assumption is often preferable to the alternative: limiting a denominator to people with known police interactions (e.g., arrests). This alternative would be expected to minimize the effect of racism by focusing only on racial disparities at the later stage of individuals' interactions with police, when disparities in earlier stages are known.[26] Edwards et al.'s analysis did not formally test changes over time, but they informally observed that the gap between Black and white deaths appeared to be narrowing. If source reliability were found to be stable over time, future research could explore what time variant factors might explain the change or whether geographic differences might also be involved.

Transitioning from disparities in all forms of fatal force to shootings, specifically, Mesic et al. examined the influence of structural racism on fatal shootings by police among individuals who were not confirmed to be armed. Mesic et al. created a state-level racism index based on two validated indicators: residential segregation and gaps in advantage.

"Gaps in advantage" were defined by incarceration rates, educational attainment, economic indicators, and employment status. The outcome of interest was the ratio of Black to white shooting fatalities, 2013-2017, as reported by Mapping Police Violence.[27] After controlling for multiple state-level variables, including socioeconomic factors, demographic factors, crime and arrest rates, and gun prevalence, Mesic et al. found the racism index to be a significant predictor of Black-white disparities among victims who whose weapon status was unarmed or unknown, but not among armed victims. Within the racism index, residential segregation, economic disparity and employment disparity were the most robust indicators of fatal shootings of unarmed victims (Incident Rate Ratio [IRR]=1.7, 1.4, and 1.3, respectively). Citing prior research that decisions to shoot happen more quickly among armed individuals, the authors theorized that weapons may be perceived to be a dominant threat. But, in the absence of a weapon, personal biases, influenced by structural determinants, may wield more influence over threat assessment.[27] A possible limitation of this study was that racism was defined only by conditions for Black versus white individuals. However, for some states (e.g., Montana, the state with the lowest racism index) racism may manifest more clearly among other communities of color.

In 2021, Thomas et al. further examined the interaction of race and armed status on fatal shootings by police in a case-only design.[b] They used a 2015-2019 sample, drawn from *The Washington Post* database, including Black and white men whose armed status was known (n=3,090). In stratified and adjusted models, indications of interaction emerged.

[b] Were they available, control cases would have been men with documented race and weapon statuses, who interacted with police but were not killed. Law enforcement agencies are not required to document these characteristics, and those that do often report sequelae of an encounter by conditioning on the encounter. This would bias racial effects downward, as previously described.

This implies that the combination of variables may have a greater effect than their independent presence, although results did not meet criteria for inferring causal effects. When race, armed status, and age were examined together, findings were null among males under 35 years of age, but disparities were found among unarmed Black men over age 54. When race, armed status, and mental illness were considered together, Black men who were perceived to be mentally ill when killed, were less likely to be armed than those who were white and similarly perceived. White men were more likely to be documented as mentally ill. The authors interpreted these findings to be an indication that bias against Blackness may be stronger than bias against mental illness, with acknowledgement that under-documentation of mental illness among Black men could shift inferences toward the null.

Finally, in the examination of race and armed status with US region, Thomas et al. identified the Midwest to be causally associated with higher risk to armed Black men; their risk was lower in the South. This implies that regional racial population density may be important to the effect of intersectional racial identities and armed conditions on fatal shootings by police. A key limitation of this study was the use of county-level demographic data as estimates of individual characteristics.

Collectively, these three representative studies highlight that research on shootings by police *is* research on health disparities. As such, researchers should be guided by disparities-related theoretical frameworks. Gaps in racial disparities may be narrowing, but data limitations must be overcome for future longitudinal analyses to confirm. Meanwhile, differences in shootings by police by race may be cross-sectionally observable in new subgroup analyses (e.g., rural/urban cross-sections). Finally, interactions between race and

armed status, age, region, assumptions of mental illness, and responses to mental illness should be considered. However, given the relative rareness of police shooting events, regional or other subgroup analyses may be challenged by a lack of sufficient power to analyze statistical interactions adequately. Expanding case inclusion to both nonfatal and fatal injuries may reduce this limitation if fatal and nonfatal cases are determined to be similar enough to justify using an unstratified, total-injury outcome.

Defining rurality and identifying the rural knowledge gap

No single standard for identifying rural and urban areas exists in public health research.[28,29] Two categorical options include county-based measures and zip-code based measures. Comparing 5 methods of measuring rurality from within these two categories,[c] Hemenway et al.'s mean estimate placed 27% of the US populace in a rural residence (i.e., living in non-metropolitan and non-metropolitan-adjacent areas).[29] Estimates ranged from 14% to 45%. In comparison, approximately half (54%) of US law enforcement agencies were assigned to cities with fewer than 10,000 residents, according to the Federal Bureau of Investigation.[30] Average per capita law enforcement staffing ranged from a low of 1.6 officers per 1,000 residents in cities with 50,000-250,000 residents to a high of 4.2 officers per 1,000 residents in smaller towns with under 10,000 residents. The largest cities (1 million or more residents) employed 3.1 officers per 1,000 residents. Counties' law enforcement officer allocations were similar, with 2.6 officers per 1,000 residents in metropolitan counties, and 3.3 officers per 1,000 residents in nonmetropolitan counties.[30]

[c] Two methods were county based: 6 categories per the National Center for Health Statistics Urban Rural Classification Scheme Codes (NCHS) and 9 categories per the Rural-Urban Continuum Codes of the US Department of Agriculture (USDA). The NCHS and the USDA estimated that 14% of the population live in rural counties. Three methods were zip code based: 12 categories per the 2006 National Center for Education Statistics (NCES), 3 categories per the 2010 US Census, and 3 categories based on residents' self-assessment per the "FiveThirtyEight" advocacy website. These estimates were more variable: 45%, 35%, and 25%, respectively.

Zimring's 2017 analysis of the geographic distribution of fatal shootings by police first called into question the assumption that shootings by police are a disproportionately urban problem. From his analysis, Zimring concluded that "killings by police are not concentrated exclusively in cities or close[ly] linked to urban crime."[31] In 2018, Edwards et al. examined 2 county-level definitions of rurality (US Census and NCHS) and per capita police homicides (weapon non-specific) using the Fatal Encounters database. Similar to Zimring, Edwards et al. concluded that "although risk is high in the large urban metropolitan areas…the risk is also significant in smaller and rural metropolitan areas."[32] In 2020, Hemenway et al. further substantiated these observations in their comparison of rurality measures. They found that, contrary to other forms of interpersonal gun violence, per capita rates of fatal shootings by police appear to be comparable in urban and rural jurisdictions. These finding held across all 5 methods of defining rurality.[29] Based on these results, Hemenway, et al. concluded that more research is needed regarding the circumstances surrounding shootings in rural law enforcement jurisdictions. Zimring and Hemenway et al. hypothesized that rates of gun ownership in rural areas might be one influential characteristic.[31,33]

Less formally, in 2020 researchers with Mapping Police Violence observed that the frequency of fatal shootings appeared to be decreasing in urban jurisdictions and increasing in rural jurisdictions, although national yearly counts have appeared stagnant (Figure 1).[18,34] This observation should be interpreted with some caveats. First, reliance on newer media sources limited the observation period available. Second, within the available period, known reporting biases exist, as there has been a steady increase in both public interest[2] and media coverage of the issue over time.[35] Third, as a relatively rare event,

counts are subject to statistical volatility, particularly as time or jurisdiction size shrinks. The situational, demographic, or other characteristic differences of urban and rural jurisdictions that may be contributing to potentially diverging trends in fatal shootings by police is unknown.

Measuring gun ownership and its significance to shootings by police nationally

Gun possession and ownership are inconsistently documented in the US. Without a meaningful national registry, either self-report or a proxy measurement is required. Both options have limitations. The most valid and accepted proxy measurement has been the proportion of suicides in a region completed with a gun.[36] A key limitation of this proxy is it can only provide regional (usually state-level) estimates of gun exposure. Additionally, recent scholarship suggests that the suicide proxy may be more sensitive to demographic variation than to actual gun prevalence.[37] The self-reporting alternative, usually by survey, is subject to social desirability bias, potentially leading to underreporting of gun ownership. In a 2017 online survey, the Pew Research Center estimated gun ownership using two questions of personal and household ownership, posed to a nationally representative sample of 3,930 US adults from the American Trends Panel. Gun ownership was estimated to be more than twice as common among rural residents than urban residents (46% vs 19%, with suburban ownership estimated at 28%).[38]

In 2019, Hemenway et al. examined the association between household gun ownership and fatal shootings by police. Their interest was based on work by Swedler et al. (2015) that identified rates of household gun ownership (defined by both survey and suicide proxy) to be a key risk factor for police occupational fatalities (defined as the portion of law enforcement officers killed in a state from 1996 to 2010).[33,39] Hemenway et

al. compared the 10 states with the highest gun ownership to the 5 states with the lowest ownership, aiming for balance in person-years. Next, they estimated the association between ownership and 1) fatal shootings, 2) fatal shootings of a victim with a gun, and 3) fatal shootings of a victim without a gun after controlling for state population, violent crime arrest rates, and other demographic covariates. They concluded that states with higher gun ownership had 3.6-times higher rates of fatal shootings by police, and associations were stronger for victims who were armed with a gun. The association between gun ownership and fatal shootings by police persisted after controlling for crime, poverty, urbanization, and racial demographics. Hemenway et al. estimated that 46% of state variation in fatal shootings by police may be explained by the combination of a state's violent crime rate and gun ownership.[33]

Summary of rural area and gun ownership knowledge gaps

In summary, contrary to traditional assumptions, fatal police shootings are not a disproportionately urban problem.[29,31,32] With acknowledgement to longitudinal data limitations, potentially opposing trends in rural and urban jurisdictions may belie seemingly stagnant national rates of shootings by police.[18,34] Like shootings by police in urban settings, exposures to deadly force within rural settings may be unequal. Despite challenges in defining rurality and estimating gun ownership, higher gun ownership rates in rural jurisdictions have been found to be associated with higher incidence of fatal shootings by police. Moreover, gun ownership appears to contribute substantially to state-level variation in fatal shootings by police.[33] Still, more than half of observed state-level variation remains unexplained, and gun ownership's contribution to nonfatal shootings has not been examined.

Nonfatal injury considerations

Combined, fatal and nonfatal incidents more closely approximate the total number of police decisions to use deadly force. Studies of community-based gun violence suggest that differences between fatal and nonfatal shootings include victim demographics, wound severity, shooting motives, and responsiveness to community-based interventions.[40,41] Nonfatal shootings by police are governed by the same use of force policies as fatal shootings and are likely to share many commonalities with fatal shootings. However, prior research indicates that other characteristics that ought to be considered equally under use-of-force policies (e.g., race), in practice, are not. Nonfatal shootings may simply be a consequence of poor aim or may be a product of environmental factors, complex assessments of threat, and differences in individual vulnerability. Regardless, they represent an under-evaluated outcome of actions taken despite known potential for death or other enduring consequences.

If fatal and nonfatal incidents prove to be more qualitatively similar than different, inclusion of both outcomes may meaningfully add power to studies of police involved shootings. On the other hand, if circumstances surrounding fatal and nonfatal incidents are qualitatively different, as they are in community-based gun violence more generally, then the development of the field's understanding of nonfatal shootings will be essential to the identification of interventions that more comprehensively reduce the incidence of deadly police violence.

Summary of gaps in literature

Because of the field's nascency, administrative heterogeneity, and agency non-transparency, relatively few policy studies of shootings by police exist. Despite mounting

scrutiny from advocates and the public, as well as growth in agency adoption of body cameras and other accountability measures, annual incidence of shootings by police nationally appear to have remained static. The seemingly persistent stability of fatal shootings over time gives an impression of intransigence. However, studies of shootings by police have been limited to a nonrandom subset of events. Specifically, research on shootings by police and its correlates has almost exclusively relied on fatal outcome data, largely interpreted within an urban context. More recent discoveries of an under-recognized comparability of urban and rural rates suggest that drivers of police use of deadly force may be more embedded in shared aspects of a fragmented system of policing than has previously been recognized. Moreover, potentially divergent time-trends across urban and rural contexts suggest that yet-unidentified policy interventions or other modifiable characteristics may be acting differently upon urban and rural jurisdictions. Analyzing the circumstances surrounding nonfatal outcomes nationally, examining shootings by police in non-urban settings, assessing the role of gun ownership in all-outcome injurious shootings, and interpreting these issues through a theoretical lens that recognizes policy's potential to disrupt health disparities may uncover new opportunities for equitably reducing policing-related harms. This dissertation aims to expand upon gaps in knowledge by analyzing a new dataset that includes nonfatal outcomes and will facilitate the study of previously underexamined social and policy contexts.

Conceptual Framework

Original model

Diderichsen, Evans, and Whitehead's model of the Social Basis of Disparities in Health[1] defines differences in health vulnerability and health consequences to be a product

of the interaction between society-level social and policy contexts and individual-level social position and exposures. The model originates from an era of social science that has since been criticized for over-emphasizing disparities (i.e., individual and group differences) and under-emphasizing inequities (i.e., societally constructed injustice). However, the integration of "policy entry points" in the model introduces potential for a more equity-minded orientation. In prior work, the model has been adapted and applied to hundreds of policy-relevant social and health conditions, ranging from governmental transformations for social justice to unjust consequences of COVID-19 pandemic responses.[42,43] This model was selected for its utility in guiding problem (re-)definition and positioning results within the context of potential societal determinants and more equitable, corrective reforms.

According to the model, health inequities develop through four possible mechanisms: social stratification, differential exposure, differential susceptibility, and differential consequences. These mechanisms are shaped by the distribution of power, wealth, and risks in the social context. To reduce health disparities, distribution imbalances must be equalized through policy intervention. Policy interventions can intervene along each pathway (i.e., by influencing social stratification, decreasing exposures, decreasing vulnerability, or preventing unequal consequences). For the purposes of this work, the first three pathways (leading to injury outcomes) are of primary interest; the ultimate outcome, social consequences of injury, is beyond the scope of the current project.

Model adaptation and application

Figure 2 depicts the adapted framework, specific to the interests of this research. This section applies key model constructs to the issue of shootings by police to support interpretation of the proposed aims within the conceptual framework.

Societal Factors – Social Contexts. Policing is one of society's most public-facing forms of government.[9] Accordingly, legally justified use of force is closely associated with specific government interests and functions of police. Policing-related government interests include: enforcement of law; maintenance of order;[d] and officer safety, an asset to the execution of law enforcement and order maintenance.[10] Enforcement of these interests may vary by social context, which may in turn shape what communities expect from police and the frequency and form of policing activities within a community. Social context is difficult to measure but may include factors such as demographic composition, indicators of economic security, educational attainment, patterns in fulfillment of basic needs, access to social and health services, police prevalence, gun prevalence, rurality, and other factors.

Societal Factors – Policy Contexts. Current and historical policies shape and reinforce social contexts and individuals' positions and conditions within it. Measures of the policy context may include categorical indicators of policy presence or continuous measures of policy impact. Relevant policies may promote or restrict social and economic wellbeing, shape access to securities and services, influence the availability and prevalence in guns in public and private spaces, or otherwise influence the stratification of power, wealth, and risk locally.

Individual Factors. Who is subject to use of force in pursuit of policing-related governmental interests has been shown to be unequally distributed across society. Social

[d] Includes community care-taking functions and involuntary commitment.

position may be variously defined and signaled, for example, through the social constructs of race, gender, perceived age, or housing status. Social position informs exposures or causes of injury (i.e., exposures to police or shootings by police) and vulnerability to fatal and nonfatal injury outcomes and consequences.

Specific Aims

This proposal aims to expand upon current understandings of injurious shootings by police by examining national prevalence, incidence, and societal correlates using a new dataset that includes fatal and nonfatal injuries. This inquiry is motivated by a recognition of the historical tolerance of unequal and ill-defined consequences of policing in US society and a current policy opportunity to redesign the conditions that shape and perpetuate its harms. In an effort to lay the foundations for this long-term pursuit, this dissertation has three specific aims.

Aim 1

First, describe total people injured or killed in shootings by police in the United States using an up-to-date, multi-year nationwide dataset. Second, compare characteristics of fatal versus nonfatal injurious shootings nationally.

Aim 2

Compare the incidence of injurious shootings by police in urban, suburban, and rural areas of the United States from 2015 to 2020. Next, cross-sectionally describe the prevalence and incidence of characteristics associated with injurious shootings by rurality.

Aim 3

Describe state- and county-level variation in injurious shootings by police. Then, analyze the association between social and policy characteristics of the state or county and county-level rates of injurious shootings by police in the United States.

Injury Data Source

The dataset used to investigate these aims was built by a team of 14 public health students, based on cases identified from the GVA. To identify cases, the GVA search tool was used to filter incidents by year (i.e., 2015-2020, inclusive) and incident characteristic (i.e., "officer involved incident"). All resulting cases were randomly assigned to members of the data abstraction team. Of these cases, 10% were distributed to two or more team members for quality assurance. Collectively, the team manually reviewed every case.

Case review consisted of a) reading all articles linked to the GVA record, b) evaluating the incident (and each injured person within) against inclusion criteria, c) searching for additional sources of online information and cross-referencing Fatal Encounters (for fatal injuries) to resolve uncertainties from the linked articles, and d) documenting incident and person characteristics via a Qualtrics survey tool. Documented variables are detailed in Appendix A. Retained cases included incidents in which one or more law enforcement officers intentionally fired shots that resulted in injury to a person who was not an on-duty law enforcement officer. Data entry occurred from July 2021 to April 2022. Duplicate cases were reviewed and details reconciled. Differences tended to be limited to specified characteristics versus characteristics designated as "unknown." Secondary review and related data cleaning occurred from April through June 2022.

A peculiarity of one variable is worth noting. Abstraction protocols were such that team members designated race and ethnicity only when explicitly stated in reviewed

materials. Injured people whose photo was provided without race or ethnicity stated were designated as "unspecified." In the analyses presented here, "unspecified" was collapsed with "unknown" (i.e., unstated and unpictured). However, in the analysis, it became evident that our team's conservative race/ethnicity designation process was unmatched by the cross-referenced fatal injury repository. Consequently, "unspecified or unknown" is substantially larger for nonfatal injuries than fatal injuries. This made absolute estimates of injury burden when stratified by race/ethnicity overly conservative and within-race case fatality estimates falsely high. Confidence is higher for relative comparisons between racial and ethnic categories. As of this writing, an effort is in progress to review "unspecified" case photos to improve usability for future research.

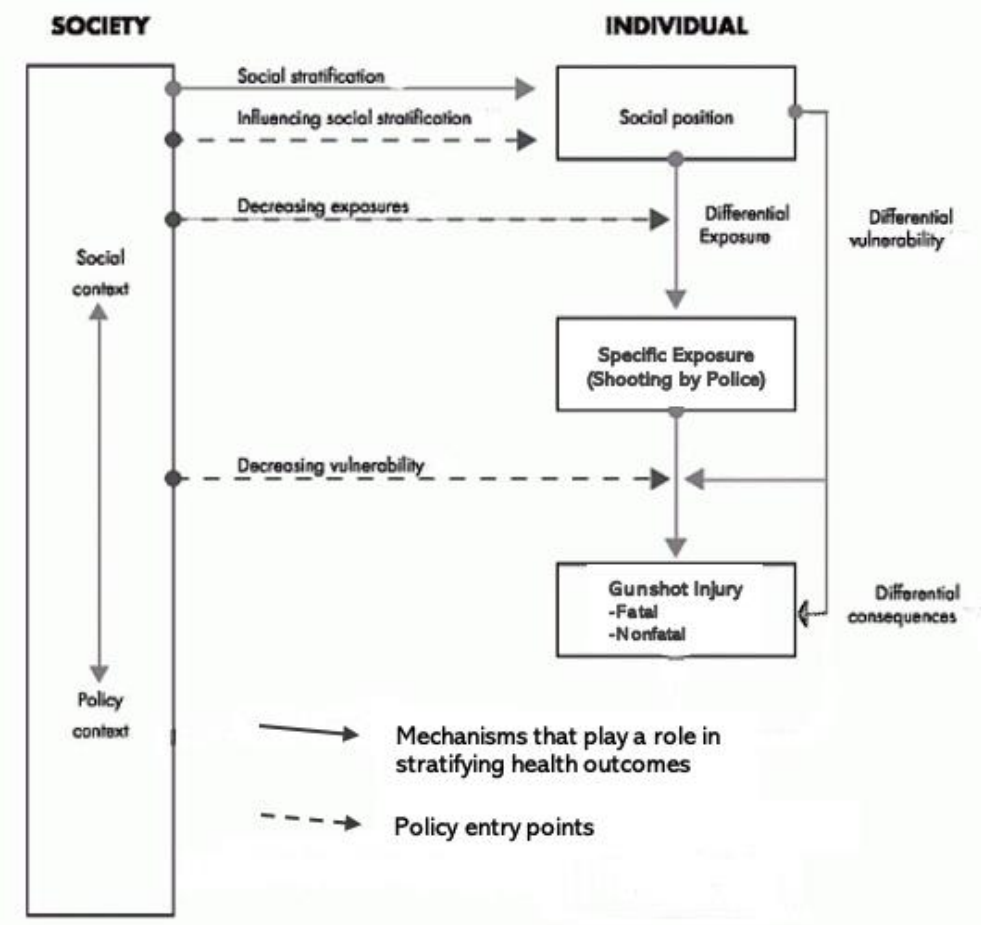
Dissertation Organization

Chapters 2-4 of this dissertation include the three manuscripts associated with each of the three respective aims. Chapter 5 is a concluding chapter. Manuscript 1 is a descriptive, epidemiologic study of total, fatal, and nonfatal injurious shootings by police in the United States from 2015-2020. Manuscript 2 compares the characteristics and contexts of shootings occurring in urban, suburban, and rural settings. Manuscript 3 uses multilevel modeling to explore the role of social and policy factors in county injury incidence. The concluding chapter contains a summary of findings from the dissertation, a discussion of policy implications, an analysis of strengths and limitations, and recommendations for priority future research. Tables and figures referenced in the text of each manuscript are provided at the chapter's end. Supplemental tables that are identified in the manuscript but not discussed in-depth are located in the appendices.

Chapter One Figures and Tables

Figure 1. Trends in Fatal Shootings by Police, Urban vs Rural[44]

Figure 2. Conceptual Framework
Adapted from Diderichsen, Evans, & Whitehead, 2001.[1]



Chapter Two: Manuscript One

Epidemiologic analysis of fatal and nonfatal shootings by police in the United States, 2015-2020

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Abstract

BACKGROUND: Shootings by police are an underexamined and unequally experienced source of firearm injury, resulting in 1,000 US deaths annually. No nationwide analysis of total injury burden or characteristics of injurious shootings by US police currently exists.

OBJECTIVES: To describe all-outcome injurious shootings by police and compare characteristics of fatal versus nonfatal injurious shootings nationally.

DESIGN: We employed a data abstraction process to improve the specificity and usability of the Gun Violence Archive's open-source repository of shootings by police. We estimated the frequency of injurious shooting incidents from 2015-2020, case fatality rates by incident and victim characteristics, and relative odds of death associated with each characteristic.

RESULTS: In total, 10,617 people were injured in shootings by police, an average of 1,770 people annually. 55% of injured people died. Case fatality rates varied. Compared to injuries during police-initiated responses, odds of fatality were 38% higher from injuries following dispatched responses. When a shooting injury occurred, frequently fatal incidents involved people with knives (68% fatal), assaults (61-65% fatal), or threats of harm to self or others (62-67% fatal). Behavioral health needs and wellbeing checks were also associated with frequently fatal injuries (67% and 65%, respectively). Injuries to unarmed or vehicle-armed people were less frequently fatal (50% and 36%, respectively). Compared to non-Hispanic white victims, Hispanic or non-Hispanic Black victims had 50-51% lower odds of fatal injury, indicating worse total injury disparities than suggested by fatalities alone.

CONCLUSION: Based on results, we call for reporting system enhancements and identify targeted opportunities to reduce harm through social services. Evaluations of emerging reforms should include all-outcome shooting injuries for more precise estimation of impact overall and among disproportionately affected groups.

Funding to support data collection and analysis was provided by New Venture Fund and Joyce Foundation. Ms. Ward acknowledges support from the National Institute of Child Health and Human Development (T32-HD 094687). Dr. Cepeda acknowledges support from the National Institute on Drug Abuse (K01DA054521). Funders had no role in the study design, statistical analyses, interpretation of data or drafting of this manuscript.

Introduction

Firearm injuries are a public health crisis, annually costing 45,000 lives and more than 1 million disability-adjusted life years in the United States alone.[45,46] Harms associated with firearm-injuries are compounded and reinforced by underreporting, inadequate funding for prevention, and other structural inequities.[2] Among the most underreported but societally impactful forms of firearm injury are shootings by police, which result in 1,000 US fatalities annually[1] and likely contribute to worsening public perceptions of policing. According to a Pew Research Center survey, in 2020 just 35% of US adults agreed that police use the right amount of force in all situations, and 34% believed that police treat racial and ethnic groups equally.[7] These views have fueled national policy debates about public safety reforms,[47] but data needed for empirical decision-making are lacking because of persistent gaps in national use-of-force injury surveillance.

Owing to their relative comprehensiveness, inclusion of contextual data, and minimal reporting lag, news media repositories (e.g., Fatal Encounters, Mapping Police Violence, *The Guardian*'s The Counted, *The Washington Post*'s Fatal Force, and Gun Violence Archive (GVA)) are currently the best-available source for a national accounting of injuries by police use of deadly force. Alternative data sources include accountability systems of the US Federal Bureau of Investigation (including the recently phased-out Supplemental Homicide Reports, replaced by National Use-of-Force Data Collection), the Centers for Disease Control and Prevention (CDC)'s National Vital Statistics System, and CDC's National Violent Death Reporting System. These three systems underestimate fatal injuries by police shootings through insufficient agency participation, inconsistencies in cause-of-death designation, and inconsistent state participation, respectively.[12–14,48,49] Some states and

localities maintain accessible databases, but these sources are not nationally representative.[31,50] Of all national data sources, only National Use-of-Force Data Collection and GVA document fatal and nonfatal shootings by police.

The various media repositories produce comparable national estimates of fatal injuries from police use-of-force.[14,51] These sources have been used to describe disparities in fatal injuries by age,[32,52] race,[31,32,53,54] gender,[32] armed status,[33,53] mental health status,[53] and other characteristics, including US region.[27,32,53,55] In Nix et al.'s illustrative analysis of 2015's shooting fatalities (n=990), 50% of people killed in police shootings were white; 26% were Black; 96% were men. The average victim was 36.7 years old. Most victims were armed (82% with a deadly weapon or replica gun; 5.5% with a vehicle; 9% unarmed). Twenty-five percent reportedly displayed signs of mental illness.[56] Although collectively illuminating, by failing to account for nonfatal injuries, fatality studies still severely underestimate the national burden of injury from shootings by on-duty police.

Few studies have examined nonfatal injuries, leaving the frequency and character of these shootings uncertain. In one analysis of 11 urban police and sheriffs' departments with publicly available injury data, fatalities comprised 53% of injurious shootings by police.[57] Another analysis of four state-mandated databases estimated 55.5% of people injured in police shootings died.[50] A broadly inclusive study describing 2015's GVA-listed "officer involved incidents" (n=1,907) reported 49% of incidents were fatal.[58] In these studies, fatal injuries were associated with older victim age,[50,58] white versus Black racial identity,[50,57] multiple police shooters,[57] and non-officer weapon possession.[50,58] Odds of fatality were higher from injuries to victims armed with knives or blunt-force objects, compared to firearms, and lower among vehicularly armed victims (odds ratio [OR] knife:

2.20; OR blunt object: 2.33; vehicle: 0.26).[58] Unarmed victims had higher odds of survival than armed victims.[50] When nonfatal injuries were included, injury disparities most affecting people who are Black were projected to be more severe than when estimated from fatalities alone.[50]

In sum, open-source data repositories of police use-of-force are reliable and informative resources that have produced broad understanding of fatal shootings by police nationally. However, fatal shootings may represent little more than half of all injurious shootings by police. To date, no published studies have examined the full and current burden of physical injury from shootings by on-duty US law enforcement officers. The objectives of this study were to 1) describe total people injured or killed in shootings by police in the United States using an up-to-date, multi-year nationwide dataset, and 2) compare characteristics of fatal versus nonfatal injurious shootings nationally.

Methods

Data

Data representing incidents and victim characteristics were extracted and compiled from GVA's linked articles and other publicly available sources. GVA is a database of fatal and nonfatal US gun violence events, identified from approximately 7,500 media, law enforcement, government, and commercial sources daily since 2013.[35] Incidents are catalogued by date, location, and gun violence type (e.g., "officer involved"). Data abstraction occurred from July 2021 to April 2022 for shootings by police occurring January 1, 2015 through December 31, 2020. The abstraction team consisted of 14 public health students from the Johns Hopkins Bloomberg School of Public Health. Abstractors received standardized training and a randomly assigned subset of 14,155 incidents.

Additionally, a blinded 10% of incidents were repetitively assigned for quality assurance. Median case assignment was 1,100 (range: 460 to 5,525).

Cases were restricted to include only incidents of shots fired by one or more law enforcement officers, resulting in injuries to people who were not responding officers. Accidental discharges, policing occupational injuries, injuries by bullet alternatives exclusively (e.g., rubber bullets), shootings without injury, and self-inflicted injuries were excluded. GVA-designated "suicide by cop" shootings (i.e., shootings presumed to have been intentionally provoked) were retained.

Measures

Abstracted variables included situational characteristics (e.g., response type, incident type, shooting location, weapon involvement), victim demographics (e.g., gender, age, race, ethnicity), victim characteristics (e.g., housed or unhoused, armed status and weapon type, injury outcome), and a limited set of shooting-officer characteristics (e.g., on- or off-duty status, alone or accompanied, agency affiliation). Abstractors additionally identified and described incidents in which mental or behavioral health conditions were explicitly named in association with the shooting or its initiating incident. These cases were re-reviewed and confirmed. Definitions of all abstracted variables are provided in Appendix A.

All descriptors were categorically coded using a combination of deductive and inductive techniques, aiming for objective reflection of best-available reporting. Abstractors cross-referenced fatal incidents with Fatal Encounters. Race and ethnicity designations were made only when specified by sources; if withheld by police or otherwise unreported, abstractors selected "unspecified or unknown." Coding uncertainties were

discussed in weekly meetings. Post-hoc review of repetitively assigned incidents revealed strong coding consistency; rare discrepancies were resolved through additional-source review by the first author.

Analyses

Counts and proportions were calculated for total incidents and injuries, entirely nonfatal incidents vs. incidents with at least one fatality, and nonfatal injuries vs. fatal injuries. Case fatality rates were calculated for incident- and person-characteristics. For each characteristic, simple logistic regression was used to estimate odds of fatal versus nonfatal injury. Reference categories were defined to support intuitive comparisons, based on majority representation (e.g., local police agencies, non-Hispanic white ethno-racial designation, masculine gender) or simplicity of the imagined comparator (e.g., unarmed victim, shooting-related initiating incident). For age, regression models first included only age-specified victims (i.e., excluding descriptive ages, such as "juvenile," "adult," or decade-approximated), then categorically examined all victims as "juvenile" (ages 0-17) or "adult" (ages 18+). Alternatively, we estimated the effect of each characteristic after controlling for all other statistically significant variables in a random-intercept model, nesting victims within incidents. Confidence intervals were calculated based on an alpha of 0.05.

Estimates reflect injurious shootings by officers ostensibly acting "in the line of duty," including shootings by on-duty officers, on- and off-duty officers in a multiple-officer response, off-duty officers acting in an on-duty capacity (e.g., performing investigative activities, identifying oneself as police), and incidents without explicitly reported duty status. In sensitivity analyses, estimates were compared under more restrictive duty-status criteria (i.e., only explicitly on-duty or both on- and off-duty) and maximally inclusive duty-

status criteria (i.e., also off-duty officers working security positions and off-duty officers not acting in a law-enforcement capacity). Analyses were performed using Stata version 16.1.[59] The study was determined to be not human subjects research by the Johns Hopkins Bloomberg School of Public Health IRB.

Results

From 2015-2020, there were 10,310 incidents of US police shooting their firearms and injuring one or more people (Table 1). These incidents resulted in 5,874 fatalities and 4,743 individuals with nonfatal gunshot injuries, a 55.3% case fatality rate (Table 2). On average, 1,770 people were injured annually (979 fatally; 791 nonfatally) (Figure 1). Examined monthly, injury frequency appeared cyclical but otherwise stable over the six-year period (Figure 2). In over half of injurious shooting incidents, a non-officer was armed with a firearm (56%, n=5,739); 4% involved non-officer possession of a BB gun or replica gun (n=403). Combined, 58% of these incidents involved a fatality. Knives were involved in 15% of incidents (n=1,543, 68% fatal), and a vehicle was reportedly weaponized in 8% of incidents (n=807, 36% fatal). In another 8%, no weapon was involved (n=785, 54% fatal). In 1.5% of incidents, a non-officer reportedly gained control of a service weapon (n=98) or nearly did so (n=46) (Table 1).

Injurious shootings typically involved multiple police shooters (81%), most frequently from a local police department (local police: 62%, sheriff's office: 23%, state police: 6%, special jurisdiction: 1%). Fourteen percent of incidents with at least one fatality occurred during a single-officer response, compared to 18% of nonfatal-injury incidents. Dispatch by emergency services preceded 62% of injurious incidents; officer-initiated encounters preceded 36% of incidents. The most common reasons for police involvement

before injurious shootings were traffic stops (16% of incidents, 51% fatal), domestic incidents (16% of incidents, 65% fatal), shots-fired (9% of incidents, 55% fatal), and warrants (9% of incidents, 61% fatal). Suicidal crises represented 6% of injurious incidents (62% fatal). Rarer but more frequently fatal injurious shootings included wellbeing checks (2% of incidents, 65% fatal) and threats (e.g., an armed person verbalizing intent to harm) (2% of incidents, 67% fatal) (Table 1).

In victim-level analysis, weapon status, shooting-agency type, response type, and incident type were proportionately similar to incident-level descriptions. Victims' ages ranged from younger than 1 to 93 years; 95% were adults. Nonfatally injured people tended to be younger than fatally injured (nonfatal median age: 30 [IQR: 24-40 years], fatal median age: 35 [IQR: 27-45 years]). Sixty-seven percent of juveniles who were shot were not killed. Men and boys comprised 94% of victims. Race or ethnicity was specified for 58% of victims (n=6,111). When specified, 46% of people were described as non-Hispanic white (n=2,796, 86% fatal), 29% non-Hispanic Black (n=1,762, 75% fatal), and 21% Hispanic of any race (n=1,301, 76% fatal). Seventy-nine percent of victims without explicitly stated ethno-racial identities were nonfatally injured. Among unarmed victims with specified race-ethnicity, 38% were non-Hispanic white (n=222), 35% were non-Hispanic Black (n=203), and 23% were Hispanic (n=133) (data not shown). Nearly 3% of victims (n=277) were unhoused, of whom 66% were fatally shot. Across incident types, 23% of injured people were shot in incidents involving mental or behavioral health issues (n=2,401, 67% fatal) (Table 2).

Unadjusted logistic regression models suggest that compared to unarmed injured people (n=955, 9%), odds of a fatal injury were significantly higher for injured people who

were armed with a firearm (OR: 1.39; 95% CI: 1.21-1.60), BB or replica gun (OR: 1.37; 95% CI: 1.07-1.74), knife (OR: 2.12; 95% CI: 1.80-2.51), or blunt force object (OR: 1.62; 95% CI: 1.19-2.22). Odds of fatality were lower for injured people armed with a vehicle (OR: 0.56; 95% CI: 0.45-0.68). Compared to shooting injuries during an officer-initiated interaction, odds of fatality were higher from injuries following dispatched interactions (OR: 1.38; 95% CI: 1.27-1.49). Compared to injuries from police shootings following an on-view or dispatched "shots-fired" incident, odds of fatality were higher following incidents involving verbal threats (OR: 1.75; 95% CI: 1.29-2.39), wellbeing checks (OR: 1.61; 95% CI: 1.13-2.28), domestic incidents (OR: 1.59; 95% CI: 1.36-1.87), suicidal or behavioral health crises (OR: 1.44; 95% CI: 1.17-1.76), assaults (OR: 1.36; 95% CI: 1.08-1.72), and warrant or arrest attempts (OR: 1.31; 95% CI: 1.09-1.56). Odds of fatality were lower during traffic stops and other potentially vehicle-involved incidents (e.g., burglaries, robberies or carjackings, and stolen vehicles). Incidents involving behavioral health concerns had 1.9-times higher odds of fatal injury than injuries in incidents without such concerns (95% CI: 1.72-2.08). Injuries from shootings by Sheriff's departments and state police were more likely to be lethal than injuries from shootings by local police departments (Table 3).

Demographically, odds of fatality increased by 3% with each year of victim age (1.02-1.03) and were lower for injured women compared to men (OR: 0.67, 95% CI: 0.57-0.80). When race-ethnicity was specified, odds of fatality were lower among non-Hispanic Black victims (OR: 0.49, 95% CI: 0.42-0.57) and Hispanic victims of any race (OR: 0.50, 95% CI: 0.43-0.59) compared to non-Hispanic white victims. All other person-characteristic comparisons were not statistically significant. In the adjusted model, fewer incident types

were statistically significantly associated with fatal injury, and traffic stops were predictive of fatality. All other inferences were unchanged (Table 3).

Sensitivity analysis

Estimates calculated from alternative duty-status inclusion criteria varied rarely and minimally from the main analysis. For shots-fired incidents and rare incidents (e.g., constable responses), the more restrictive on-duty criteria estimated slightly higher case fatality rates (Appendix B). In contrast, more inclusive criteria estimated lower case fatality rates for constable responses and subject-initiated responses (Appendix C). Where variation was noted, estimates tended to remain within five percentage points of the main analysis.

Discussion

In this study of 1,770 annual injuries from shootings by police over a six-year period, 45% of injured persons were nonfatally injured, consistent with prior estimates from four states' mandated reporting.[50] Compared to estimates drawn from fatal shootings only, victim and incident characteristics were proportionately similar in age, gender, involvement of unarmed victims, and other characteristics.[56] However, when nonfatally injured people were included, proportionately fewer victims identified as non-Hispanic white. Case fatality rates varied by incident characteristics. A fatality is arguably the most severe and irreversible potential outcome of a shooting, but nonfatal injuries are also physically and psychologically impactful. Situations with low case fatality rates are among the most underexamined incidents in prior research on fatal shootings by police.

Incidents with high case fatality rates generally involved complaints of physically threatening or threat-making behaviors (e.g., assaults, verbalized threats, domestic

incidents, suicidal and self-harming incidents). Threat perception among police may be amplified by a prominent, and often racialized, emphasis on threat anticipation and officer self-protection in US policing culture and training.[60] Absent explicit threats, officers may anticipate increased threat during incidents such as traffic stops or domestic violence episodes, which are more frequently associated with police occupational homicides.[61] One potential exception to this pattern in threat-related, more frequently fatal injuries was wellbeing checks, which were 61% more likely to be associated with fatal injury, despite not explicitly or necessarily involving pre-encounter threats of harm. In these cases, the probable involvement of callers and dispatchers may be a source of relayed alarm, prompting readiness for threat perception.[62,63] Of all injuries, 62% followed dispatched incidents; these injuries were 1.38-times more likely to be fatal than injuries following on-view responses.

Among injured people, Hispanic and non-Hispanic Black people had 50-51% higher odds of surviving than white victims, and juvenile victims had 63% higher odds of injury survival than adults. Accordingly, Black victims comprised 29% of race-specified injured people in this study, compared to 26% of victims in a single-year sample of fatal shootings and 13% of the total US population.[56,64] Hispanic victims comprised 21% of ethnicity-specified injured people but 18% of the US population.[64] Police may be more apt to fire shots that nonfatally injure Black or Hispanic people due to biased assumptions of criminality that, in combination with amplified threat perception, may lead to more impulsive, emotional, longer-distance, or otherwise less accurate shots. These results substantiate and build upon prior regional projections that total injuries may be unequally approximated by fatal injuries, thereby underestimating true disparities in injuries from

shootings by police.[50] If analyses are limited to fatalities, underestimates may be most pronounced for people who are Black, Hispanic, or non-adult. Racial disparities in most policing judgements and interactions are well-known.[13,65–68] Still, for incidents that may be dismissed as rare, such as shootings by police, underestimating the true scale of injury impact is a further injustice[52,69] and may obstruct progress toward preventive action and reforms.

Also relatively under-examined in prior research are injuries among people who were unhoused or experiencing symptoms of behavioral health conditions. Unhoused victims comprised nearly 3% of injured people, despite representing just 0.2% of the US population.[70] Behavioral health needs were associated with 23% of injured persons; they were almost twice as likely to die from their injuries than other victims. These represent instances in which not only are "the marginalized…further criminalized," they are also victimized by a system that is inadequately designed to meaningfully address social needs.[63] Mechanisms for less potentially injurious triaging of social services exist. In 2022, the 988 Suicide and Crisis Lifeline was introduced, yet complementary local systems for improved access to social services without entrenched criminal legal system involvement remain rare.[71] Public support is high for alternative approaches, such as diversion to mental health services or co-responder models involving police and mental health professionals,[47] but cost remains a barrier to more widespread implementation.[71] Future analysis of incidents at the intersection of dispatched responses and social or behavioral health needs may inform feasibility, design, outreach, and equity-oriented impact analyses of new crisis-support systems.

Strengths and limitations

This study affirmed and expanded upon prior understandings of shootings by police in the United States, providing the first estimate of total injured persons nationally over multiple years. With this larger dataset, previously excluded states were considered, and relatively rarer incident-types could be examined. Still, some limitations exist. First, police perspectives (themselves often reconstructed "observations of observations,"[72] which may be subject to recall and social desirability bias) are known to be over-represented in media accounts of shootings by police.[73] To diversify considered narratives, abstractors reviewed multiple reporting sources, including bystander accounts and articles not linked to the original GVA record. Additionally, the study's inclusion period was defined to allow case details to develop and be represented.[74] Still, some reporting bias is likely. More subjective variables, such as those involving interpretation of intent (e.g., declaring a vehicle weaponized or a service weapon nearly acquired), may be especially subject to dominant narratives and should be interpreted accordingly.

Second, the use of media sources relies on assumptions of newsworthiness and adequate reporting capacity, which may vary by time and place. Consistency with prior studies' estimates of fatal injuries is assuring of source validity. Still, nonfatal injuries may be less consistently or less thoroughly reported. "Unspecified" or "unknown" characteristics are best interpreted as signals of underreporting, highlighting continued need for mandatory surveillance of all-outcome shootings by police. The relatively more developed repertoire of open-source repositories for fatalities adds to known information asymmetry. This limitation restricted our ability to precisely calculate national injury disparities. Still, our estimates of fatal and nonfatal injuries, though conservative, are substantial improvements over prior projections of total and subgroup injury burden.

Finally, only injurious shootings were examined in this study; other mechanisms of deadly force exist, and nonfatal shootings without injury were not included. This analysis did not account for differences in frequency of policing activities or the unequal distribution of risk in the prerequisite condition of encountering police. Disparities were interpreted on a per capita basis, but results may not reflect individual risk for injury.

Implications

In 2002, American criminologist James Fyfe observed, "ours is a democracy that does not tell us how often we are forcibly injured or killed by the people we pay to protect us."[75] Twenty years later, despite ongoing criticism and controversy surrounding use of deadly force by police, US accountability systems remain persistently inadequate. Nonfatal injurious shootings by police are governed by the same use-of-force policies as fatal shootings and appear similar in frequency and circumstance. However, the historical exclusion of nonfatal injuries from surveillance and research has led to underestimated injury disparities and underexamined shooting incidents, particularly at the margins of policing. Of all injurious shootings by police, incidents involving wellbeing checks, behavioral health concerns, suicidal crises, and unhoused persons were among the most frequently fatal. Inadequate services for houselessness; insufficient supports for managing mental illness and substance use; and inequitable social and economic protections for Black, Hispanic, and youth populations are potential areas for priority response.[31,76] Evaluations of emerging public safety reforms should monitor fatal and nonfatal shootings by police to assess impact overall and among disproportionately affected groups. Additional research is needed regarding the role of societal firearm prevalence in shootings by police, shootings in rural and other historically underexamined regions, the role of

decision-making in single- and multiple-officer responses, and frequency of non-injurious shootings. Researchers and justice advocates would also benefit from analyses of how and for whom publicly known contextual details of police shootings evolve. Finally, improved and sustained investments in reliable data and accountability systems remain essential to the prevention of firearm injuries from armed policing responses.

Chapter Two Figures and Tables

Figure 1.
People injured in fatal and nonfatal shootings by police, by year

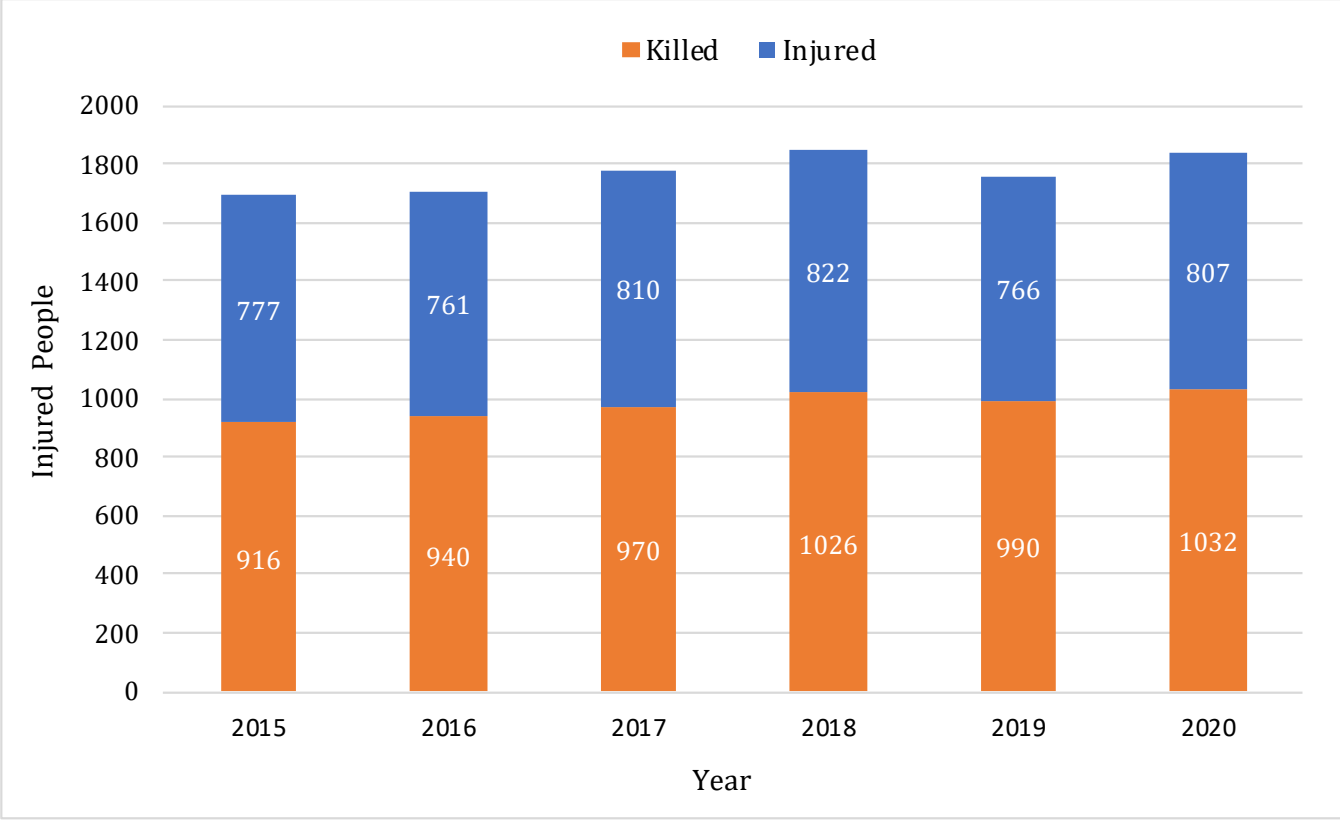


Figure 2.
People injured in fatal and nonfatal shootings by police, by month

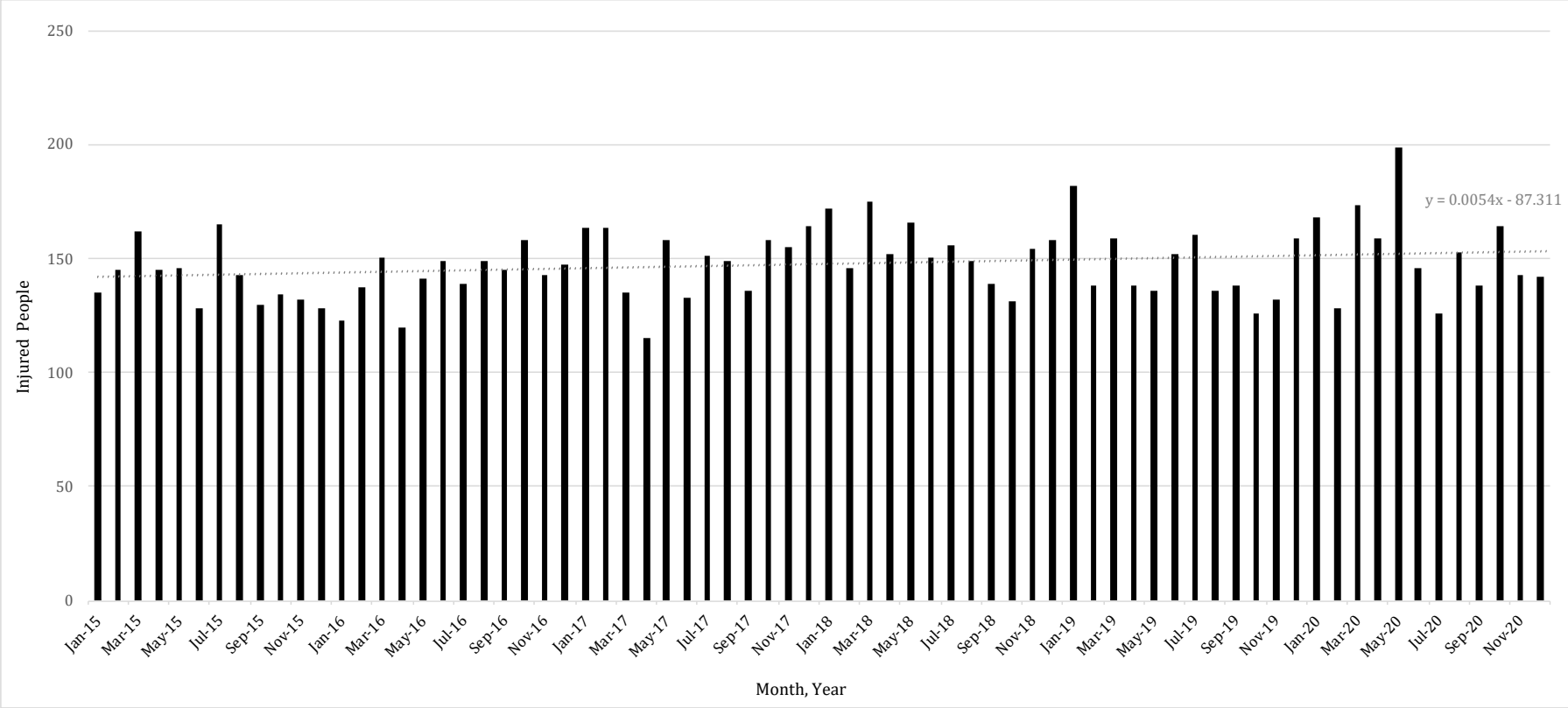


Table 1. Fatal and nonfatal injurious shooting incidents, by event characteristic[1]

Incident Characteristic	Nonfatal Injurious Incident	Fatal Incident	% Fatal	Total Injurious Shooting Incidents (%)
Total	4,470	5,840	56.7	10,310 (100)
Officer Duty Status				
On-duty	4,344	5,735	56.9	10,079 (97.8)
On- and off-duty	3	6	66.7	9 (0.1)
Off-duty acting as on-duty	61	43	41.3	104 (1.0)
Unknown	77	41	34.7	118 (1.1)
Incident Weapon				
Unarmed	361	424	54.0	785 (7.6)
Firearm	2,362	3,327	58.5	5,689 (55.2)
Handgun[2]	883	1,347	60.4	2,230 (21.6)
Rifle[2]	215	334	60.8	549 (5.3)
Shotgun[2]	117	201	63.2	318 (3.1)
Multiple types, unspecified[2]	39	68	63.6	107 (1.0)
Service weapon[2]	41	57	58.2	98 (1.0)
Unknown[2]	1,116	1,383	55.3	2,499 (24.2)
Multiple, with firearm	25	25	50.0	50 (0.5)
BB or replica gun	175	228	56.6	403 (3.9)
Total firearm or gun, including "multiple with firearm" & "BB or replica gun"	2,562	3,580	58.3	6,142 (59.6)
Knife or other cutting/stabbing instrument	490	1,053	68.2	1,543 (15.0)
Vehicle	515	292	36.2	807 (7.8)
Blunt object	82	126	60.1	208 (2.0)
Multiple, without firearm	8	14	63.6	22 (0.2)
Service weapon concern[3]	16	30	65.2	46 (0.5)
Other	31	57	64.8	88 (0.9)
Weapon unknown	66	53	44.5	119 (1.2)
Armed status unknown	339	211	38.4	550 (5.3)
Single Law Enforcement Officer Response				
No	3,481	4,893	58.4	8,374 (81.2)
Yes	806	832	50.8	1,638 (15.9)
Both[4]	0	3	100.0	3 (<0.1)
Unknown	182	112	38.1	294 (2.9)

Agency type				
Local police	2,868	3,481	54.8	6,349 (61.6)
Sheriff's office	983	1,411	58.9	2,394 (23.2)
State police	227	341	60.0	568 (5.5)
National agency	74	103	58.2	177 (1.7)
Special jurisdiction	50	28	35.9	78 (0.8)
Constable or marshal	5	5	50.0	10 (0.1)
Multiple shooting agencies	209	441	67.8	650 (6.3)
Unknown	54	30	35.7	84 (0.8)
Response type				
On view	1,754	1,952	52.7	3,706 (36.0)
Dispatched to 911 call	2,589	3,782	59.4	6,371 (61.8)
By subject	53	56	51.4	109 (1.1)
Unknown	74	50	40.3	124 (1.2)
Incident Type				
Shooting	439	525	54.5	964 (9.4)
Assault	155	249	61.6	404 (3.9)
Crash (includes hit-and-run)	43	61	58.7	104 (1.0)
Disorderly conduct or dispute/disturbance	162	236	59.3	398 (3.9)
Domestic disturbance, dispute, or violence	567	1,047	64.9	1,614 (15.7)
Investigative	243	294	54.7	537 (5.2)
Robbery or carjacking	408	398	49.4	806 (7.8)
Burglary	122	101	45.3	223 (2.2)
Stolen vehicle	79	57	41.9	136 (1.3)
Suicidal or behavioral health crisis	238	392	62.2	630 (6.1)
Suspicious person or vehicle	263	286	52.1	549 (5.3)
Threats	71	144	67.0	215 (2.1)
Traffic stop	790	811	50.7	1,601 (15.5)
Trespassing	73	101	58.0	174 (1.7)
Warrant or arrest	376	592	61.2	968 (9.4)
Weapon complaint	203	245	54.7	448 (4.4)
Wellbeing check	54	101	65.2	155 (1.5)
Other[5]	107	142	57.0	249 (2.4)
Fire	10	14	58.3	24 (0.2)
Hostage	19	40	67.8	59 (0.6)
Involuntary commitment	11	11	50.0	22 (0.2)

Pedestrian stop	14	10	41.7	24 (0.2)
Subject initiated, not otherwise specified	16	24	60.0	40 (0.4)
Vandalism	11	16	59.3	27 (0.3)
Unknown	77	58	43.0	135 (1.3)

Notes: [1] = Includes on duty, both on and off duty, off duty but acting as on duty, and unknown duty status. [2] = Values may exceed total firearm-involved incidents because multiple gun types in a single incident were possible. [3] = Service weapon concern indicates that an officer stated they thought the subject might gain control of their service weapon. [4] = Both single and multiple officer involvement could occur if multiple shooting scenes were involved. [5] = In addition to the specified subgroups listed below, included within "other" incidents are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc.

Table 2. Fatally and nonfatally injured persons, by event or person characteristic[1]

Incident or Person Characteristic	Nonfatally Injured	Fatally Injured	% Fatal	Total Injured Persons (%)
Total	4,743	5,874	55.3	10,617 (100)
Officer Duty Status				
On-duty	4,593	5,783	55.7	10,376 (97.7)
On- and off-duty	4	7	63.6	11 (0.1)
Off-duty acting as on-duty	68	43	38.7	111 (1.0)
Unknown	78	41	34.5	119 (1.1)
Person Weapon				
Unarmed	478	477	49.9	955 (9.0)
Firearm	2,406	3,339	58.1	5,745 (54.1)
Multiple, with firearm	13	17	56.7	30 (0.3)
BB or replica gun	154	210	57.7	364 (3.4)
Total firearm or gun, including "multiple with firearm" & "BB or replica gun"	2,573	3,566	58.1	6,139 (57.8)
Knife or other cutting/stabbing instrument	491	1,040	67.9	1,531 (14.4)
Vehicle	496	279	36.0	775 (7.3)
Blunt object	76	123	61.8	199 (1.9)
Multiple, without firearm	7	5	41.7	12 (0.1)
Other	111	116	51.1	227 (2.1)
Unknown	511	268	34.4	779 (7.3)
Agency type				
Local police	3,039	3,498	53.8	6,537 (61.6)
Sheriff's office	1,030	1,419	57.9	2,449 (23.1)
State police	237	345	59.3	582 (5.5)
National agency	80	104	56.5	184 (1.7)
Special jurisdiction	53	28	34.6	81 (0.8)
Constable or marshal	6	5	45.5	11 (0.1)
Multiple shooting agencies	241	445	64.9	686 (6.5)
Unknown	57	30	34.5	87 (0.8)
Age[2]				
Range	<1 to 93	6 to 91		
Mean of known ages (n=9,467; 59.8% fatal)	33	37	-	35.4 years

Median of known ages (n=9,4667; 59.8% fatal)	30	35	-	33 years
Total juvenile count	212	105	33.1	317 (3.0)
Total adult count	4,317	5,733	57.0	10,050 (94.7)
Unknown	214	36	14.4	250 (2.4)
Gender				
Man	4,370	5,613	56.2	9,983 (94.0)
Woman	287	248	46.4	535 (5.0)
Transgender	1	10	90.9	11 (0.1)
Unknown	85	3	3.4	88 (0.8)
Race/Ethnicity				
Non-Hispanic, white	392	2,404	86.0	2,796 (26.3)
Non-Hispanic, Black	441	1,321	75.0	1,762 (16.6)
Hispanic, any race	319	982	75.5	1,301 (12.3)
American Indian or Alaskan Native	14	105	88.2	119 (1.1)
Asian or Pacific Islander	12	104	89.7	116 (1.1)
Other, including Middle Eastern-North African	4	13	76.5	17 (0.2)
Unspecified or unknown	3,561	945	21.0	4,506 (42.4)
Unhoused person				
Yes	93	184	66.4	277 (2.6)
Response type				
On view	1,923	1,970	50.6	3,893 (36.7)
Dispatched to 911 call	2,690	3,798	58.8	6,488 (61.1)
By subject	54	56	50.9	110 (1.0)
Unknown	76	50	39.7	126 (1.2)
Incident Type				
Shooting	464	530	53.5	994 (9.4)
Assault	161	250	60.8	411 (3.9)
Crash (includes hit-and-run)	43	61	58.7	104 (1.0)
Disorderly conduct or dispute/disturbance	173	237	57.8	410 (3.9)
Domestic disturbance, dispute, or violence	576	1,051	64.6	1,627 (15.3)
Investigative	280	298	51.6	578 (5.4)
Robbery or carjacking	448	400	47.2	848 (8.0)
Burglary	126	102	44.7	228 (2.1)
Stolen vehicle	90	58	39.2	148 (1.4)

Suicidal or behavioral health crisis	239	392	62.1	631 (5.9)
Suspicious person or vehicle	276	287	51.0	563 (5.3)
Threats	72	144	66.7	216 (2.0)
Traffic stop	857	817	48.8	1,674 (15.8)
Trespassing	81	101	55.5	182 (1.7)
Warrant or arrest	402	600	59.9	1,002 (9.4)
Weapon complaint	210	245	53.4	455 (4.3)
Wellbeing check	55	101	64.7	156 (1.5)
Other[3]	113	142	55.7	255 (2.4)
Fire	10	14	58.3	24 (0.2)
Hostage	20	40	66.7	60 (0.6)
Involuntary commitment	12	11	47.8	23 (0.2)
Pedestrian stop	15	10	40.0	25 (0.2)
Subject initiated, not otherwise specified	16	24	60.0	40 (0.4)
Vandalism	11	16	59.3	27 (0.3)
Unknown	77	58	43.0	135 (1.3)
Behavioral health involvement, incident[4]				
Yes	790	1,611	67.1	2,401 (22.6)

Notes: [1] = Includes on duty, both on and off duty, off duty but acting as on duty, and unknown duty status. [2] = Age was entered as specified, where applicable. Otherwise, age was categorized as juvenile (ages 0-17), adult (ages 18+), or unknown. [3] = In addition to the specified subgroups listed below, included within "other" incidents are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc. [4] = Behavioral health incidents include suicidal or self-harming behaviors, substance use, diagnosis of serious mental illness relevant to the incident, disability that may have been misinterpreted as a mental or behavioral health issue, and transportation or response to inpatient behavioral health facility.

Table 3. Logistic regression models predicting odds of fatal versus nonfatal injury[1]

	Unadjusted			Adjusted		
Incident or Person Characteristic	**OR**	**p-value**	**95% CI**	**OR**	**p-value**	**95% CI**
Officer Duty Status						
On-duty	*Ref*	-	-	*Ref*	-	-
On- and off-duty	1.39	0.600	0.41 – 4.75	0.96	0.967	0.16 – 5.84
Off-duty acting as on-duty	0.50***	<0.001	0.34 – 0.74	0.61	0.122	0.33 – 1.14
Unknown	0.42***	<0.001	0.29 – 0.61	1.15	0.685	0.58 – 2.29
Person Weapon						
Unarmed	*Ref*	-	-	*Ref*	-	-
Firearm	1.39***	<0.001	1.21 – 1.60	1.71***	<0.001	1.34 – 2.19
Multiple, with firearm	1.31	0.470	0.63 – 2.73	1.32	0.630	0.42 – 4.14
BB or replica gun	1.37*	0.012	1.07 – 1.74	1.17	0.413	0.80 – 1.72
Knife or other cutting/stabbing instrument	2.12***	<0.001	1.80 – 2.51	2.22***	<0.001	1.64 – 3.00
Vehicle	0.56***	<0.001	0.45 – 0.68	0.58**	0.001	0.43 – 0.80
Blunt object	1.62**	0.002	1.19 – 2.22	1.74*	0.029	1.06 – 2.87
Multiple, without firearm	0.72	0.570	0.22 – 2.27	0.22	0.085	0.04 – 1.23
Other	1.05	0.755	0.78 – 1.40	1.15	0.540	0.73 – 1.82
Unknown	0.53***	<0.001	0.43 – 0.64	0.81	0.177	0.59 – 1.10
Agency type						
Local police	*Ref*	-	-	*Ref*	-	-
Sheriff's office	1.20***	<0.001	1.09 – 1.31	1.40***	<0.001	1.19 - 1.65
State police	1.26**	0.008	1.06 – 1.50	1.60**	0.001	1.20 – 2.14

National agency	1.13	0.420	0.84 – 1.52	1.14	0.594	0.70 – 1.85
Special jurisdiction	0.46**	0.001	0.29 – 0.73	0.80	0.547	0.39 – 1.64
Constable/marshal	0.72	0.594	0.21 – 2.37	0.66	0.683	0.09 – 4.90
Multiple shooting agencies	1.60***	<0.001	1.36 – 1.89	1.70***	<0.001	1.29 – 2.25
Unknown	0.46**	0.001	0.29 – 0.71	1.34	0.416	0.66 – 2.69
Single Law Enforcement Officer Response						
No	*Ref*	-	-	*Ref*	-	-
Yes	0.74***	<0.001	0.67 – 0.83	0.71***	<0.001	0.59 – 0.86
Both[4]	2.26	0.480	0.24 – 21.75	4.75	0.361	0.17 – 134.67
Unknown	0.47***	<0.001	0.37 – 0.59	0.80	0.325	0.52 – 1.24
Age						
Where specified (n=9,467)[2]	1.03***	<0.001	1.02 – 1.03	*Not included in model*		
Adult	*Ref*	-	-	*Ref*	-	-
Juvenile	0.37***	<0.001	0.29 – 0.47	0.55**	0.002	0.37 – 0.81
Unknown	0.13***	<0.001	0.09 – 0.18	0.62	0.055	0.38 – 1.01
Gender						
Man	*Ref*	-	-	*Ref*	-	-
Woman	0.67***	<0.001	0.57 – 0.80	0.69*	0.013	0.51 – 0.92
Transgender	7.79	0.050	1.00 – 60.8	8.67	0.104	0.64 – 117.53
Unknown	0.27***	<0.001	0.01 – 0.09	0.15**	0.007	0.04 – 0.59
Race/Ethnicity						
White	*Ref*	-	-	*Ref*	-	-
Black	0.49***	<0.001	0.42 – 0.57	0.57***	<0.001	0.45 – 0.70
American Indian/Alaskan Native	1.22	0.487	0.69 – 2.16	1.54	0.228	0.76 – 3.11

Asian/Pacific Islander	1.41	0.264	0.77 – 2.59	1.64	0.185	0.79 – 3.40
Other, including Middle Eastern-North African	0.53	0.269	0.17 – 1.63	0.53	0.377	0.13 – 2.19
Hispanic	0.50***	<0.001	0.43 – 0.59	0.51***	<0.001	0.40 – 0.65
Unknown or unspecified	0.04***	<0.001	0.04 – 0.05	0.02***	<0.001	0.01 – 0.05
Unhoused						
No/Unknown	*Ref*	-	-			
Yes	1.25	0.093	0.96 – 1.61	*Not included in model*		
Response type						
On view	*Ref*	-	-	*Ref*	-	-
Dispatched to 911 call	1.38***	<0.001	1.27 – 1.49	1.43**	0.001	1.15 – 1.77
By subject	1.01	0.950	0.69 – 1.48	0.73	0.336	0.39 – 1.38
Unknown	0.64*	0.017	0.45 – 0.92	0.90	0.776	0.44 – 1.86
Incident Type						
Shooting	*Ref*	-	-	*Ref*	-	-
Assault	1.36*	0.010	1.08 – 1.72	1.40	0.088	0.95 – 2.06
Civil disorder/threats	1.75***	<0.001	1.29 – 2.39	2.42**	0.001	1.46 – 4.03
Crash (includes hit-and-run)	1.24	0.300	0.82 – 1.87	1.85	0.073	0.94 – 3.64
Disorderly or Dispute/disturbance	1.21	0.114	0.96 – 1.52	1.42	0.067	0.98 – 2.08
Domestic disturbance/dispute/violence	1.59***	<0.001	1.36 – 1.87	1.72***	<0.001	1.31 – 2.27
Investigative	0.93	0.500	0.76 – 1.14	1.20	0.327	0.83 – 1.72
Robbery or Carjacking	0.78**	0.009	0.65 – 0.94	0.92	0.572	0.69 – 1.23
Burglary	0.79*	0.020	0.53 – 0.95	0.71	0.143	0.45 – 1.12
Stolen vehicle	0.56**	0.001	0.40 – 0.80	1.16	0.614	0.65 – 2.05
Suicidal or behavioral health crisis	1.44***	<0.001	1.17 – 1.76	1.32	0.114	0.93 – 1.88
Suspicious person or vehicle	0.91	0.374	0.74 – 1.12	1.14	0.456	0.81 – 1.60

Traffic stop	0.83*	0.024	0.71 – 0.98	**1.46***	**0.015**	**1.08 – 1.98**
Trespassing	1.09	0.589	0.79 – 1.50	1.50	0.120	0.90 – 2.51
Warrant or Arrest	1.31**	0.003	1.09 – 1.56	1.96***	<0.001	1.38 – 2.80
Weapon Complaint	1.02	0.852	0.82 – 1.28	0.85	0.358	0.59 – 1.21
Wellbeing Check	1.61**	0.008	1.13 – 2.28	1.93*	0.026	1.08 – 3.44
Other[3]	1.10	0.499	0.83 – 1.45	1.38	0.156	0.88 – 2.17
Fire	1.22	0.927	0.54 – 2.79			
Hostage	1.75*	0.046	1.01 – 3.04			
Vandalism	1.27	0.542	0.59 – 2.77			
Pedestrian Stop	0.58	0.192	0.26 – 1.31			
Involuntary Commitment	0.80	0.602	0.35 – 1.84			
Subject initiated, not otherwise specified	1.31	0.457	0.48 – 1.40	*Collapsed into "Other"*		
Unknown	0.66*	0.025	0.46 – 0.95	1.77	0.105	0.89 – 3.55
Behavioral health involvement, incident[4]						
None	*Ref*	-	-	*Ref*	-	-
Any	1.89***	<0.001	1.72 – 2.08	1.38***	<0.001	1.15 – 1.66

Notes: *p < 0.05, **p < 0.01, ***p <0.001. [1] = Includes on duty, both on and off duty, off duty but acting as on duty, and unknown duty status. [2]= OR represents change in odds of fatality for each additional victim age. [3] = In addition to the specified subgroups listed below, included within "other" incidents are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc. [4] = Behavioral health incidents include suicidal or self-harming behaviors, substance use, diagnosis of serious mental illness relevant to the incident, disability that may have been misinterpreted as a mental or behavioral health issue, and transportation or response to inpatient behavioral health facility. **Bold** indicates directional change in odds ratio.

Chapter Three: Manuscript Two

Characteristics of injurious shootings by police across the US urban-rural continuum, 2015-2020

Abstract

PURPOSE: Much research on shootings by police has focused on urban jurisdictions. However, most US policing agencies are not located in cities, and comparable or potentially worsening, injury incidence occurs in non-urban areas. This study compares the incidence and characteristics of injurious shootings by police in US urban, suburban, and rural areas from 2015-2020.

METHODS: Characteristics of fatal and nonfatal injurious shootings were abstracted from the Gun Violence Archive. Using county-based and zip-code-based rurality designation schemes, we compare national distribution, incidence, and trends in injurious shootings by police. Then, we cross-sectionally describe incident- and person- characteristics associated with injurious shootings in urban, suburban, and rural areas.

FINDINGS: Incidence of injurious shootings in rural areas approached or exceeded urban rates; lethality was highest in rural areas. In urban, suburban, and rural areas, injurious shootings were most frequently preceded by domestic violence incidents, traffic stops, or shots-fired reports. As rurality increased, larger portions of injurious shootings involved behavioral health needs, dispatch, single responders, sheriffs, or multiple agencies. After accounting for demographic differences, Black, Native American, and Hispanic residents were injured at higher rates than white residents in all examined areas.

CONCLUSION: Shootings by police represent an overlooked and inequitable source of injury in rural areas. Broadly similar incident characteristics suggest potential for wide-reaching reforms. To prevent use-of-force deaths and injuries in rural areas, emerging crisis prevention, dispatch, and response systems must assure proportionate rural-area coverage. Additionally, sheriffs' offices should be included in legislative prevention and accountability measures for rural-area impact.

Introduction

In 2014, multiple high-profile deaths from shootings by police sparked public outcry and reinvigorated calls for better surveillance of policing behaviors and improved police accountability for improper uses of deadly force. The deaths of Michael Brown in the large suburb of Ferguson, Missouri; Laquan McDonald in urban Chicago; and Tamir Rice in the city of Cleveland catalyzed the development of new national databases for enhanced police transparency. Resulting open-source media repositories (e.g., *The Guardian*'s The Counted, *The Washington Post*'s Fatal Force, Fatal Encounters, Mapping Police Violence, and the Gun Violence Archive (GVA)) were improvements over existing governmental sources of voluntary agency reporting.[12–14,48,49,51] As access to data on shootings by police improved, research grew but remained constrained by a predominant focus on fatal outcomes and urban implications or interventions.[21–24,57]

More recently, researchers have questioned the implicit assumption that shootings by police occur at higher rates in urban areas than in suburban, town, or rural areas.[31] Rather, fatal shootings by police appear to not be geographically confined to cities nor closely linked to rates of urban crime.[31] From 2012-2016, police were responsible for 8% of all US adult male homicides, with geographic variation ranging from 10% of homicides in predominantly rural areas to 7% in large metro areas.[32] In other words, "significant" risk for police homicide was projected among men living in small metropolitan and rural areas.[32] In a cross-sectional 2015-2017analysis, per capita rates of fatal shootings by police were found to be comparable in urban and rural areas by most measures of rurality.[29] Additionally, despite generally stable national trends, the frequency of fatal shootings by police may be increasing in rural and suburban areas while declining in urban areas.[18,34]

Collectively, these findings question the adequacy of centering policing research, interventions, and reforms on metropolitan jurisdictions.[22,29,34]

Across the urban-rural continuum, characteristics of policing and shootings by police may be influenced by geographic and social conditions.[32] Geographically, the patrolling of more highway miles in non-urban areas may mean officers in rural jurisdictions more frequently engage in traffic stops[77] or encounter longer distances between calls, which may increase response times, single-officer arrivals, and officer-experienced stress.[78,79] Additionally, overlapping jurisdictions may present coordination challenges.[79] Socially, cities are often more demographically diverse and may contain areas of concentrated poverty.[80] Rural communities may be comprised of more "insular social networks," characterized by residential stability but distrust of outsiders and the government.[77] Compared to urban jurisdictions, rural communities may contain a broader range of law enforcement agencies; local police may be viewed more favorably than county or state officials.[77]

Policing in urban areas may be relatively specialized and targeted. Conversely, officers in non-urban areas may act as generalists,[79] more frequently performing acts of crime prevention and service provision (e.g., responding to animal-related calls, public intoxication, or interpersonal conflicts) versus enforcing laws.[77] In non-metropolitan communities, a relative lack of mental health services,[81,82] greater likelihood of being uninsured,[81] and greater stigma associated with mental illness[81,82] may increase the likelihood of police involvement in behavioral health situations. Despite lower violent crime rates,[83] residents of rural communities may experience frustration with police or sheriffs' officials when social needs are insufficiently addressed.[77]

Rural areas also tend to be more politically conservative, traditionally aligning with resistance to police reforms[83] and favoring more expansive gun access.[84,85] Although most guns are owned by law-abiding citizens, higher gun prevalence may increase police anticipation of threat as 90% of police occupational deaths are by firearms.[31] In 2021, 53% of rural residents reported living in a gun-owing household, compared to 29% of urban residents and 40% of suburban residents.[84] Combined with potential weapons involvement, tensions between communities and police may also contribute to injury risk in rural environments. Historically, police in rural areas have faced more barriers to education and training than police in urban jurisdictions,[86] secondary to rural jurisdictions' staffing and budgetary constraints.[79,81,82,87] These conditions may additionally shape capacity to respond to complex and potentially volatile crises.

Differences in training, resources, and other contextual factors; how they shape community-and-police relationships; and sources of actual or perceived threat may contribute to policing's use of deadly force along the urban-rural continuum. However, data limitations and historical assumptions of police shootings as a largely urban problem have restricted capacity for foundational analyses of shootings by police in non-metropolitan areas. This study represents the first, multi-year, nationwide, descriptive analysis of injurious shootings by police along the urban-rural continuum. Specific objectives were to: 1) compare the incidence of injurious shootings by police in urban, suburban, and rural areas of the United States from 2015 to 2020, and 2) cross-sectionally describe the prevalence and incidence of characteristics associated with injurious shootings by rurality.

Methods

Data

Descriptive data on shootings by police were extracted and compiled from the GVA by a team of 14 students from the Johns Hopkins Bloomberg School of Public Health. The GVA is a database of fatal and nonfatal US gun violence events, identified from approximately 7,500 media, law enforcement, government, and commercial sources daily since 2013.[35] Shootings labeled as "officer involved incidents," occurring from January 1, 2015 through December 31, 2020 were individually reviewed and assessed against inclusion criteria. Incidents of shots fired by one or more law enforcement officers, resulting in injuries to people who were not responding officers, were retained. Accidental discharges, policing occupational injuries, injuries by bullet alternatives exclusively (e.g., rubber bullets), shootings without injury, and self-inflicted injuries were excluded. GVA-designated "suicide by cop" shootings (i.e., shootings presumed to have been intentionally provoked) were retained. Cases meeting inclusion criteria were further reviewed by the data abstraction team to determine characteristics of the injured person, incident, and officers involved. Data abstraction occurred from July 2021 - April 2022 (Chapter 2).

For this analysis, we examined injurious shootings involving one or more shooting officers who were ostensibly on-duty. This included officers explicitly described as "on-duty" and formally off-duty officers acting in an on-duty capacity (e.g., identifying themselves as police, responding in uniform). Shootings with no explicitly stated duty status were retained, owing to presumptions of off-duty status being a newsworthy detail. In prior sensitivity analyses (Appendices B-C), national characterizations of fatal and nonfatal shootings by police were not significantly altered by more restrictive or more inclusive duty-status criteria. Prior analyses also suggested that fatal and nonfatal injurious shootings were characteristically similar enough to justify combined, all-outcome analyses

(Chapter 2). For this analysis, fatal and nonfatal injurious shootings were grouped by rurality classification, determined by the geocoordinates and year of the shooting.

Multiple methods for defining geographic rurality were considered, as no single, public health standard exists.[28,29] County-based designations are typically thought to be better descriptors of "place," or geography. Alternatively, zip-code-based designations tend to better capture residents' sense of social and physical "space."[29] Advantages of county schemes include relatively stable boundaries, utility as a unit of governance, and greater availability of county-level data. Disadvantages include infrequent updating schedules and aggregation of socially distinct areas. Zip-code based schemes enable more focused examinations of local features and conditions. Appendix D provides details on the county and zip code designation alternatives considered for this analysis.

To examine and compare implications of alternative schemes, we linked the abstracted GVA dataset to data compiled from the National Center for Health Statistics (NCHS), the US Department of Agriculture (USDA), National Center for Education Statistics (NCES), and the US Census. The USDA and NCES schemes were subsequently prioritized to enable nonbinary comparisons of urban, suburban, and rural geographies. Using a reverse geo-coding process, each shooting location was linked to its zip code. For the USDA scheme, zip codes were then linked to counties, and counties were linked to current rural-urban designations, established by the USDA in 2013. For the NCES scheme, zip codes were approximated by zip code tabulation areas (ZCTAs) and linked to the rural-urban "locale" designation associated with the shooting location and year. For incidence calculations, total and race-specific county-level population data were obtained from the Centers for Disease Control and Prevention (CDC WONDER[64]) for USDA designations. For NCES designations,

ZCTA-level population estimates were drawn from the US Census. US territories were excluded. As needed, missing race-specific population values were interpolated using same-locality, nearest-neighbor year.

Measures

In the USDA Rural-Urban Continuum Codes, counties are classified first as metropolitan or non-metropolitan. Metropolitan counties are then subdivided according to population size. Non-metropolitan counties are subdivided by their total urban population and adjacency to one or more metropolitan areas, defined by geography and commuting patterns of the local workforce. Counties are numerically designated as 1-9 (Metro counties: 1-3, Nonmetro counties: 4-9). Prior research has described non-metropolitan urban areas located adjacent to metropolitan areas as conceptually suburban.[29] The resulting three-level scheme was comprised of Urban (i.e., Metro counties 1-3), Suburban (i.e., Non-Metro Urban/Metro Adjacent counties 4 and 6), and Rural counties (i.e., Non-Metro Urban/Not Metro Adjacent or Completely Rural counties 5 and 7-9).[29] County-level designations are revised every ten years, most recently in 2013.[88]

The NCES framework was created to support policymakers' understanding of the relationship between communities' local physical features, social conditions, and the educational (or other) institutions that serve them.[89] The NCES framework designates each ZCTA as belonging to one of four types of geographies: City, Suburban, Town, or Rural. These categories are divided into three subtypes. For City and Suburban locales, subtypes are defined by the overall size of the urban area. For Town and Rural locales, subtypes are defined by distance to urbanized areas and clusters. Subtypes may be collapsed into the four locale types or into an urban-rural dichotomy by combining City with Suburban and

Town with Rural.[89] For this analysis, City and Suburban categories were retained, while Town areas were collapsed into Rural areas, owing to the conceptual compatibility of these categories and the small proportion of victims (0.2%) and US population (0.2%) represented by the Town geography type.

The dataset abstracted from the GVA included descriptive variables for each person injured (e.g., race/ethnicity, injury outcome), characteristics of the shooting incident (e.g., geocoded location, presence of multiple officers, agency affiliation of the officer(s) firing shots, involvement of behavioral health needs, victim weapon status), and characteristics of the policing encounter that preceded the shooting. Precipitating encounter characteristics included incident type (e.g., report of shots fired prior to officer arrival, domestic incident, traffic stop) and response type (i.e., officer-initiated, dispatched, subject-initiated, or unknown). Race and ethnicity designations were assigned to reflect social labels explicitly described in best-available reporting, not visual judgments by individual abstractors. Multiple designations were possible. Incidents explicitly described as involving behavioral health needs (e.g., substance use, exacerbation of a behavioral health condition) were identified by each abstractor, secondarily reviewed, and confirmed. Definitions of each characteristic are provided in Appendix A.

Analyses

To visualize the geographic distribution of injurious shootings by police nationally, we mapped the location and rurality of each injured person according to USDA 2013 designations and NCES designations in the year of the shooting (Figure 1). Then, we longitudinally compared annually aggregated, all-outcome injury incidence per 100,000 residents by rurality designation according to each designation scheme (Figure 2).

Population distributions associated with each scheme were also reviewed. Distributions were compared against prior research indicating that 26% of Americans in 2014 considered their residential community to be urban, 53% suburban, and 21% rural.[90] Because policing agencies are assigned to geographically defined jurisdictions, as well as residential communities, we secondarily considered that 97% of US land mass is rurally populated.[86] The 2013 USDA scheme described 86% of Americans as residents of urban counties, 9% as conceptually suburban residents, and 5% as residents of predominantly town or rural counties. The NCES scheme described 26% of Americans as living in city zip codes, 29% suburban, under 1% town-dwelling, and 45% living in predominantly rural zip codes (data not shown).

We ultimately selected the NCES scheme for use in cross-sectional analysis for two primary reasons. First, the study of shootings by police aligns well with the scheme's original purpose of informing the function of institutions by enabling focused analyses of communities' social and physical conditions. Second, compared to the USDA scheme, population distribution across the NCES urban-rural continuum aligned better with Americans' perceptions of their social environment, with justifiable overrepresentation of rurally designated areas. Finally, we conducted a cross-sectional descriptive analysis of incident- and person-characteristics associated with injurious shootings over the six-year period, using NCES-defined rurality designations. Descriptive measures included frequency, prevalence, and incidence per 100,000 residents. Analyses were performed using Stata version 16.1.[59] The study was determined to be not human subjects research by the Johns Hopkins Bloomberg School of Public Health IRB.

Results

Injury incidence

USDA and NCES designations estimated substantially different distributions of injurious shootings by police in urban areas (i.e., USDA: “Metro”; NCES: “City”), suburban areas (i.e., USDA: “Non-Metro Urban, Metro Adjacent;” NCES: “Suburban”), and town or rural areas (i.e., USDA: “Non-Metro Urban, Not Metro Adjacent” or “Completely Rural;” NCES: “Town” or "Rural”) (Figure 1). From 2015-2020, both schemes estimated the incidence of injured persons to vary between 0.4 – 0.8 per 100,000 people annually (Figure 2). The USDA scheme estimated the highest rates of injury to be in town or rural areas. Rates varied from 0.63 or 0.64 injured people per 100,000 town and rural residents in 2016 and 2019 to 0.78 injured people per 100,000 town and rural residents in 2018. Conceptually suburban and urban areas had relatively lower injury incidence. Suburban rates increased from 0.41 injured people per 100,000 suburban residents in 2015 to 0.59 injured people per 100,000 suburban residents in 2017. Rates remained at 0.57 injured people per 100,000 suburban residents in 2020. Urban rates were similar and varied little over time (0.52-0.55 injured people per 100,000 urban residents) (Figure 2, Panel A).

The NCES scheme suggested greater differentiation between urban, suburban, and town or rural areas. Injury incidence was highest in urban areas but declined over the study period from 0.77 injured people per 100,000 urban residents in 2015 to 0.69 injured people per 100,000 urban residents in 2020. Suburban areas experienced the lowest and most stable rates of injury, varying between 0.39 and 0.44 injured people per 100,000 suburban residents. In town and rural areas, injury incidence increased from 0.47 injured people in 2015 to 0.59 injured people per 100,000 town and rural residents in 2020 (Figure 2, Panel B).

Cross-sectional analysis

With rurality defined according to the NCES scheme, 34% of 2015-2020's injurious shootings by police occurred in urban areas (n=3,594), 22% in suburban areas (n=2,293), and 45% in primarily rural areas (i.e., town or rural, n=4,730). The incidence of shootings per 100,000 residents was highest in urban areas (urban: 0.7 injured people per 100,000 residents; suburban: 0.4 injured people per 100,000 residents; town or rural: 0.5 injured people per 100,000 residents). Shooting lethality was higher in rural areas, where 58% of people shot by police did not survive (vs. 53-54% in urban and suburban areas) (Table 1).

Victims' armed status was similar in urban, suburban, and rural areas, with 9% of victims overall (n=955) being unarmed prior to the shooting (urban: 10%, n=345; suburban: 9%, n=214; town or rural: 8%, n=396). Nationally, 58% of victims were armed with a firearm or gun, including replica guns. Gun prevalence among people who were injured in suburban areas was lower (urban: 59%, n=2,131; suburban: 54%, n=1,226; town & rural: 59%, n=2,782). A relatively larger portion of suburban victims were described as armed with a vehicle (urban: 6%, n=226; suburban: 9%, n=206; town or rural: 7%, n=343).

Race was unspecified or unknown in 43-46% of victimizations. When race was specified, more victims in town and rural areas were described as white (urban: 17%, n=600; suburban: 22%, n=509; town or rural: 36%, n=1,687), and more victims in urban areas were described as Black (urban: 25%, n=887; suburban: 19%, n=435; town or rural: 9%, n=440) or Hispanic (urban: 15%, n=536; suburban: 13%, n=298; town or rural: 10%, n=467). These racial differences were largely accounted for by population demographics. Per capita injuries to people described as white or Hispanic were similar across rurality designations. Per capita injures to people described as Black or Native American were

highest in urban areas (urban: 0.9 injured Black people per 100,000 Black residents and 1.0 injured Native American people per 100,000 Native American residents; suburban: 0.6 injured Black people per 100,000 Black residents and 0.3 injured Native American people per 100,000 Native American residents; town or rural: 0.6 injured Black people per 100,000 Black residents and 0.7 injured Native American people per 100,000 Native American residents) (Table 1).

Agency and response characteristics associated with injurious shootings were more variable. In all areas, most injurious shootings were preceded by dispatched responses. As rurality increased, dispatched responses accounted for a larger portion of initiating events (urban: 58%, n=2095; suburban: 61%: n=1399; town or rural: 63%, n=2996). The portion of shootings occurring during a single-officer response was also highest in rural areas (urban: 15%, n=527; suburban: 15%, n=350; town or rural: 17%, n=805). As rurality increased, proportionately more injurious shootings involved officers affiliated with sheriff's offices (urban: 7%, n=261; suburban: 24%, n=545; town or rural: 35%, n=1643). Shootings involving shots fired by state police and multiple different law enforcement agencies were most prevalent in town or rural areas (urban: 2% state police, n=82 and 3% multiple agencies, n=109; suburban: 3% state police, n=78 and 5% multiple agencies, n=109; town or rural: 9% state police, n=422 and 10% multiple agencies, n=468). Most shooting officers in urban and suburban areas were affiliated with local police departments (urban: 83%, n=2999; suburban: 65%, n=1491); local police were involved in less than half of injurious shootings in town or rural areas (43%, n=2049) (Table 2).

The reasons for police involvement prior to injurious shootings were similar but varied in prevalence across the urban-rural continuum. In urban areas, the most prevalent

initiating incidents were traffic stops (13%, n=478), domestic incidents (12%, n=431), reports of shots fired (12%, n=414), robberies or carjackings (11%, n=379), and warrants or arrests (9%, n=317). In suburban areas, traffic stops (16%, n=375) and domestic incidents (15%, n=351) were also the most prevalent initiating incidents, followed by robberies or carjackings (9%, n=204), reports of shots fired (9%, n=196), and warrants or arrests (8%, n=177). In town and rural areas, domestic incidents (18%, n=846) then traffic stops (17%, n=821) accounted for the largest portion of initiating incidents, followed by warrants or arrests (11%, n=508), reports of shots fired (8%, n=384), and suicidal or behavioral health crises (7%, n=326). Across reported incident types, behavioral health involvement was somewhat more prevalent in more rural areas (urban: 21%, n=749; suburban: 22%, n=503; town or rural: 24%, n=1149) (Table 2).

Conclusion

This study of injurious shootings by police across the urban-rural continuum suggests under-addressed injury risk in rural areas of the US. Despite substantial variation by rurality designation schemes, rural areas appeared distinct from urban and suburban areas with regard to responder mix, involvement of dispatch, lethality, and prevalence of co-occuring behavioral health needs in injurious shootings. From 2015-2020, rural counties experienced the highest rates of injurious shootings by police nationally. Rural zip codes experienced more moderate, but increasing, rates of injury, while suburban and urban rates stabilized or declined. This suggests that interventions targeting urban areas, including police reforms[91]and non-policing alternatives, may not be reaching rural jurisdictions or may be ill-adapted to rural areas' unique social and policing contexts.

Descriptive analyses suggest the most substantial difference in injurious shootings by rurality was which agencies fired shots. In urban areas, 83% of injurious shootings were by local police officers. As rurality increased, proportionately fewer injurious shootings involved local police. Just 43% of injurious shootings in town and rural areas involved only local police; 35% involved sheriff's offices and 10% involved multiple agencies. This distinction may have important implications for efforts to reduce policing-related harms in rural areas. Sheriffs' power and discretion extends broadly to hiring and firing decisions, policymaking, and strategic policing initiatives.[92] Despite local variation, national and state sheriffs' associations have tended to be politically conservative and resistant to legislative reforms for policing accountability, citing sheriff's electoral accountability.[93] However, a study of 5,604 sheriffs' elections spanning more than 50 years found the average position tenure of a sheriff to be nearly 3-times longer than the average police chief.[92] Accordingly, despite purported electoral accountability, sheriffs were more insulated from political shifts, union influence, and responses to incidents of misconduct.[92] Such longevity may present opportunity for lasting change across fragmented policing jurisdictions or may obstruct accountability in communities where unchecked influence prevails.[94]

Characteristic similarities in injurious shootings across the urban-rural continuum included precipitating incidents and weapons involvement. Traffic stops, domestic violence, shots-fired, and attempts to serve warrants or complete arrests were among the most common types of policing encounters associated with injurious shootings in all examined groups. Rural areas experienced more shooting injuries in association with behavioral health needs. Despite higher rates of gun prevalence in rural areas,[84] 59% of injured people in urban and rural areas were armed with firearms or replica guns.

Unarmed victims were also proportionately similar in urban, suburban, and rural areas. Future research should explore whether contextual differences in weapon involvement may exist within these broad similarities. In more remote areas, for example, firearm involvement may be more frequently associated with domestic violence (versus out-of-home illicit activity), and domestic violence may escalate to higher levels of severity, including police involvement, when access to victims' services is distant or limited.[95] Overall, similarities suggest potential for trainings and procedural interventions employed in urban jurisdictions to be adaptable to suburban, town, and rural areas, despite otherwise diverse policing contexts. State-level policy interventions, such as concealed carrying permits,[85] investments in access to social services,[82] and stronger use-of-force guidance and oversight[96] may also broadly reduce risk of injury across jurisdictions.

Consistent with prior research,[29] the largest portion of victims in this study were white residents of rural areas. However, after adjusting for local racial and ethnic demographics, the highest incidence of injuries from shootings by police were among Native American residents of urban areas. This was followed by: Black residents of urban areas, Native American residents of rural areas, and Black residents of suburban and rural areas. These groups' per capita rates of injury were 3-5-times higher than white residents living in the same rurality designation. Rates of injury to Hispanic residents of urban, suburban, and rural areas were lower but still double white residents' injury rates. These patterns are generally consistent with Hemenway et al.'s estimated per capita fatal police shootings of white, Black, and Hispanic Americans between 2015-2017.[29] Differences to specific estimates are consistent with this study's inclusion of nonfatal injuries, an outcome that disproportionately affected Black[50,57] and Hispanic individuals (Chapter 2).

Relatedly, 58% of injurious shootings in rural areas were fatal, compared to 53% of urban and 54% of suburban injurious shootings. Differences in lethality may also be explained by the larger number of injurious shootings involving shots fired by multiple different policing agencies, a rare occurance in urban areas. This may be an indication of more shooting officers, overall, and therefore more severe use-of-force[57] or a product of rural areas' reliance on multiple responding agencies. Either interpretation may be complicated by responding agencies' potentially different protocols and training. Single-responder incidents also comprised proportionately more rural incidents than urban incidents, but differences were smaller and such events were not found to be associated with higher lethality in prior analyses (Chapter 2). Other determinants of lethality may include service weapon specifications and post-event response systems. Higher caliber firearms are associated with higher likelihood of death from injury,[97] and agency weapon selections vary.[57,98] Future research should examine the role of agency-issued firearms in shooting-related injuries across the urban-rural continuum. Finally, distance from specialized tertiary care, a frequently hypothesized determinant of survivorship, counterintuitively has not been significantly associated with survival from shootings by police.[57] Future research should examine onsite death as a potential mediator and helicopter transport as a potential moderator of this relationship. Additionally, state- and county-level policy determinants of shooting characteristics (e.g., weapon involvement) should be examined in future analysis for potential contribution to injury locally.

Strengths and limitations

The use of county and zip code rurality designation schemes to estimate injury incidence longitudinally was a strength of this study, revealing greater definitional

differences than were evident from prior cross-sectional analyses of fatal shootings by police.[29] We used the NCES scheme for descriptive analyses. Estimates of incident- and person-level characteristics by other rurality designations may differ. The sparse designation of rural areas in county schemes (e.g., USDA, NCHS) precluded direct, descriptive comparisons within the included timeframe.

Quantity and quality of reporting may differ by rurality, owing to media consolidation trends and reduced rural-area coverage.[99] Comparable prevalence of unknown variables across strata suggest minimal variation in reporting quality. Still, estimates of injury frequency and rural-versus-urban comparisons are likely conservative. Analyses of race and ethnicity characteristics were limited by strict designation procedures. Here, too, injury estimates are conservative. Validity of relative inferences is assured by the similar prevalence of unknown race-ethnicity across rurality groups. Finally, this study was unable to account for other uses of deadly force or shootings by police without injury, analogous to "near-miss" sentinel events in other areas of system reform for injury prevention.[100] Caution should be exercised in directly inferring individual risk from the estimates presented, owing to differences in individual exposure to police and local distributions of policing activities.

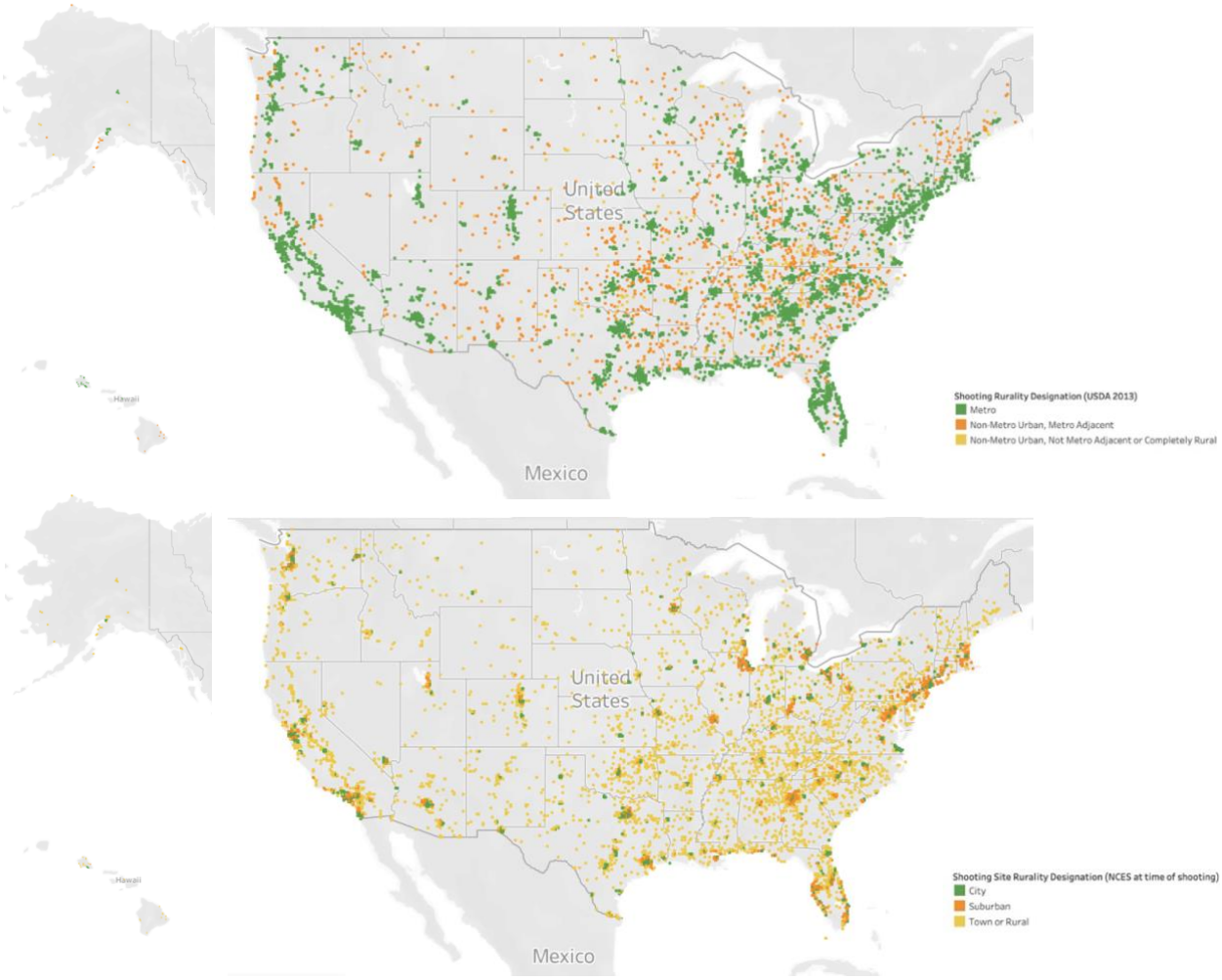
Implications

With an estimated 18,000, mostly non-metropolitan, US law enforcement agencies, systems of policing are fragmented and diverse.[8] Contrary to traditional assumptions, we find that injurious shootings by police affect rural areas of the US at rates approaching or exceeding those of urban areas. Many characteristics of shootings across the urban-rural continuum were similar, but rural areas experienced more shootings associated with

behavioral health needs and saw higher levels of sheriffs' involvement. Limited access to mental health or substance use services may affect rural residents and officers, alike, potentially escalating community needs to crisis and straining officers' ability to objectively and safely respond.[79] Emerging crisis prevention and response systems must consider the social and geographic needs of rural jurisdictions.[101] Strategies for improving access may include expansion of telehealth services coverage and technologies, with access points assured outside of the home or department.[79] Recent executive orders to improve federal agencies' data collection, use-of-force standards, arrest-related procedures, and militarization practices should also be adopted by state and local agencies.[101] Policy interventions at the county level, potentially in combination with consolidation of very small and resource-limited agencies, may improve coordination- and capacity-related limitations.[94] Finally, the nation's increasing effort to improve policing systems and accountability through executive and legislative action must include affiliates of sheriff's offices for sustained impact nationally and in rural areas of the US, specifically.

Chapter Three Figures and Tables

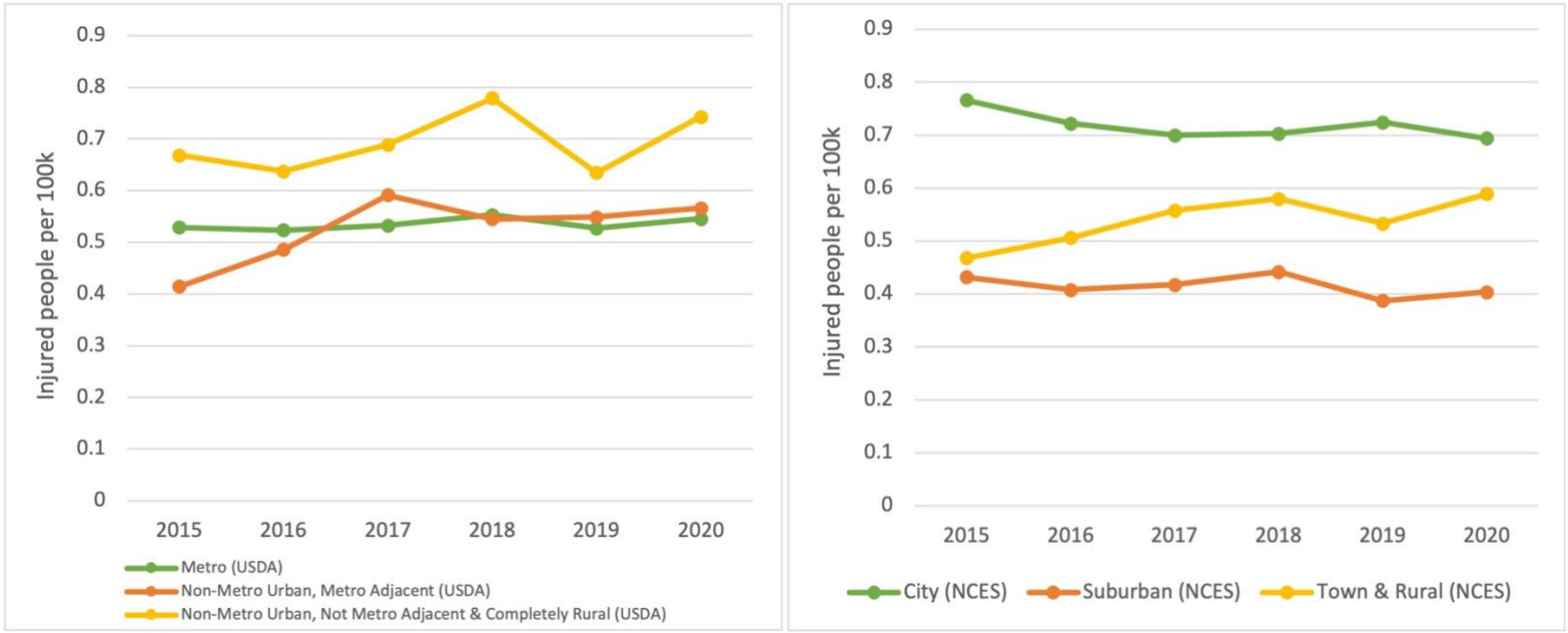
Figure 1. Map of persons injured from shootings by police in the United States, 2015-2020 (Panel A: County-based rurality designation scheme; Panel B: Zip Code-based rurality designation scheme.)



Note: Map generated with Tableau[102]

USDA = United States Department of Agriculture rurality schema, based on County Rural-Urban Continuum Codes. NCES = National Center for Educational Statistics rurality scheme, based on Zip Code Tabulation Area.

Figure 2. People injured in shootings by police, per 100,000, by rurality (Panel A: County-based rurality designation scheme; Panel B: Zip Code-based rurality designation scheme.)



Notes: USDA = United States Department of Agriculture rurality schema, based on County Rural-Urban Continuum Codes.

NCES = National Center for Educational Statistics rurality scheme, based on Zip Code Tabulation Area.

Table 1. Prevalence and incidence of person characteristics associated with injurious shootings by police in urban, suburban, and town or rural areas of the US, 2015-2020

	Urban[1]		**Suburban[1]**		**Town & Rural[1]**		**National**	
	Injured persons n (%)	Injured persons per 100k residents[2]	Injured persons n (%)	Injured persons per 100k residents[2]	Injured persons n (%)	Injured persons per 100k residents[2]	Injured persons n (%)	Injured persons per 100k residents[2]
Total Injurious Shootings	3594 (100)	0.71	2293(100)	0.41	4730 (100)	0.54	10617 (100)	0.54
Fatally injured	1903 (53.0)	0.38	1240 (54.1)	0.22	2731 (57.7)	0.31	5874 (55.3)	0.30
Nonfatally injured	1691 (47.1)	0.33	1053 (45.9)	0.19	1999 (42.3)	0.23	4743 (44.7)	0.24
Weapon type								
Unarmed	345 (9.6)	0.07	214 (9.3)	0.04	396 (8.4)	0.04	955 (9.0)	0.05
Total firearm or gun	2131 (59.3)	0.42	1226 (53.5)	0.22	2782 (58.8)	0.31	6139 (57.8)	0.31
Firearm	*1965 (54.7)*	*0.39*	*1131 (49.3)*	*0.20*	*2649 (56.0)*	*0.30*	*5745 (54.1)*	*0.29*
Multiple, with firearm	*11 (0.3)*	*<0.01*	*11 (0.5)*	*0.00*	*8 (0.2)*	*<0.01*	*32 (0.3)*	*<0.01*
BB or replica gun	*155 (4.3)*	*0.03*	*84 (3.7)*	*0.01*	*125 (2.6)*	*0.01*	*362 (3.4)*	*0.02*
Knife or cutting/stabbing	524 (14.6)	0.10	369 (16.1)	0.07	638 (13.5)	0.07	1531 (14.4)	0.08
Vehicle	226 (6.3)	0.04	206 (9.0)	0.04	343 (7.3)	0.04	775 (7.3)	0.04
Blunt object	65 (1.8)	0.01	44 (1.9)	0.01	90 (1.9)	0.01	199 (1.9)	0.01
Other or multiple, without firearm	67 (1.9)	0.01	59 (2.6)	0.01	113 (2.4)	0.01	239 (2.3)	0.01
Unknown	236 (6.6)	0.05	175 (7.6)	0.03	368 (7.8)	0.04	779 (7.3)	0.04
Race or ethnicity of injured person[3]								
White	600 (16.7)	0.20	509 (22.2)	0.13	1687 (35.7)	0.23	2796 (26.3)	0.20
Black	887 (24.7)	0.89	435 (19.0)	0.61	440 (9.3)	0.59	1762 (16.6)	0.72

American Indian or Alaskan Native	32 (0.9)	1.04	7 (0.3)	0.34	80 (1.7)	0.74	119 (1.1)	0.75
Hispanic, any race	536 (14.9)	0.42	298 (13.0)	0.25	467 (9.9)	0.40	1301 (12.3)	0.36
Other, unspecified, or unknown	1539 (42.8)	0.30	1044 (45.5)	0.19	2056 (43.5)	0.23	4639 (43.7)	0.24

Note:

1=Based on NCES Rural Urban Classification Scheme, 2015 - 2020. Rurality designation is based on geocoordinates and year of shooting. “Urban” includes Large, Mid-size, and Small Cities; “Suburban” includes Large, Mid-size, and Small Suburban areas; “Town & Rural” includes Fringe, Distant, and Remote Towns and Rural areas.

2= Calculated as total person-years, 2015-2020 in the specified geography. City annual average population = 84,233,981.2; Suburban annual average population = 93,602,752.8; Town & Rural annual average population = 147,278,370; National annual average population = 325,115,104.

3= Incidence by victim race or ethnicity calculated using race-specific population, calculated as total person-years, 2015-2020 in the ZCTA of the shooting, collapsed by NCES rurality designation. City annual average white population = 49,805,345; Suburban annual average white population = 65,893,265.5; Town & Rural annual average white population = 120,309,606.2; National annual average white population = 236,008,216.7; City annual average Black population = 16,574,535.2; Suburban annual average Black population = 11,866,591.5; Town & Rural annual average Black population = 12,427,414.8; National annual average Black population = 40,868,541.5; City annual average American Indian/Alaskan Native population = 510,798.3; Suburban annual average American Indian/Alaskan Native population = 344,699.7; Town & Rural annual average

American Indian/Alaskan Native population = 1,791,523.5; National annual average American Indian/Alaskan Native population = 2,647,021.5; City annual average Hispanic population = 21,348,059.5; Suburban annual average Hispanic population = 19,619,384.2; Town & Rural annual average Hispanic population = 19,377,764.8; National annual average Hispanic population = 60,345,208.5.

Table 2. Frequency and prevalence of responder and incident characteristics associated with injurious shootings by police in urban, suburban, and town or rural areas of the US, 2015-2020

	Urban[1]	**Suburban[1]**	**Town & Rural[1]**	**National**
	Injured persons n (%)	Injured persons n (%)	Injured persons n (%)	Injured persons n (%)
Total Injurious Shootings	3594 (100)	2293(100)	4730 (100)	10617 (100)
Response type				
On view	1417 (39.4)	837 (36.5)	1639 (34.7)	3893 (36.7)
Dispatched	2095 (58.3)	1399 (61.0)	2995 (63.3)	6488 (61.1)
Subject-initiated	47 (1.3)	32 (1.4)	31 (0.7)	110 (1.0)
Unknown	36 (1.0)	25 (1.1)	65 (1.4)	126 (1.2)
Number of responding officers				
Single	527 (14.7)	350 (15.3)	805 (17.0)	1682 (15.8)
Multiple	2982 (83.0)	1878 (81.9)	3774 (79.8)	8634 (81.3)
Both	1 (<0.1)	1 (<0.1)	2 (<0.1)	4 (<0.1)
Unknown	84 (2.3)	64 (2.8)	149 (3.2)	297 (2.8)
Agency firing shots				
Local police	2999 (83.4)	1491 (65.0)	2049 (43.3)	6537 (61.6)
Sheriff's office	261 (7.3)	545 (23.8)	1643 (34.7)	2449 (23.1)
State police	82 (2.3)	78 (3.4)	422 (8.9)	582 (5.5)
National agency	84 (2.3)	24 (1.1)	76 (1.6)	184 (1.7)
Special jurisdiction	33 (0.9)	15 (0.7)	33 (0.7)	81 (0.8)
Constable or marshal	1 (<0.1)	6 (0.3)	4 (0.1)	11 (0.1)
Multiple shooting agencies	109 (3.0)	109 (4.8)	468 (9.9)	686 (6.5)
Unknown	27 (0.8)	25 (1.1)	35 (0.7)	87 (0.8)
Initiating incident				
Shots fired incident	414 (11.5)	196 (8.6)	384 (8.1)	994 (9.4)
Assault	171 (4.8)	86 (3.8)	154 (3.3)	411 (3.9)
Threats	89 (2.5)	36 (1.6)	91 (1.9)	216 (2.0)
Crash	31 (0.9)	19 (0.8)	54 (1.1)	104 (1.0)
Disorderly/Dispute	151 (4.2)	88 (3.8)	170 (3.6)	409 (3.9)
Domestic incident	431 (12.0)	351 (15.3)	846 (17.9)	1628 (15.3)
Investigative	229 (6.4)	132 (5.8)	217 (4.6)	578 (5.4)
Robbery or Carjacking	379 (10.6)	204 (8.9)	265 (5.6)	848 (8.0)
Burglary	72 (2.0)	64 (2.8)	92 (2.0)	228 (2.2)

Stolen Vehicle	50 (1.4)	32 (1.4)	66 (1.4)	148 (1.4)
Suicidal or behavioral health crisis	159 (4.4)	146 (6.4)	326 (6.9)	631 (5.9)
Suspicious person or vehicle	198 (5.5)	148 (6.5)	217 (4.6)	563 (5.3)
Traffic stop	478 (13.3)	375 (16.4)	821 (17.4)	1674 (15.8)
Trespassing	48 (1.3)	41 (1.8)	93 (2.0)	182 (1.7)
Warrant or Arrest	317 (8.8)	177 (7.7)	508 (10.7)	1002 (9.4)
Weapon complaint	203 (5.7)	88 (3.8)	164 (3.5)	455 (4.3)
Wellbeing check	41 (1.1)	35 (1.5)	80 (1.7)	156 (1.5)
Other	92 (2.6)	47 (2.1)	116 (2.5)	255 (2.4)
Unknown	41 (1.1)	28 (1.2)	66 (1.4)	135 (1.3)
Behavioral health involvement	749 (20.9)	503 (21.9)	1149 (24.3)	2401 (22.6)

Note: 1=Based on NCES Rural Urban Classification Scheme, 2015 - 2020. Rurality designation is based on geocoordinates and year of shooting. “Urban” includes Large, Mid-size, and Small Cities; “Suburban” includes Large, Mid-size, and Small Suburban areas; “Town & Rural” includes Fringe, Distant, and Remote Towns and Rural areas.

Chapter Four: Manuscript Three

Social and policy characteristics associated with injurious shooting by police in US counties: A multilevel analysis, 2015-2020

Abstract

From 2015-2020, 1,770 people were injured annually in shootings by police in the United States, disproportionately harming members of minoritized groups. Prior studies of the structural determinants of these inequities have examined state-level aggregations and fatal outcomes. This study aimed to: 1) describe state and county variation in fatal and nonfatal injurious shootings by police, and 2) analyze the relationship between state and county contextual differences and differences in county rates of injurious shootings by police. Injury data were abstracted from the Gun Violence Archive and aggregated by county-year. Covariate selection was informed by theories of police use of force and the Social Basis of Disparities in Health conceptual framework. Multilevel, fixed effects, negative binomial regression models were estimated, nesting years within counties and states. Analyses control for within-group correlation, county population, local reporting presence, and multiple measures of social conflict and community violence. From 2015-2020, 56% of counties experienced injurious shootings. For each state-level percentage increase in adults with unmet substance use disorder (SUD) needs, there was a 25% increase in county-level injurious shootings by police. For each percentage increase in county income inequality, a 5% increase in injurious shootings was observed. Two firearm policies (i.e., statutes requiring concealed carry (CCW) licenses or permits to purchase firearms (PTP)) were associated with fewer injurious shootings. To prevent patterns of

injurious shootings by police, policymakers should consider strong CCW licensing systems, PTP, addressing unmanaged SUD in crisis fund allocation and use, and evaluating local investments in non-policing responses to social needs.

Introduction

From 2015-2020 an annual average of 1,770 people were injured in shootings by police in the United States (Chapter 2). These injuries are known to be unequally experienced and outsized in their individual and societal impact. Research suggests that Black men are most disproportionately affected, with 2.5-times higher life course risk of fatal injury by police use-of-force than white men.[32] Native American and Latino men also face elevated threat relative to white men and women of all racial and ethnic identities.[32] Inequities in death by police use-of-force have additionally been found to vary by age,[52,53] mental health vulnerabilities,[53] and US region.[27,53,55,103] The drivers underlying these persistent disparities, remain an open question and the subject of decades of research.[104,105]

Two theoretical orientations common to studies of extra-organizational determinants of police-inflicted fatal injury include 1) the social conflict paradigm and 2) the community violence paradigm. Social conflict perspectives consider force to be a tool of the State, used on behalf of the privileged, to control groups that threaten the status quo.[103] Studies informed by this orientation typically examine factors such as community demographic composition,[106] social vulnerability and inequality measures (e.g., Gini Coefficient),[55] and measures of structural racism.[27] In contrast, community violence perspectives focus on the presence of real or perceived threats to police safety that make deadly force a "necessary response"[103] (e.g., gun prevalence,[33] violent crime rates[106]). The literature is ambivalent to the legitimacy of one school of thought over the other. For example, Mesic et al. found evidence of both social conflict hypothesis and community violence hypothesis in their analysis of a state racism index. Their findings suggested

significant contributions of both structural racism and arrest rates to Black-white disparities in fatal shootings of unarmed victims.[27] Hemenway et al. also considered aspects of both paradigms and found that after controlling for state violent crime rate, poverty rate, urbanization, and non-white population, state-level household firearm ownership was positively correlated with rates of fatal shootings in all 50 states.[33]

Diderichsen, Evans, and Whitehead's conceptual model of the Social Basis of Disparities in Health identifies potential mechanisms through which social and policy contexts may unequally produce and perpetuate injuries from shootings by police. According to the model, health disparities develop through a layered process that produces patterns of individual differences in social position, exposures, susceptibility, and consequences. These layered determinants are shaped by distributions of power, wealth, and risks in the social context. To reduce health disparities, distribution imbalances must be equalized through policies that reduce social stratification, decrease harmful exposures, decrease vulnerability, or prevent differential consequences.[1] Applied to shootings by police, the model posits that injury disparities (e.g., overburden among minoritized ethnic and racial groups, people with behavioral health vulnerabilities, or residents of some localities over others) are the consequence of differences in exposures to police and shootings by police. These exposure differences, whether responses to social conflict or community violence, are shaped by societally created differences in social position. Potential for social stratification may be indirectly implied by demographic and other community characteristics or measurably observed as income inequality, residential segregation, disparities in educational attainment, or other manifestations of structural racism.[107–109] To prevent injuries, the model suggests that policies should focus on

elevating the social status of vulnerable individuals or equitably reducing exposures to policing (Figure 1).

Efforts to identify the social and policy characteristics of communities with greatest vulnerability to policing-related injuries have encountered multiple methodological challenges. First, as detailed previously (Chapters 2, 3), data limitations have restricted prior national research on police use of force to fatal injury outcomes. Yet, fatalities comprise just 55% of all injurious shootings by police (Chapter 2). Moreover, without consistent documentation of police encounters more broadly, studies have been challenged to identify meaningful denominators and controls.[53] Working from these restricted datasets, research on geographic heterogeneity has tended to focus on state-level determinants and outcomes.[27,33] Such studies may be limited in their applied utility, given the "hyperlocal" tactics advocated by public safety reformers[110] and the potential to obscure meaningful variation in local contexts and practices. Other studies have focused on the context and dynamics of major US cities.[103,106] However, these designs fail to consider more rural communities with comparable injury incidence but challenges of population scale.[29, ch.3] Additionally, some policies are preempted from local adoption or otherwise require involvement of the state (e.g., some firearm policies, social welfare spending),[111,112] suggesting that the inclusion of state-level determinants is necessary but insufficient for a thorough and useful analysis.

One solution to these methodological limitations would be to examine counties grouped within states to account for expected within-group correlation in social and policy contexts.[113] In addition to being politically meaningful, themselves, counties are a more inclusive unit of analysis than zip codes or cities, and multilevel modeling presents a more

robust method for identifying opportunities for policy intervention. This study takes that approach, enabled by a new, nationally comprehensive dataset of fatal and nonfatal injurious shootings by police from 2015 to 2020. Building upon specific state-level analyses of household gun ownership[33] and social stratification in the production of disparate harm,[27] this study seeks to identify social contexts and existing or potential policies to reduce societal vulnerability to injury from shootings by police. The specific research objectives were to 1) describe state- and county-level variation in injurious shootings by police, and 2) analyze the association between social and policy characteristics of the state or county and county-level rates of injurious shootings by police in the United States.

Methods

Data sources and measures

Injury data for this study were drawn from a dataset that was abstracted from the Gun Violence Archive (GVA), as detailed previously (Chapters 2, 3). The outcome of interest was people injured in shootings by police, aggregated by county-year. A shooting was included if an "on duty" law enforcement officer fired shots that injured a person who was not a law enforcement officer. "On duty" was operationalized to include shootings by officers who were explicitly described as such in publicly available materials, officers who were off-duty but were acting in an on-duty capacity (e.g., identified themselves as police), and incidents in which duty status was unstated. In prior analyses, this definition was shown to produce estimates that were robust to more restrictive or more expansive duty-status criteria (Chapter 2). Counties with no shootings during the six-year period were retained to allow for a nationally comprehensive comparison of all counties' social and policy contexts alongside the injury outcome.

Covariate selection was informed by the Social Basis of Disparities in Health conceptual model,[1] in consultation with emerging research on measures of structural racism[107–109] and prior analyses of fatal shootings by police.[27,33,114] Covariates included social factors relevant to social stratification or potential exposure to policing, policy factors relevant to stratification or exposure, and year to account for the dynamic interplay between social and policy contexts and the outcome. When possible, county-level measures were prioritized over state-level measures.

Social context. To describe county and state social contexts, demographic variables were drawn from the US Census (e.g., state population, percent income inequality based on the Gini Coefficient), the American Community Survey (e.g., poverty rate, residential segregation), and the Center for Disease Control and Prevention (CDC)'s Wide-Ranging Online Data for Epidemiologic Research (WONDER) (e.g., county population size and demographics). Other social context measures were drawn from the US Department of Labor (e.g., state unemployment), the US Department of Veterans' Affairs (e.g., state veteran population), the US Department of Housing and Urban Development (e.g., state unhoused population), the US Department of Education (e.g., graduation rates), the US Department of Agriculture (USDA) (e.g., county rurality designations), Vera Institute of Justice (e.g., incarceration rate, available annually for prisons only), Mental Health America[115] (e.g., prevalence of adult mental illness), the Federal Bureau of Investigation (FBI)'s Uniform Crime Reporting Program (e.g., violent crime rate, assaults on law enforcement officers), the US Department of Health and Human Services Substance Abuse and Mental Health Service Administration (SAMHSA) (e.g., 2019 self-reported unmet behavioral health needs), and CDC WONDER (e.g., estimated state firearm prevalence).

Number of sworn officers within a county at the study period's midpoint was estimated from a Lexipol Police1 listing of agencies,[8] manually supplemented with staffing data from Police Scorecard[116] and other publicly available sources (e.g., agency websites, agency-issued annual reports). Additionally, to account for geographically unequal reporting coverage and potentially unequal injury undercounts, an indicator variable was used to designate county news deserts. A news desert was defined to be a county with no daily or weekly newspapers in 2019, the only study-period year with data available.[117]

Firearm prevalence was estimated by a proxy variable, calculated as the ratio of firearm suicides to total suicides in a state. Despite known limitations, this proxy is the current gold standard in the field.[37] Uncensored county-level suicide data were not available for this analysis. County rurality was designated according to 2013 USDA Rural Urban Continuum Codes (detailed in Chapter 3) and collapsed into categories of urban, suburban, and rural. These categories were designated with an indicator variable, using urban counties as the referent.

Policy context. Several characteristics of the policy context were also considered. Examined firearm policies included: the absence of permitting systems for regulating the concealed carry of weapons (CCW) in public, permit to purchase (PTP) statutes regulating firearm ownership, and extreme risk protection orders (ERPO) to allow for temporary dispossession of firearms in crisis. State adoption of firearm policies was determined from published legal research.[85,118,119] A state with the statute was designated "1" upon the start of the first full year following policy adoption, "0" otherwise. Measures of state spending priorities included per capita spending on health, police, and public welfare. These were drawn from the US Census. Measures of inequity in policy systems included non-white

versus white residential segregation and various measures of racial disparities in high school graduation rates and poverty rates, drawn from the American Community Survey.

Analyses

Data were organized as a panel dataset with shooting victims summed by county-year (2015-2020) and counties nested within states. As appropriate, missing year variables were linearly extrapolated and interpolated, with the support of 2021 variables, as available. Descriptive statistics were calculated to assess the size of potentially correlated clusters and heterogeneity in the prevalence and lethality of injurious shootings by state and county. Results were mapped to visually compare state differences in injury frequency, rates, and lethality. To analyze county-level variation, injury frequency within counties and injury prevalence among counties within states were assessed.

Next, cross-sectional negative binomial regression models were estimated, based on observed overdispersion in the count distribution (county mean annual injuries: 3.4; variance: 158.4). Owing to its unique governance structure, the District of Columbia (DC) was excluded. Potential state- and county-level correlates of injury prevalence were first examined in bivariate regression models, controlling for year. Results were interpreted as incident rate ratios (IRR) with confidence intervals calculated based on an alpha of 0.05. To address the limitation posed by having only a state-level proxy to estimate the relationship between firearm prevalence and county-level injury counts, an interaction term was created between the state firearm proxy and percent nonwhite county population. In 2015, 70% of US gun owners were white,[120] suggesting that there may be correlation between counties with larger non-white populations and counties with fewer gun owners. Though imprecise, the interaction term, absent a more proximal firearm prevalence estimate,

allowed for between-county variation in gun ownership within specified state levels of firearm prevalence.

Next, the presence of group effects and appropriateness of multilevel modeling[113] was confirmed in a null model in which 6 years were clustered within 3,142 counties, clustered within 50 states. Independent variables and fixed effects were then introduced with a county-population offset. The full, fixed effects model contained 10 state measures of social context (i.e., percent unemployed, percent veterans, per capita unhoused, violent crime rate, gun prevalence proxy main effect, prevalence of any mental illness among adults, adult prevalence of unmet mental health needs, adult prevalence of unmet alcohol use disorder needs, adult prevalence of unmet substance use disorder (SUD) needs, and assaults on law enforcement officers involving a knife or firearm), 7 county measures of social context (i.e., population total, percent Gini, percent population non-white main effect, sworn officers, percent population 65 or older, rurality, and news desert indicator), and the interaction term of state gun prevalence and county demographics. Also included were 9 state measures of policy context (i.e., Black vs. white, Native American vs. white, and Hispanic vs. white high school graduation rate ratios; policy indicator values for permitless CCW, PTP, and ERPO; and per capita spending on health, police, and public welfare), 3 county measures of policy context (i.e., Non-white vs. white residential segregation, Black vs. white poverty rate ratio, and Native American vs. white poverty ratio) and time. Collinearity was assessed and only found in the interaction term with its main effects.

The full, adjusted model was not significantly improved by excluding the interaction term, eliminating potentially duplicative ratio variables, introducing state incarceration rate, introducing state poverty rate, replacing itemized per capita spending with spending

ratios, or introducing random effects. In sensitivity tests, all analyses were repeated with 2015-2019 as the inclusion period to assess for effects of pandemic-related data interpolation and large social changes observed in 2020. To assess the effect of outlier counties, 2015-2020 models were rerun with the exclusion of the six highest-injury counties. All analyses were performed using Stata version 16.1.[59] Maps were generated using Tableau Desktop 2022.3.[102] The study was determined to be not human subjects research by the Johns Hopkins Bloomberg School of Public Health IRB.

Results

State prevalence, incidence, and lethality of injurious shootings by police varied considerably during the 6-year pooled timeframe (2015-2020). Rhode Island experienced the fewest shootings, and California experienced the most (n=15 and n=1,458, respectively). Per capita, incidence was lowest in New York (1.3 injured people per 100,000 residents) and highest in New Mexico (9.3 injured people per 100,000 residents) (Table 1). Lethality tended to be highest in states of the Mountain West and Pacific Northwest and lowest in select states of the Northeast, Midwest, and Gulf Coast regions (Figure 2). Within states, the portion of counties reporting injurious shootings ranged from 20% in Nebraska (19 of 93 counties) to 100% in Arizona, Delaware, and New Hampshire (Table 1). Fifty-six percent of all US counties and DC (n=1,748 of 3,134) experienced one or more injurious shootings by police. Twenty percent of counties (n=637) reported one injurious shooting; six counties (i.e., San Bernardino County, CA; Clark County, NV; Cook County, IL; Harris County, TX; Maricopa County, AZ; Los Angeles County, CA) reported more than 100 injurious shootings (results not shown).

Bivariate regression models suggested multiple significant demographic, social, and policy correlates of injurious shootings within a county. In unadjusted models, permitless CCW was associated with fewer county shooting injuries (CCW IRR: 0.71, 95% CI: 0.63 – 0.80), and ERPO policies were associated with more shooting-related injuries (IRR: 2.93, 95% CI: 2.57 – 3.35). Higher per capita spending on police than health and multiple measures of structural racism manifestations (e.g., disparities in high school graduation rates, residential segregation) also appeared to be associated with more injuries from shootings by police (Table 2).

In the adjusted model, in which within-group correlation, county population size, journalistic presence, and other previously significant variables were considered, fewer characteristics emerged as significant. Notably, after controlling for other state- and county-level characteristics, counties in states with permitless CCW policies had 23% higher injurious shooting incidence than counties in states with regulated CCW (95% CI: 1.06 – 1.44). Counties in states with PTP policies had 44% lower incidence of injurious shootings than counties in states with unpermitted firearm purchasing systems (95% CI: 0.39 – 0.79). In the adjusted model, ERPO policies were not significantly associated with shooting injury incidence. For each state-level percentage increase in adults with unmet SUD needs, an associated 25% higher county injury incidence was observed (95% CI: 1.10 – 1.43). At the county-level, higher income inequality (IRR: 1.04, 95% CI: 1.02 – 1.06) and urbanicity (Rural IRR: 0.25, 95% CI: 0.03 – 0.31; Suburban IRR: 0.30, 95% CI: 0.27 – 0.34) remained significantly associated with injury rates. After controlling for all other variables, each percentage increase in a county's non-white population was associated with a 4% increase in injurious shootings (95% CI: 1.02 – 1.06). After controlling for state-level gun

prevalence and other factors, estimated lower county gun prevalence was associated with 6% lower injury incidence (95% CI: 0.91 – 0.97). The model also suggested a yearly incidence rate increase of 6% (95% CI: 1.01 – 1.12) after controlling for other time-variant characteristics (Table 2).

In sensitivity analyses, only estimates from the unadjusted models were significantly affected by the exclusion of 2020. With 2020 excluded, subtle shifts toward null associations, generally concentrated among variables associated with structural racism, were observed. Additionally, in the 2015-2019 adjusted model, time was less impactful, as evidenced by each year's association with a 1% increase in injury rates after controlling for other variables (95% CI: 1.01 – 1.02) (Appendix E, Table E1). When outlier counties were excluded from the 2015-2020 model, unadjusted state graduation disparities were significantly associated with county shooting injuries. In the full model with outlier counties excluded, the only significant change was in association with the interaction term estimate of county gun prevalence, weakening confidence in the utility of this estimator (Appendix E, Table E2).

Discussion

In this study of the social and policy correlates of injurious shootings by police, 56% of US counties were found to have experienced at least one injurious shooting from 2015-2020. Consistent with community violence theories, which hypothesize that police may be more apt to fire their weapons when they anticipate more prevalent firearm possession, the most impactful policy interventions were gun related. Specifically, permitless CCW was associated with 23% higher county incidence of injurious shootings by police than county incidence in states with stronger CCW systems. CCW licensing introduces more preventive

oversight over public firearm carrying and may also be associated with differences in carrying frequency.[121] State PTP systems were associated with 44% lower county incidence of injurious shootings by police compared to counties in states without PTP. PTP may more indirectly improve public safety associated with gun possession by limiting untraceable diversion of firearms to prohibited persons.[122] In private-space encounters, PTP may act more directly by increasing purchaser and seller accountability for safe gun ownership.[122] These findings build upon prior research by Doucette et al., which identified a causal relationship between permitless CCW and injurious shootings by police, to additionally identify probable protections from PTP.[85] This research also advances the work of Hemenway et al.[33] to suggest that more impactful to policing-related shooting injuries than state firearm ownership may be *underregulated* firearm ownership.

Second, consistent with a social conflict perspective on policing, which focuses on maintenance of the social order, for each percentage increase in adults with undermanaged SUD in a state, a 25% increase in injurious shootings was observed. Each percentage increase in county income inequality was associated with a 5% increase in injurious shootings by police. Per capita state investments in health, policing, or public welfare were not significantly associated with injury incidence, suggesting that existing systems with potential to proactively address these social needs do so inadequately. Instead, counties with larger gaps in economic wellbeing or communities in states that insufficiently respond to substance use needs may react with policing approaches and suffer more policing-related harms. Currently, at least 5% of Congressionally appropriated Community Mental Health Services Block Grant funds have been earmarked for crisis services, such as crisis response teams and residential treatment programs.[123] The size of a state's grant allocation

is based on population size and state prevalence of mental illness.[123] These findings suggest that unmanaged SUD may be a distinct and additionally useful metric for resource allocation and spending to improve equity, strengthen social protections, and reduce policing-related injuries locally.

Among the policy correlates that were not found to be significantly associated with injurious shootings in the full model were ERPO policies. These policies have a similar safer-gun-ownership objective as PTP and CCW permits. However, they differ in their reliance on local uptake; large variations in county implementation have been observed.[124] Additionally, ERPO's potential as a tool for reducing threat in suicidal crises, which comprise a significant portion of injurious shootings in rural communities especially,[Ch3] may be underutilized.[125] When implemented, the involvement of police in executing ERPOs may introduce short-term increases in policing exposures in exchange for longer-term crisis protections. Future research should examine the role of county-level ERPO implementation on injuries from shootings by police to inform safest policy adoption and use.

Prior research suggests that injuries from police use of force increased over the first 15 years of the 21st century.[126] This cross-sectional analysis does not claim to describe trends in injuries from the most lethal form of deadly force. However, sensitivity tests in which 2020 was omitted suggest that, in isolation, pandemic-related amplification of structurally reinforced social and health disparities was significant to the frequency of shooting injuries inflicted by police in US counties. In more comprehensive regression models, pandemic-related conditions were subtly impactful, as evidenced by amplified year-effects but otherwise minimal changes within a six-year, cross-sectional analysis.

Future research should replicate these analyses longitudinally to monitor post-pandemic trends and their potentially lasting impact on policing-related injuries and inequities.

This study was the first to cross-sectionally examine six years of fatal and nonfatal injurious shootings by police within counties of the US, alongside more than 30 distinct state, county, and time-related characteristics of the social and policy context. This theory-informed analysis builds upon prior research to better contextualize the role of gun prevalence and account for multiple levels of social and policy characteristics. Still, some limitations should be considered. First, this study was only able to examine shooting-related injuries, the most lethal form of deadly force. Harms associated with other police uses of force may be more common and may respond differently to community social and policy determinants.

Second, the cross-sectional design limits capacity for causal inference. In particular, the directionality of the relationship between unmet SUD needs and injurious shootings by police remains unclear. In addition to unmet needs potentially provoking law enforcement contact, care gaps may be exacerbated by disengagement from healthcare institutions following criminal legal system contact.[127] Still, the potential for policy intervention to be positively disruptive persists. Future research should disentangle these relationships to inform the best targeting of interventions.

Third, incomplete data from pandemic-related collection challenges (e.g., American Community Survey) or county-level censoring (e.g., poverty rate ratios, county firearm proxy) could not be fully resolved by statistical interpolation or interaction terms. Sensitivity analyses suggest the multivariate model was robust to elimination of a single year, offering some assurance for stability of findings. Potential for omitted variable bias

remains always-present in observational analyses.[114] The inclusion of fixed effects helped to address unobserved heterogeneity between years, counties, and states within the dataset.

Finally, the significance of the news desert variable suggests that injurious shootings are sensitive to local variation in journalism presence, an indication of underreporting risk. Variable inclusion was a model strength despite the need to presume time-invariance. In truth, this limitation may worsen as local news consolidation trends continue.[128] Reducing reliance on media repositories for police accountability by establishing mandatory federal reporting systems remains an urgent priority.

Injurious shootings by police are a relatively rare outcome that was experienced by more than half of US counties from 2015 to 2020. That hundreds of counties did not report injuries suggests preventability; that hundreds more did suggests prevention through wide-reaching social and policy reforms is warranted. This study found that effective prevention approaches may include adopting stronger CCW and PTP statutes to reduce police-anticipated sources of threat and investing in non-policing responses to social needs (e.g., improved access to safer management of substance use). The methodological framework presented acknowledged state determinants but prioritized county-level measures. Building from this model, future research should examine the effect of county-specific social and health investments on injurious shootings by police and injury trends over time.

Chapter Four Figures and Tables

Figure 1. Conceptual framework of the Social Basis of Disparities in Health,[1] applied to injuries from shootings by police

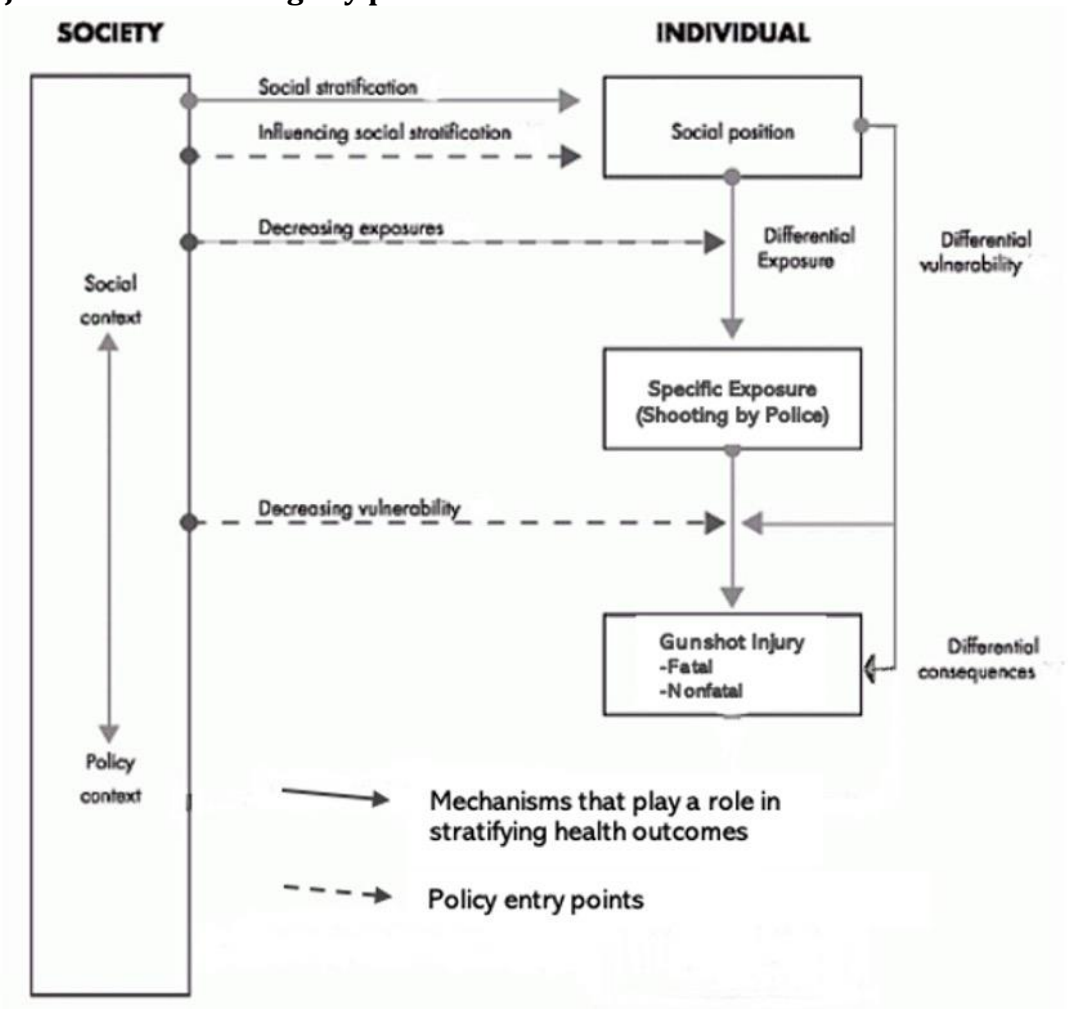


Table 1. Prevalence of fatal and nonfatal injurious shootings by police, by state and county, 2015-2020

State	Percent of counties with injurious shooting (n of N)	Total injured people	Injured people per 100k	Case fatality rate	Median within-county victim count [IQR]
United States	56 (1748 of 3,143)	10,617	3.3	55%	1 [0, 3]
Alabama	78 (52 of 67)	218	4.5	48%	2 [1, 3]
Alaska	41 (12 of 29)	58	7.9	72%	0 [0, 1]
Arizona	100 (15 of 15)	411	5.8	65%	8 [4, 18]
Arkansas	53 (40 of 75)	146	4.9	55%	1 [0, 3]
California	83 (48 of 58)	1458	3.7	59%	7 [1, 22]
Colorado	56 (36 of 64)	323	5.7	64%	1 [0, 2]
Connecticut	88 (7 of 8)	50	1.4	42%	3 [1.5, 13]
Delaware	100 (3 of 3)	27	2.8	56%	8 [3, 16]
District of Columbia	N/A	36	5.2	36%	N/A
Florida	81 (54 of 67)	701	3.3	56%	4 [1, 11]
Georgia	57 (91 of 159)	407	3.9	50%	1 [0, 3]
Hawaii	60 (3 of 5)	42	3.0	71%	3 [0, 13]
Idaho	52 (23 of 44)	79	4.5	63%	1 [0, 2]
Illinois	39 (40 of 102)	261	2.1	43%	0 [0, 1]
Indiana	58 (53 of 92)	217	3.2	48%	1 [0, 2]
Iowa	32 (32 of 99)	70	2.2	51%	0 [0, 1]
Kansas	35 (37 of 105)	111	3.8	45%	0 [0, 1]
Kentucky	52 (62 of 120)	189	4.2	57%	1 [0, 2]
Louisiana	67 (43 of 64)	232	5.0	48%	1 [0, 3]
Maine	81 (13 of 16)	37	2.8	59%	2 [1, 3]
Maryland	71 (17 of 24)	161	2.7	52%	2.5 [0, 7]
Massachusetts	86 (12 of 14)	93	1.4	41%	6 [1, 11]
Michigan	48 (40 of 83)	181	1.8	51%	0 [0, 2]
Minnesota	37 (32 of 87)	108	1.9	62%	0 [0, 1]
Mississippi	55 (45 of 82)	158	5.3	49%	1 [0, 2]
Missouri	52 (60 of 115)	308	5.0	49%	1 [0, 2]

Montana	43 (24 of 56)	50	4.7	76%	0 [0, 1]
Nebraska	20 (19 of 93)	47	2.4	51%	0 [0, 0]
Nevada	53 (9 of 17)	180	6.0	60%	1 [0, 4]
New Hampshire	100 (10 of 10)	23	1.7	70%	1.5 [1, 3]
New Jersey	95 (20 of 21)	132	1.5	54%	3 [1, 8]
New Mexico	76 (25 of 33)	195	9.3	60%	2 [1, 6]
New York	65 (40 of 62)	246	1.3	46%	1 [0, 3]
North Carolina	76 (76 of 100)	304	3.0	56%	1.5 [1, 4]
North Dakota	26 (14 of 53)	28	3.7	39%	0 [0, 1]
Ohio	61 (54 of 88)	306	2.6	52%	1 [0, 3]
Oklahoma	75 (58 of 77)	280	7.1	63%	1 [1, 4]
Oregon	67 (24 of 36)	149	3.6	63%	1.5 [0, 4]
Pennsylvania	76 (51 of 67)	267	2.1	49%	1 [1, 4]
Rhode Island	60 (3 of 5)	15	1.4	27%	1 [0, 2]
South Carolina	78 (36 of 46)	178	3.5	49%	2 [1, 4]
South Dakota	27 (18 of 66)	38	4.3	50%	0 [0, 1]
Tennessee	71 (67 of 95)	283	4.2	54%	1 [0, 3]
Texas	52 (131 of 254)	947	3.3	55%	1 [0, 2]
Utah	45 (13 of 29)	104	3.3	63%	0 [0, 1]
Vermont	57 (8 of 14)	19	3.0	47%	1 [0, 2]
Virginia	54 (72 of 134)	196	2.3	51%	1 [0, 2]
Washington	64 (25 of 39)	273	3.7	63%	2 [0, 6]
West Virginia	51 (28 of 55)	91	5.0	63%	1 [0, 3]
Wisconsin	57 (41 of 72)	158	2.7	60%	1 [0, 3]
Wyoming	48 (11 of 23)	26	4.5	69%	0 [0, 2]

Figure 2. State variation in frequency of injurious shootings by police, 2015-2020

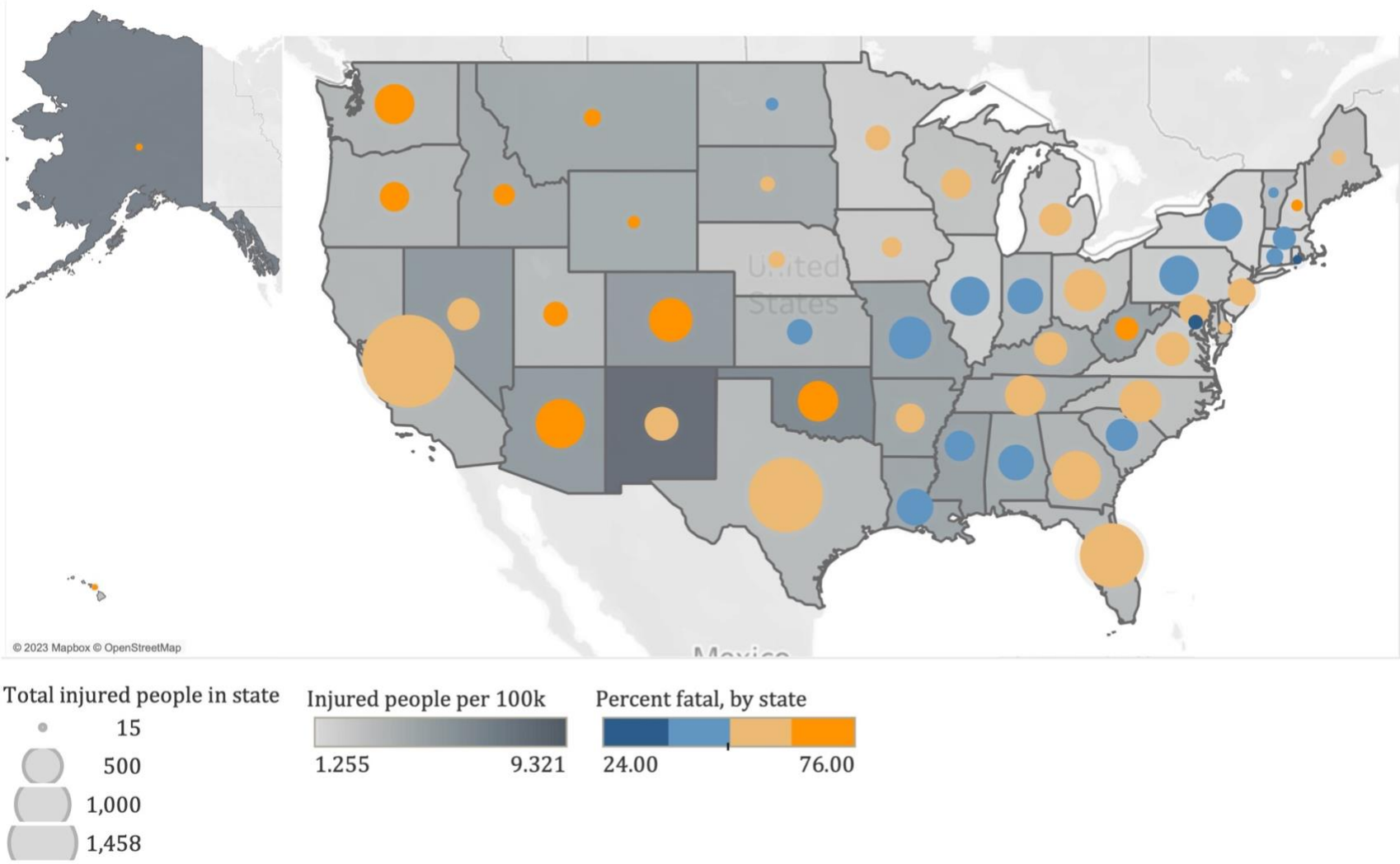


Table 2. Social and policy correlates of shootings by police within counties of the United States, 2015-2020

Characteristic	Bivariate Model[1]			Multivariate Model[2]		
	IRR	p-value	95% CI	IRR	p-value	95% CI
Social Context – Social Stratification & Exposure						
State-level Characteristics						
Population Total	1.00***	<0.001	1.00 – 1.00	Excluded, county value used		
Income Inequality (Gini, percent)	1.26***	<0.001	1.23 – 1.29	Excluded, county value used		
Poverty Rate	1.01	0.125	1.00 – 1.03	Excluded for county gini		
Percent Population Non-White	1.04***	<0.001	1.03 – 1.04	Excluded, county value used		
Incarceration Rate (prisons)	1.00	0.916	1.00 – 1.00	Excluded for parsimony		
Percent Unemployment	1.16***	<0.001	1.13 – 1.19	0.98	0.560	0.90 – 1.06
Percent Population Veterans	0.85***	<0.001	0.83 – 0.87	1.00	0.884	0.96 – 1.05
Population Unhoused (per 100k)	1.01***	<0.001	1.00 – 1.01	1.00	0.315	1.00 – 1.00
Violent Crime Rate (per 100k)	1.00***	<0.001	1.00 – 1.00	1.00*	0.034	1.00 - 1.00
Estimated Gun Prevalence (FS/S)[3,4]	0.05***	<0.001	0.03 – 0.08	0.60	0.583	0.10 – 3.67
Prevalence of Any Mental Illness (% Adults)	0.91***	<0.001	0.88 – 0.93	1.01	0.674	0.97 – 1.04
Unmet Mental Health Needs (% Adults, 2019)	0.97	0.059	0.95 – 1.00	0.98	0.633	0.90 – 1.07
Unmet Alcohol Use Disorder Needs (% Adults, 2019)	1.02	0.101	1.00 – 1.04	0.94	0.202	0.86 – 1.03
Unmet Substance Use Disorder Needs (% Adults, 2019)	1.23***	<0.001	1.18 – 1.28	1.25***	<0.001	1.10 – 1.43
Assaults on Law Enforcement Officers (firearm, knife)	1.09***	<0.001	1.07 – 1.10	1.00	0.708	0.99 – 1.01
County-level Characteristics						
Population Total	1.00***	<0.001	1.00 – 1.00	1.00***	<0.001	1.00 – 1.00
Income Inequality (Gini, percent)	1.18***	<0.001	1.17 – 1.20	1.05***	<0.001	1.03 – 1.07
Percent Population Non-White[4]	1.04***	<0.001	1.04 – 1.05	1.04***	<0.001	1.02 – 1.06
Sworn Law Enforcement Officers (2017 estimate)	1.00***	<0.001	1.00 – 1.00	1.00	0.762	1.00 - 1.00
Percent Population 65 or Older	0.84***	<0.001	0.84 – 0.85	0.95***	<0.001	0.94 – 0.97
Rurality Designation						

Urban	*Ref*	n/a	n/a	*Ref*	n/a	n/a
Rural	0.06***	<0.001	0.05 – 0.06	0.25***	<0.001	0.20 – 0.31
Suburban	0.13***	<0.001	0.12 – 0.14	0.30***	<0.001	0.27 – 0.34
Reporting Presence: County had no newspapers in 2019	0.38***	<0.001	0.32 – 0.46	0.65**	0.003	0.49 – 0.86
State-level & County-level Interaction Characteristics						
Gun ownership + County Percent Population Non-White[4]	0.70***	<0.001	0.67 – 0.72	0.94***	<0.001	0.91 – 0.97
Policy Context – Social Stratification & Exposure						
State-level Characteristics						
High School Grad Rate, Black Residents	0.98***	<0.001	0.98 - 0.99	Excluded, ratio used		
High School Grad Rate, AI/AN Residents	0.99***	<0.001	0.98 - 0.99	Excluded, ratio used		
High School Grad Rate, Hispanic Residents	0.98***	<0.001	0.98 – 0.99	Excluded, ratio used		
High School Grad Rate, White Residents	0.96***	<0.001	0.95 – 0.97	Excluded, ratio used		
High School Grad Rate Ratio, Black : White Residents	1.66*	0.033	1.04 – 2.65	0.88	0.749	0.42 – 1.87
High School Grad Rate Ratio, AI/AN : White Residents	1.72*	0.022	1.08 – 2.75	0.95	0.897	0.47 – 1.94
High School Grad Rate Ratio, Hispanic : White Residents	12.03***	<0.001	5.82 – 24.83	0.95	0.926	0.30 – 3.00
Permitless Concealed Carry Weapons Policy (CCW)	0.71***	<0.001	0.63 – 0.80	1.23**	0.007	1.06 – 1.44
Permit to Purchase Policy (PTP)	0.76***	<0.001	0.68 – 0.85	0.56**	0.001	0.39 – 0.79
Extreme Risk Protection Order Policy (ERPO)	2.93***	<0.001	2.57 – 3.35	0.94	0.251	0.84 – 1.05
Per Capita Spending, Total	1.00*	0.014	1.00 – 1.00	Excluded, itemized spending used		
Per Capita Spending on Corrections	1.01***	<0.001	1.00 – 1.01	Excluded, police spending used		
Per Capita Spending on Health	1.00***	<0.001	1.00 – 1.00	1.00*	0.048	1.00 – 1.00
Per Capita Spending on Police	1.00	0.090	1.00 – 1.00	1.00	0.532	1.00 – 1.00
Per Capita Spending on Public welfare	1.00***	<0.001	1.00 – 1.00	1.00	0.589	1.00 – 1.00
Per Capita Spending Ratio, Police : Public Welfare	0.85***	<0.001	0.82 – 0.88	Excluded, itemized spending used		
Per Capita Spending Ratio, Corrections : Public Welfare	0.98	0.060	0.97 – 1.00	Excluded, itemized spending used		
Per Capita Spending Ratio, Policing : Health	1.91***	<0.001	1.75 – 2.07	Excluded, itemized spending used		
County-level Characteristics						
Residential Segregation – Non-White vs White	1.03***	<0.001	1.03 – 1.04	1.01***	<0.001	1.01 – 1.02

Poverty Rate Ratio – Black vs White	0.96**	0.003	0.94 – 0.99	0.96**	0.008	0.93 – 0.99
Poverty Rate Ratio – Native vs White	1.06***	<0.001	1.04 – 1.09	1.01	0.527	0.99 – 1.03
Nongeographic Characteristics - Time						
Year	1.02	0.180	0.99 – 1.04	1.06*	0.015	1.01 - 1.12

Notes: Washington, D.C. excluded. *p < 0.05, **p < 0.01, ***p <0.001. AI/AN = American Indian or Alaskan Native. 1=The bivariate model only controls for year, allowing for time variance within a cross-sectional analysis of a panel dataset. 2=The multivariate, fixed effects model includes all indicated variables, including a gun ownership interaction variable to improve the county-level estimation of the state gun ownership proxy, and allows for two levels of clustering (year within county, within state). 3=State-level gun prevalence is estimated by the portion of suicides in a state completed with a firearm (i.e., firearm suicides (FS) / suicides (S)). 4= Within the otherwise unadjusted (after controlling for year) interaction model, each unit increase in state firearm prevalence and percentage increase in non-white county population (main effects) were associated with 20.5-times (p<0.001, 95% CI: 10.29 – 40.83) and 1.28-times (p<0.001, 95% CI: 1.26 – 1.31) higher prevalence of injurious shootings by police, respectively.

Chapter Five: Conclusion

Summary of Findings

This dissertation sought to expand knowledge about the character, consequence, and social and policy correlates of injurious shootings by police in the United States. As "the second face of the state,"[9] one might expect the powers and results of policing to be subject to full, democratic scrutiny. Instead, the police are uniquely powerful in their capacity for largely discretionary firearm use, while remaining shielded from scrutiny by a fragmented and generally opaque system of oversight. Despite decades of voiced concern,[75] there remains no national mandate for public disclosure and documentation of police use of deadly force. Where governmental transparency has lacked, media repositories have incrementally filled the gaps, beginning with a focus on fatal injuries. In continuation of these efforts to improve accountability and inform prevention, this dissertation consisted of 3 studies that collectively form a more thorough accounting and analysis of injurious shootings by police. The key findings of each of these studies, individually and collectively, are summarized here.

Aim 1a: Describe total people injured or killed in shootings by police in the United States using an up-to-date, multi-year nationwide dataset. Aim 1b: Compare characteristics of fatal versus nonfatal injurious shootings nationally.

This manuscript introduced and explored the novel dataset that was the basis for this dissertation. Prior research on police shootings or other uses of deadly force had been limited by jurisdiction or outcome; this study analyzed six years of nationally comprehensive data on fatal and nonfatal injurious shootings by police. Results indicated that from 2015-2020, an annual average of 1,770 people were injured in shootings by

police. Fifty-five percent of injured people died. Case fatality rates varied by incident type, weapon involvement, and victim demographics, indicating that fatality studies represent an uneven snapshot of the whole.

When a shooting injury occurred, more frequently fatal incidents tended to involve threats (e.g., assaults, suicidal crises, domestic violence) or dispatched engagements (e.g., wellbeing checks, behavioral health needs). Within these themes, emerged a second important observation in the relatively high lethality of injuries that occurred in association with police responses to social needs. Injuries that were less frequently fatal included traffic stops, injuries to people who were unarmed or armed with a vehicle, juveniles, and injuries to people described as Hispanic or non-Hispanic Black. These "less lethal" incidents represent shootings that have been inadequately represented in prior analyses of fatal injuries only.

Despite these distinctions, the broad similarities between fatal and nonfatal injurious shootings overall imply that future combined-outcome analyses would be justified without necessary stratification. At the same time, this study revealed that analyses of fatal injuries, alone, inadequately represent injurious shootings more broadly. Moreover, such studies underestimate racial disparities in total burden of injury from shootings by police.

Aim 2a: Compare the incidence of injurious shootings by police in urban, suburban, and rural areas of the United States from 2015 to 2020. Aim 2b: Cross-sectionally describe the prevalence and incidence of characteristics associated with injurious shootings by rurality.

Building on findings from Aim 1, this manuscript shifted the analytic focus to victims' social position, as defined by an urban, suburban, or conceptually rural geographic social context. This study was motivated by research that suggested that per capita fatal shootings by police were cross-sectionally comparable in urban and rural jurisdictions of the US (2015-2017)[29] but that urban and rural trends may differ.[34] This study also found that, contrary to common assumptions of an essentially urban nature, injurious shootings by police occurred at substantial frequencies and rates in rural areas of the US. Depending on how rurality was defined, injury incidence in rural areas approached or exceeded injury incidence in urban areas from 2015-2020.

Stratified by rurality context, the specific characteristics of shooting exposures and injured persons were largely similar. Across the urban-rural continuum, encounters commonly preceding injurious shootings included domestic violence incidents, traffic stops, and reports of shots fired. Racial disparities were found in all contexts. However, as rurality increased (from urban, to suburban, to town and rural jurisdictions), more shooting injuries involved behavioral health needs, dispatched interactions, single responders, sheriffs, or multiple agencies firing their weapons. Findings from this study suggest that to sustainably reduce injuries from shootings by police nationally, interventions and reforms need to be tailored to the characteristics, constraints, and agents of policing in urban and non-urban jurisdictions, alike.

Aim 3a: Describe state- and county-level variation in injurious shootings by police. Aim 3b: Analyze the association between social and policy characteristics of the state or county and county-level rates of injurious shootings by police in the United States.

Building on Aim 2, this study explored an alternative dimension of geographic variation, county and state aggregations. It employed multilevel modeling methods to analyze society's structural and compositional factors associated with inequitable injury burden from shootings by police locally. Across the 6-year pooled timeframe (2015-2020), 56% of US counties were found to have experienced at least one injurious shooting. State prevalence, incidence, and lethality of injurious shootings by police varied considerably. Analytic results suggested that multiple social and policy determinants were associated with variation in shooting injury occurrence. In the fully adjusted model, state statutes requiring permits to purchase firearms (PTP) or to carry concealed weapons (CCW) were associated with lower county injury incidence. After controlling for other demographic and structural characteristics, counties in states with PTP had 44% lower injury incidence, and counties in states that allowed permitless CCW had 23% higher injury incidence. Additionally, for each state-level percentage increase in adults with self-reported unmet substance use disorder (SUD) needs, an associated 25% increase in counties' injury incidence was observed. For each percentage increase in county income inequality, incidence of injurious shootings by police increased by 5%. Neither ERPO statutes nor state spending on health, policing, or public welfare were found to be associated with injury incidence locally.

Synthesis of Aims 1-3

In addition to the results emphasized above, several patterns emerged from the synthesis of Aims 1-3. First, consistent patterns in vulnerability were seen among Black, Hispanic, and Native American men. For each of these groups, disparities were more pervasive and more severe than suggested by prior research. Second, patterns of

vulnerability associated with the nations' insufficient response to behavioral health needs was also evident. These incidents comprised 23% of injurious shootings and (after adjusting for the involvement of other incident and victim characteristics) were 38% more likely to be fatal than incidents without behavioral health involvement. Unmanaged SUD appeared to be especially significant, as indicated by analyses of the social and policy correlates of county injury incidence. Third, despite strong assurances of data validity and reliability, results indicated an ongoing need for formalized, mandatory and systematic surveillance of police use of force.

Strengths and Limitations

The studies presented are based on a novel dataset, built through rigorous, multiple-coder processes, including cross-referencing to validated sources. These strengths bolster confidence in internal data validity. Additionally, strong assurances of reliability were found in the first study's findings of consistency with prior national studies' estimates of fatal injuries, as well as regional studies' descriptions of fatal and nonfatal injuries. In the second study, rural, suburban, and urban jurisdictions' comparable prevalence of unknown characteristics offers assurances of geographic reliability in quality of reporting, presuming incidents were reported. From this dataset, the first multi-year, nationwide analyses of fatal and nonfatal injurious shootings by police were possible. By increasing power, the inclusion of multiple years and outcomes enabled more specific categorical analyses and helped to advance knowledge of shootings by police in non-urban communities of the United States. Collectively, these represent gains to external validity. Analytically, additional strengths included the use of statistical methods to account for within-group

correlation in county and state characteristics and sensitivity analyses to test measurement validity (e.g., rurality definitions, duty status criteria) and robustness to outlier effects.

Some limitations must also be considered. As indicated by the third study, a significantly lower rate of injury was associated with a county "news desert" designation. This suggests risk for underreporting of injuries, which likely varies regionally and by injury outcome. Thus, despite offering a vastly more comprehensive characterization of injuries from shootings by police, the estimates presented here are likely still conservative. Additionally, this dissertation's outcome of interest was injurious shootings by police. Other uses of force can lead to injury and death, and discharge of weapons (a use of force, in itself) can occur without injury. Though important, such incidents were not included in these studies, owing to an expectation that they would not be as comprehensively discoverable through news sources. Thus, in many ways, this dissertation's epidemiologic gains amount to a far clearer view of the tip of the iceberg.

Uncertainty and data non-transparency complicated multiple measures and interpretations. First, the frequency and variability of typical policing actions nationally is not well documented, complicating the interpretation of patterns of policing associated with injurious shootings. This dissertation examined victim, incident, county, and state characteristics. Organizational characteristics were limited to policing agency type. Additional research on the role of organizational characteristics within a comprehensive, national context is warranted. Second, the lack of a national gun-owner registry and county censoring of the suicide proxy (itself a poorer estimator of gun ownership in urban and racially diverse contexts), restricted capacity to study the role of local gun prevalence. Third, the designation of race or ethnicity in the novel dataset underlying this research was

discovered to be uneven between fatal and nonfatal outcomes. This was due to a conservative designation protocol that was unmatched in the cross-referenced, validated dataset of fatal outcomes. At time of writing, this aspect of the dataset was being corrected to enable more complete estimates in future analyses.

In recognition of the need for incremental advances in a data-challenged field of study, this dissertation research was largely cross-sectional and descriptive. Limited, preliminary exploration of time variance was included in Aim 2's examination of rurality definitions and Aim 3's panel design with year control. Otherwise, caution was exercised to acknowledge ambiguous temporal precedence and to ground causal hypotheses in theory. Finally, the inclusion period (2015-2020) contained an historic year. Additional sensitivity analyses tested for undue influence from 2020's data disruptions, historic violence, gun purchasing spikes, and heightened police-and-community tensions. Results suggest that consequences to pooled estimates were minimal. Impact beyond 2020 is a question for future research.

Policy Implications

Applying the Social Basis of Disparities in Health conceptual framework to the results presented here illuminates multiple potential mechanisms for reducing disparities in injuries from shootings by police. Specifically, policies can 1) elevate vulnerable individuals' social position, 2) decrease exposures to policing encounters and related shootings, or 3) address patterns in individuals' vulnerability to fatal and nonfatal injury.[1] This study finds evidence in support of several of these propositions.

Mechanism 1: Policies to elevate vulnerable individuals' social position

Invest in social justice programs and initiatives. Income inequality, a measure of county social stratification, was found to be a significant correlate of higher shooting injury incidence. More subtle, but also significant, was residential segregation among non-white and white residents of a county. However, per-capita spending on state health and public welfare programs were found to have little association with local injury incidence. This suggests that, at least with regard to policing implications, improving social position may require local attention. Examples of promising social justice investments can be found in multiple communities of the US. For example, in Richmond California (and other cities since), Advance Peace has invested in people identified to be the city's most influential, violence-involved individuals. The program focuses on healing traumas, building social capital and life skills, expanding worldviews through "transformative travel," and providing earned stipends to those who are most at-risk and influential to cycles of violence.[129] Other cities have committed to paying reparations to Black residents, in partial acknowledgement of historical discrimination and its lasting consequences to generational wealth.[130,131] By elevating the socioeconomic standing of individuals and groups who face entrenched and disproportionate risk for injurious encounters with police, these and other such policies may be promising strategies for local reductions in policing-related harms. Other communities should follow their lead.

Incorporate unmet substance use disorder needs into crisis fund allocation and targeting. Another powerful correlate of injurious shootings was the percentage of adults in a state with unmet needs related to SUD. In adjusted models, each percentage increase in adults with unmet needs was associated with 25% higher county incidence of injurious shootings. This presents another opportunity for communities to invest in their

most vulnerable residents. While, again, locally focused implementation may be needed, state and federal policies may also be implicated. State block grant funds to support community mental health services are allocated by the US Congress, under authorization of the Public Health Service Act with administrative support from SAMHSA.[132] These funds are allocated according to state population size and prevalence of mental illness. A portion of funds is earmarked for crisis services.[123]

Findings from the studies presented here suggest that a substantial portion of individuals who are injured in shootings by police were also experiencing acute or chronic manifestations of undermanaged behavioral health conditions. After adjusting for county demographics, state prevalence of mental illness, state funding for health and public welfare services, and multiple other factors, undermanaged SUD among adults remained a powerful, state-level correlate of county injury incidence. This implies that if investments in crisis interventions are motivated, at least in part, by a goal of reducing policing-related harms, unaddressed SUD may be a distinctly important metric for crisis funding, response, and prevention.

Policy mechanisms for potentially reducing police-involved shooting injuries by elevating the social standing of individuals who are struggling with behavioral health needs include: adding state prevalence of undermanaged substance use disorders to criteria for allocating Community Mental Health Services Block Grants, targeting SAMHSA spending guidance to include focused services for unmet substance use disorder needs, and assuring that grantees' reporting requirements include a focus on closing priority need gaps.

Mechanism 2: Policies to decrease exposures to policing encounters and shootings

Adopt PTP and CCW licensing statutes for safer gun possession and carrying. Of the policy variables assessed in Aim 3, two state gun statutes were most strongly associated with county-level shooting injuries. Specifically, permitless CCW was associated with higher county incidence of injurious shootings by police; PTP statutes were associated with lower incidence. In recent years, a trend toward more permissive (i.e., permitless) concealed carrying and minimal regulation of firearm purchasing has been documented.[85,133] Despite this deregulation trend, most Americans do not favor permitless concealed carry,[134] nor do they believe that more permissive CCW would make them feel safer.[135] Most Americans also endorse PTP policies.[134] In 2022, Oregon voters approved a new state PTP statute, an indication that political will to reverse recent trends exists.[136] By introducing mechanisms for law enforcement agencies to improve the safety of CCW and firearm purchasing in a more controlled and preventive manner, CCW licensing and PTP policies may reduce the frequency of actual or anticipated high-risk encounters with police, thereby preventing shooting injuries. More states should adopt these policies, which should include procedural assurances of equitable implementation.

Invest in non-policing interventions for violence prevention and behavioral health promotion. A second strategy for decreasing exposures to police and shootings by police is to limit police involvement in incidents for which law enforcement intervention may not be necessary. In 2021, 72% of Americans, including 79% of Black Americans, agreed that individuals displaying symptoms of mental illness should be diverted to health care services rather than arrested.[47] Building on prior recommendations to improve the targeting of crisis funds, these and other sources of public funding should additionally prioritize non-policing interventions. Examples of such interventions with evidence of

strong public support include community-based violence intervention programs,[47] hospital-based violence intervention programs,[47] the 988 Suicide and Crisis Lifeline,[137] and local 988 referral services. Proportionate access to residents of rural communities must be assured in these investments.

Mechanism 3: Policies to address patterns in individuals' vulnerability to fatal and nonfatal injury

Mandate standardized reporting for all law enforcement agencies. Fund research to identify and evaluate interventions. The United States' system of policing is a complex and highly fragmented network of at least 18,000 largely autonomous agencies.[8] Required record-keeping and reporting standards, use of force authorization, officer protections, and potential consequences of misconduct are largely defined by states. Much heterogeneity exists.[10] Few states require reporting of nonfatal use of force.[50] Such state and local differentiation, fragmentation, and non-transparency complicate efforts to define patterns in policing-related harms, identify agency-level determinants of shooting frequency, or implement and evaluate broadly effective injury prevention strategies. For officer and agency accountability and future capacity to evaluate existing and recommended interventions, sustainably reliable data are essential. The FBI introduced the National Use-of-Force Data Collection system in 2019, but reporting remains too sparse for national use.[138] A federal mandatory reporting standard and sustained funding to support research is urgently needed.

Priorities for Future Research

Opportunities for future research are many. This dissertation has demonstrated that the newly available dataset validly and reliably introduces near-compressive national

estimates of injurious shootings by police over a 6-year span to the study of policing-related consequences. With this larger dataset, this dissertation demonstrated capacity to examine more detailed characteristics and contexts of shootings that had previously been minimally scrutinized (e.g., specific types of incidents, rural jurisdictions). Data abstraction continues into 2021 and efforts are in progress to improve race and ethnicity designations, assuring ongoing data relevance. Ongoing research needs include 1) defining the problem and describing its individual and societal impact and 2) identifying and evaluating problem solutions.

Define the problem

Further define behavioral health needs and urban/rural differences. An immediate next research opportunity is more fully detail the involvement of behavioral health needs in shootings by police. The current research categorically identified behavioral health involvement, noting substantially incomplete overlap with dispatched encounters for suicidal or behavioral health crises. Future research should employ further content analysis to identify patterns of behavioral health needs, injurious shooting outcomes, and their association with pre-encounter details that may help to preventively triage and train crisis services. Parallel analysis of 911 or 988 dispatch records may help to contextualize findings. Future research should also examine potential contextual differences in urban-rural firearm involvement.

Improve methods for studying determinants of survival. Unlike most forms of trauma, distance from specialized tertiary care, a frequently hypothesized determinant of survivorship, counterintuitively has tended to not be significantly associated with survival from shootings by police.[57] Distance to trauma center may be confounded by mode of

transport (e.g., ambulance, helicopter), mismeasured (e.g., as through non-exclusion of onsite deaths, which are likely more prevalent in shootings by police), or under-differentiated because of geographic clustering of incidents near trauma centers in urban shootings by police. Future research should seek to improve understanding of the role of distance to trauma care to reduce potential confounding in future studies of fatal and nonfatal outcomes. More specifically, these characteristics could be identified within a subset of the present dataset to directly examine onsite death as a potential mediator or helicopter transport as a potential moderator of survivorship.

Quantify injury consequences to individuals and society. The work presented here focused on societal correlates and the first three layers of individual manifestations of injury disparities (i.e., social position, exposures to policing and shootings by police, injury outcomes), as conceptualized by Diderichsen et al. A fourth conceptualized layer of injury disparities is consequences. Future research should explore other broad-scale individual and community consequences of injurious shootings. Such research may help to elevate the policy significance of nonfatal injuries and clarify the mechanisms of perpetuated harms. For example, with the addition of nonfatal injuries, quality of life years lost from shootings by police could be estimated. Prior research has cross-sectionally identified local associations between neighborhood police presence and pre-term birth outcomes.[139] Other health manifestations of toxic stress in vulnerable life-course stages, such as adolescence and young adulthood, may be similarly associated with police contact and may be compounded by direct or vicarious exposure to armed interventions and physical injury. Future research should examine the relationship between injury incidence and short-term physical health indicators with potentially long-term consequences (e.g., accumulation of

Adverse Childhood Experiences, juvenile and young adult sleep disturbances, feelings of sadness or hopelessness, and suicidal ideation).

Identify the role of institutions in shooting injury incidence. The institutionalized structures of policing are both opaquely localized and powerfully coalesced nationally.[140,141] This dissertation focused primarily on societal factors and incident or victim characteristics; more research is needed to illuminate meaningful variation in organizational policies and procedures. For example, future research should analyze the relationship between variation in specific procedural powers of police unions and local injurious shootings by police. This could be done by linking national injury data to legal content analyses of metropolitan union contracts.[142,143] Other research could explore the relationship between police overtime spending or sheriffs' tenure on injury outcomes.

Analyze 2020 disruptions through longitudinal analyses. 2020 was a momentous year, whose study has been challenged by co-occurring and subsequent data losses related to pandemic collection challenges and agency disengagement in new federal data collection systems. Media-based datasets may present a viable alternative for longitudinally examining police uses of force, including direct examination of 2020 impacts. The inclusion of nonfatal injuries, albeit alongside restriction to firearm-specific use of force, improves capacity for longitudinal analyses. Future research should examine the relationship between shooting injuries and pre- versus post-2020 gun-buying patterns, public opinion on public safety reforms, expectations of safety, and social media trends in policing-related public discourse.

Identify and evaluate solutions

Identifying reporting gaps and narrative contributors. Reliance on media reporting sources for injury surveillance raises important questions about who goes uncounted and for whom details are disclosed and allowed to evolve. This research has identified that Black or Hispanic victims, injured juveniles, people shot during responses to traffic stops, and people described by police as using a vehicle as a weapon have been undercounted prior in surveillance of fatal injuries only. Future research should directly investigate patterns in underreporting in injurious shootings by evaluating correlates of cases with unknown victim age or missing race indicators. Conversely, detailing the characteristics of cases that receive follow-up reporting and publication of non-policing perspectives may be of value to establishing and interpretation future injury surveillance systems.

Continue analysis of Extreme Risk Protection Orders. State adoption of ERPO statutes have expanded in recent years, but local implementation has been inconsistent. The role that this firearm-related crisis intervention has on injurious shootings by police is unclear. Future research should examine the impact of locally differentiated uptake on local injury outcomes. Findings may be informative to police-supported local uptake and safety protocols for both short- and longer-term injury prevention.

Evaluate crisis investments and police reforms on injurious shooting outcomes. A trend in US and international research is to examine the relationship between manifestations of structural racism and policing, but racism within the institution of policing, itself, is systemic and structurally reinforced.[144,145] This suggests that policies ought to intervene directly on policing, not only the social and historical contexts it occurs within. Future research should evaluate the impact of emerging reforms, non-policing crisis

response initiatives, and stronger state use-of-force statutes, which have surged since 2020,[96] on shooting-related injuries. Longitudinally modeling per capita investments in crisis responses (e.g., as through earmarked allocation of state block grant funds) and state injurious shooting outcomes may be one design that is more immediately possible despite statistically "rare event" challenges. With time, the addition of county-specific policing reforms and non-policing crisis interventions would also be valuable. Public support for reforms and crisis-response alternatives is connected to public interest in reducing policing-related harms. Evaluations of these interventions should include such outcomes.

Test 988 knowledge and acceptability. In 2020 a new nationwide phone line for suicidal and mental health crises was introduced. The new phone number was meant to be a memorable substitute to 911 for mental health emergencies[146] and a mechanism for better linking behavioral health needs to behavioral health responses.[147] But, popular discourse has warned of risks for police involvement following engagement with 988.[146,148] Though recognized as a knowledge-related barrier to uptake, 988 program leaders describe police involvement through transfer to 911 as rare, occurring in about 2% of contacts.[149] Prior studies of racial differences in public support for police reform and accountability,[135] alongside differences in injury burden presented here, suggest that concerns about police involvement in 988 may also be unequal. Such beliefs may produce unequal use, compounding inequities in access to behavioral health services and diversion from policing services for behavioral health needs. These hypotheses could be tested in an experimental survey design to explore for whom and under what conditions help-seeking intentions involving 988 versus 911 differ for needs unrelated to crime. Findings would be

informative to messaging, protocol development, and equity investments in an expanding national point-of-access to behavioral health supports.

Summary

This dissertation grew from a recognition that the harmful consequences of policing are unequally experienced and insufficiently understood. Clearly, not only deaths but also survivors of shootings by police ought to be counted. Thanks to the work of many, we now have a larger (and growing) dataset to enable the study of more focused or more nuanced questions about shootings by police and related public safety interventions. The similarities found between fatal and nonfatal injurious shootings suggest an acceptability of research designs that examine combined injury outcomes. At the same time, fatal and nonfatal shootings are different enough that to only look at the fatal half misses an important part of the picture. From a policy perspective, these findings may be especially useful to advocates for mandatory reporting systems and non-policing, preventive interventions. From a practice perspective, the descriptive details provided should inform triage and training to assure health systems are prepared to safely respond when police involvement may be harmful and may not be necessary.

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Appendix A

Data Abstraction Codebook

Table A1. Definitions of incident and person characteristics abstracted from the Gun Violence Archive

Characteristic	Definition	Incident- or injured person-level variable
Weapon type	Refers to weapons that were possessed at the time of the shooting and could have conceivably contributed to an officer's decision to shoot. Weapons that were possessed but undisclosed or unidentified until after the shooting would not meet criteria.	Incident: Reflects relevant weapon possessed by any non-officer on the scene. Injured person: Reflects the specific armed status of each injured person.
Single law enforcement officer response	Refers to whether the shooting officer was accompanied by another officer.	Incident
Agency type	Refers to the agency or agencies that fired injurious shots. Agency types include: local police, sheriff's office, state agency, special jurisdiction (e.g., school or university, park, transit, etc. when not operating within another type of law enforcement agency), constable or marshal, national agency, multiple agencies, and unknown.	Incident
Response type	Refers to who initiated the police-involved interaction prior to the shooting. Response types include: on view (when officers initiated the interaction or when officers were presented with a complaint while on patrol), dispatched (when interaction began with a 911 call), subject initiated (does not include when subject calls 911 themselves nor when a subject initiates aggression during an officer-initiated activity), and unknown.	Incident

Incident type	Refers to the stated reason for the initial police-involved interaction. When a situation evolved from what was originally stated, abstractors attempted to indicate the most up-to-date expectation of the incident, from law enforcement officer's perspective, at a time just prior to the interaction.	Incident
Assault	Refers to assaults not involving shots fired prior to police involvement and not related to domestic incidents.	
Burglary	Refers to theft of possessions without person involvement.	
Carjacking	Refers to actual or attempted theft of vehicle involving vehicle owner or occupant.	
Crash	Refers to vehicular disablement or collision, including reported hit-and-run.	
Disorderly conduct	Refers to complaints of loitering, public intoxication, lewd public conduct, etc.	
Dispute or disturbance	Refers to arguments not qualifying as domestic incidents or assaults, noise complaints, etc.	
Domestic disturbance, dispute, or violence	Refers to violence or argument in the household or between intimate partners or family members.	
Fire	Refers to incidents involving intentional or unintentional fire.	
Hostage	Refers to kidnapping or other hostage situation.	
Investigative	Refers to incidents such as surveillance activities, undercover operations, searching for missing person, or investigating a prior crime, not otherwise described as serving a warrant or attempting arrest.	
Involuntary commitment	Refers to incidents in which police were asked to escort someone to a mental health evaluation or	

	admission into a mental or behavioral health facility.	
Other	Examples include escaped prisoner, immigration-related incident, disaster rescue, eviction notice, parole check, dog complaint, fraud, fare evasion, etc.	
Pedestrian stop	Refers to interaction with pedestrian or cyclist involving possible citation.	
Robbery	Refers to theft of possessions with person involvement.	
Serving warrant or attempting arrest	Refers to arrest warrant, search warrant, etc. Typically officer-initiated.	
Shooting	Refers to shots fired. Includes observed, reported, and technology-detected.	
Stolen vehicle	Refers to reports of stolen vehicle and identification of stolen vehicle by license plate scanner.	
Subject initiated, not otherwise specified	Refers to a subject initiated interaction not otherwise categorized.	
Suicidal or behavioral health crisis	Refers to incidents involving threats of self-harm or other related behavior.	
Suspicious person or vehicle	Refers to incident described as “suspicious person” or “suspicious vehicle.”	
Threats	Refers to verbalized threats, including threats with a weapon.	
Traffic stop	Refers to interaction with vehicle operator involving possibility of citation.	
Trespassing	Refers to unwanted person on private property.	
Unknown	Includes cases in which incident type was unknown to the abstractor and cases in which incident type was reported as unknown to the responding officer(s) (e.g., as in 911 hang-up call).	
Vandalism	Refers to reports of graffiti or other property damage.	

Weapon complaint	Refers to report of a person with a gun, knife, or other weapon, not explicitly making threats.	
Wellbeing check	Refers to generally nonspecific request for police to check on a person's wellbeing. Distinct from suicidal or behavioral health crisis.	
Age	Entered as specified, where applicable, otherwise juvenile (0-17), adult (18+), or unknown	Injured person
Gender	Includes man, woman, transman or transwoman (subsequently collapsed into transgender), nonbinary (no cases submitted), or unknown.	Injured person
Race/Ethnicity	Entered as explicitly stated in publicly available source. Unknown or unspecified indicates information withheld by authorities or not explicitly reported by journalists.	Injured person
Unhoused	Refers to victims described as "homeless," "transient," with "no known address" or recently evicted.	Injured person
Mental or behavioral health issue	Abstractors documented specific objective or subjective but explicitly stated indicators of: • a named behavioral health condition that was potentially relevant to the situation, • dispatch to a mental health call, • positive toxicology results, • reports of victim as suicidal or alleged to have attempted "suicide by cop"	Incident
Officer duty status	All duty statuses refer to the officer(s) who fired shots during the injurious incident	Incident
On-duty	Officer(s) described as dispatched to a call or performing other on-shift work	
On- and off-duty	A combination of on-duty and off-duty officers are included among	

	the set of law enforcement officers who fired shots during the incident	
Off-duty acting as on-duty	Officer(s) described as both off-duty and behaving in an on-duty law enforcement capacity (e.g., responding to a call, identifying oneself as police, donning uniform to respond to neighbor request for help, etc.)	
Off-duty, second job	Officer(s) were off-duty from law enforcement role, but on-duty in supplemental employment, typically a security job, without explicit indication of behaving as or appearing to be a law enforcement officer (e.g., wearing department uniform, identifying self as police, pursuing subject beyond employer property or interests)	
Off-duty acting as off-duty	Officer(s) described as off-duty and not behaving in an on-duty law enforcement capacity (e.g., shots fired during residential break-in, victim of robbery, etc.) May include use of service weapon.	
Unknown	Status unclear or unstated	

Appendix B

Sensitivity Analysis Testing Expansive Duty-status Inclusion Criteria

Table B1. Fatal and nonfatal injurious shooting incidents, by event characteristic[1]

Incident Characteristic	Nonfatal Injurious Incident	Fatal Incident	% Fatal	Total Injurious Shooting Incidents (%)
Total	4,331	5,757	57.1	10,088 (100)
Officer Duty Status				
On-duty	4,344	5,735	56.9	10,079 (99.9)
On- and off-duty	3	6	66.7	9 (0.1)
Incident Weapon				
Unarmed	348	418	54.6	766 (7.6)
Firearm	2,297	3,283	58.8	5,580 (55.3)
Handgun[2]	856	1,326	60.8	2,182 (21.6)
Rifle[2]	210	333	61.3	543 (5.4)
Shotgun[2]	117	198	62.9	315 (3.1)
Multiple types, unspecified [2]	37	68	64.7	105 (1.0)
Service weapon[2]	39	57	59.4	96 (1.0)
Unknown[2]	1,084	1,363	55.7	2,447 (24.3)
Multiple, with firearm	24	25	51.0	49 (0.5)
BB or replica gun	174	225	56.4	399 (4.0)
Total firearm or gun, including "multiple with firearm" & "BB or replica gun"	2,495	3,533	58.6	6,028 (59.8)
Knife or other cutting/stabbing instrument	483	1,043	68.3	1,526 (15.1)
Vehicle	502	288	36.5	790 (7.8)
Blunt object	79	125	61.3	204 (2.0)
Multiple, without firearm	8	14	63.6	22 (0.2)
Service weapon concern[3]	16	29	64.4	45 (0.5)
Other	31	55	64.0	86 (0.9)
Weapon unknown	61	50	45.0	111 (1.1)
Armed status unknown	308	202	39.6	510 (5.1)
Single Law Enforcement Officer Response				
No	3,447	4,875	58.6	8,322 (82.5)

Yes	759	792	51.1	1,551 (15.4)
Both[4]	0	2	100.0	2 (<0.1)
Unknown	124	88	**41.5**	212 (2.1)
Agency type				
Local police	2,783	3,428	55.2	6,211 (61.6)
Sheriff's office	954	1,396	59.4	2,350 (23.3)
Constable or marshal	4	5	**55.6**	9 (0.1)
National agency	73	99	57.6	172 (1.7)
State police	224	338	60.1	562 (5.6)
Special jurisdiction	50	28	35.9	78 (0.8)
Multiple shooting agencies	207	439	68.0	646 (6.4)
Unknown	36	24	**40.0**	60 (0.6)
Response type				
On view	1,681	1,904	53.1	3,585 (35.5)
Dispatched to 911 call	2,547	3,759	59.6	6,306 (62.5)
By subject	51	51	50.0	102 (1.0)
Unknown	52	43	**45.3**	95 (1.0)
Incident Type				
Shooting	415	545	**58.4**	933 (9.3)
Assault	150	245	62.0	395 (3.9)
Crash (includes hit-and-run)	40	58	59.2	98 (1.0)
Disorderly conduct or dispute/disturbance	158	232	56.5	390 (3.9)
Domestic disturbance, dispute, or violence	557	1,040	65.1	1,597 (15.8)
Investigative	238	290	54.9	528 (5.2)
Robbery or carjacking	389	384	49.7	773 (7.7)
Burglary	121	98	44.7	219 (2.2)
Stolen vehicle	77	56	42.1	133 (1.3)
Suicidal or behavioral health crisis	234	391	62.6	625 (6.2)
Suspicious person or vehicle	252	279	52.5	531 (5.3)
Threats	69	141	67.1	210 (2.1)
Traffic stop	771	802	51.0	1,573 (15.6)
Trespassing	71	99	58.2	170 (1.7)
Warrant or arrest	376	589	61.0	965 (9.6)
Weapon complaint	199	245	55.2	444 (4.4)
Wellbeing check	53	100	65.4	153 (1.5)
Other[5]	103	138	57.3	241 (2.4)

Fire	9	13	59.1	22 (0.2)
Hostage	19	40	67.8	59 (0.6)
Involuntary commitment	10	11	**52.4**	21 (0.2)
Pedestrian stop	14	10	41.7	24 (0.2)
Subject initiated, not otherwise specified	16	22	**57.9**	38 (0.4)
Vandalism	11	16	59.3	27 (0.3)
Unknown	58	52	**47.3**	110 (1.1)

Notes: [1] = Includes only on duty and on and off duty multiple-responder incidents. [2] = Values may exceed total firearm-involved incidents because multiple gun types in a single incident were possible. [3] = Service weapon concern indicates that an officer stated they thought the subject might gain control of their service weapon. [4] = Both single and multiple officer involvement could occur if multiple shooting scenes were involved. [5] = In addition to the specified subgroups listed below, included within "other" incidents are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc. **Bold** indicates at least 2 percentage points deviation from main table estimate.

Table B2. Fatally and nonfatally injured persons, by event or person characteristic[1]

Incident or Person Characteristic	Nonfatally Injured	Fatally Injured	% Fatal	Total Injured Persons (%)
Total	4,597	5,790	55.7	10,387 (100)
Officer Duty Status				
On-duty	4,593	5,783	55.7	10,376 (99.9)
On- and off-duty	4	7	63.6	11 (0.1)
Person Weapon				
Unarmed	462	470	50.4	932 (9.0)
Firearm	2,346	3,295	58.4	5,641 (54.3)
Multiple, with firearm	13	17	56.7	30 (0.3)
BB or replica gun	153	207	57.5	360 (3.5)
Total firearm or gun, including "multiple with firearm" & "BB or replica gun"	2,512	3,519	56.7	6,205 (59.7)
Knife or other cutting/stabbing instrument	483	1,030	68.1	1,513 (14.6)
Vehicle	485	278	36.4	763 (7.3)
Blunt object	73	122	62.6	195 (1.9)
Multiple, without firearm	7	5	41.7	12 (0.1)
Other	107	113	51.4	220 (2.1)
Unknown	468	253	35.1	721 (6.9)
Agency type				
Local police	2,948	3,445	53.9	6,393 (61.5)
Sheriff's office	1,000	1,403	58.4	2,403 (23.1)
State police	234	342	59.4	576 (5.5)
National agency	79	100	55.9	179 (1.7)
Special jurisdiction	53	28	34.6	81 (0.8)
Constable or marshal	5	5	**50.0**	10 (0.1)
Multiple shooting agencies	239	443	65.0	682 (6.6)
Unknown	39	24	**38.1**	63 (0.6)
Age[2]				
Range	<1 to 93	6 to 91		
Mean of known ages (n=9,304; 60.0% fatal)	33	37	-	35.4 years
Median of known ages (n=9,304; 60.0% fatal)	31	35	-	33 years
Total juvenile count	201	103	33.9	304 (2.9)

Total adult count	4,201	5,655	57.4	9,856 (94.9)
Unknown	195	32	14.1	227 (2.2)
Gender				
Man	4,239	5,533	56.6	9,772 (94.1)
Woman	283	245	46.4	528 (5.1)
Transgender	1	10	90.9	11 (0.1)
Unknown	74	2	4.3	76 (0.7)
Race/Ethnicity				
Non-Hispanic, white	382	2,375	86.1	2,757 (26.5)
Non-Hispanic, Black	430	1,294	75.1	1,724 (16.6)
Hispanic, any race	309	973	75.9	1,282 (12.3)
American Indian or Alaskan Native	14	104	88.1	118 (1.1)
Asian or Pacific Islander	12	104	89.7	116 (1.1)
Other, including Middle Eastern-North African	4	13	76.5	17 (0.2)
Unknown or unspecified	3,446	927	21.2	4,373 (42.1)
Unhoused				
Yes	93	184	66.4	277 (2.7)
Response type				
On view	1,842	1,922	51.0	3,764 (36.2)
Dispatched to 911 call	2,649	3,774	58.8	6,423 (61.8)
By subject	52	51	49.5	103 (1.0)
Unknown	54	43	**44.3**	97 (0.9)
Incident Type				
Shooting	437	523	54.5	960 (9.2)
Assault	156	246	61.2	402 (3.9)
Crash (includes hit-and-run)	40	58	59.2	98 (0.9)
Disorderly conduct or dispute/disturbance	169	233	58.0	402 (3.9)
Domestic disturbance, dispute, or violence	566	1,044	64.8	1,610 (15.5)
Investigative	275	294	51.7	569 (5.5)
Robbery or carjacking	426	386	47.5	812 (7.8)
Burglary	125	99	44.2	224 (2.2)
Stolen vehicle	88	57	39.3	145 (1.4)
Suicidal or behavioral health crisis	236	390	62.3	626 (6.0)
Suspicious person or vehicle	264	280	51.5	544 (5.2)

Threats	70	141	66.8	211 (2.0)
Traffic stop	837	808	49.1	1,645 (15.8)
Trespassing	79	99	55.6	178 (1.7)
Warrant or arrest	402	597	59.8	999 (9.6)
Weapon complaint	206	245	54.3	451 (4.3)
Wellbeing check	54	100	64.9	154 (1.5)
Other[3]	109	138	55.9	247 (2.4)
Fire	9	13	59.1	22 (0.2)
Hostage	20	40	66.7	60 (0.6)
Involuntary commitment	11	11	**50.0**	22 (0.2)
Pedestrian stop	15	10	40.0	25 (0.2)
Subject initiated, not otherwise specified	16	22	**57.9**	38 (0.4)
Vandalism	11	16	59.3	27 (0.3)
Unknown	58	52	**47.3**	110 (1.1)
Behavioral health involvement, incident[4]				
Yes	772	1,597	67.4	2,371 (22.8)

Notes: [1] = Includes only on duty and on and off duty multiple-responder incidents. [2] = Age was entered as specified, where applicable. Otherwise, age was categorized as juvenile (ages 0-17), adult (ages 18+), or unknown. [3] = In addition to the specified subgroups listed below, included within "other" are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc. [4] = Behavioral health incidents include suicidal or self-harming behaviors, substance use, diagnosis of serious mental illness relevant to the incident, disability that may have been misinterpreted as a mental or behavioral health issue, and transportation or response to inpatient behavioral health facility. **Bold** indicates at least 2 percentage points deviation from main table estimate.

Table B3. Unadjusted logistic regression models predicting odds of fatal versus nonfatal injury[1]

Incident or Person Characteristic	OR	p-value	95% CI
Officer Duty Status			
On-duty	*Ref*	-	-
On- and off-duty	1.39	0.600	0.41 – 4.75
Person Weapon			
Unarmed	*Ref*	-	-
Firearm	1.38***	<0.001	1.20 – 1.59
Multiple, with firearm	1.29	0.502	0.62 – 2.68
BB or replica gun	1.33*	0.023	1.04 – 1.70
Knife or other cutting/stabbing instrument	2.10***	<0.001	1.77 – 2.48
Vehicle	0.56***	<0.001	0.46 – 0.69
Blunt object	1.64**	0.002	1.20 – 2.26
Multiple, without firearm	0.70	0.548	0.22 – 2.23
Other	1.04	0.803	0.77 – 1.39
Unknown	0.53***	<0.001	0.44 – 0.65
Agency type			
Local police	*Ref*	-	-
Sheriff's office	1.20***	<0.001	1.09 – 1.32
State police	1.25*	0.011	1.05 – 1.49
National agency	1.08	0.600	0.80 – 1.46
Special jurisdiction	0.45**	0.001	0.29 – 0.72
Constable or marshal	0.86	0.806	0.25 – 2.96
Multiple shooting agencies	1.59***	<0.001	1.36 – 1.87
Unknown	0.53*	0.014	0.32 – 0.88
Single Law Enforcement Officer Response			
No	*Ref*	-	-
Yes	0.75***	<0.001	0.67 – 0.84
Both[4]	1.50	0.741	0.14 – 16.53
Unknown	0.52***	<0.001	0.40 – 0.69
Age			
Where specified (n=9,304)[2]	1.03***	<0.001	1.02 – 1.03

Adult	*Ref*	-	-
Juvenile	0.38***	<0.001	0.30 – 0.48
Unknown	0.12	<0.001	0.08 – 0.18
Gender			
Man	*Ref*	-	-
Woman	0.66***	<0.001	0.56 – 0.79
Transgender	7.66	0.052	0.98 – 59.9
Unknown	0.21***	<0.001	0.01 – 0.08
Race/Ethnicity			
Non-Hispanic, white	*Ref*	-	-
Non-Hispanic, Black	0.48***	<0.001	0.42 – 0.56
Hispanic, any race	0.51***	<0.001	0.43 – 0.60
American Indian or Alaskan Native	1.19	0.539	0.68 – 2.11
Asian or Pacific Islander	1.39	0.284	0.76 – 2.56
Other, including Middle Eastern-North African	0.52	0.259	0.17 – 1.61
Unknown or unspecified	0.04***	<0.001	0.04 – 0.05
Unhoused			
No/Unknown	*Ref*	-	-
Yes	1.23	0.114	0.95 – 1.59
Response type			
On view	*Ref*	-	-
Dispatched to 911 call	1.37***	<0.001	1.26 – 1.48
By subject	0.94	0.757	0.64 – 1.39
Unknown	**0.76**	**0.193**	**0.51 – 1.14**
Incident Type			
Shooting	*Ref*	-	-
Assault	1.32*	0.023	1.04 – 1.67
Crash (includes hit-and-run)	1.21	0.373	0.79 – 1.85
Disorderly conduct or dispute/disturbance	1.16	0.220	0.92 – 1.47
Domestic disturbance, dispute, or violence	1.54***	<0.001	1.31 – 1.81
Investigative	0.89	0.287	0.73 – 1.10
Robbery or carjacking	0.76**	0.004	0.63 – 0.91
Burglary	0.66**	0.006	0.49 – 0.89
Stolen vehicle	0.54**	0.001	0.38 – 0.77

Suicidal or behavioral health crisis	1.38**	0.002	1.12 – 1.70
Suspicious person or vehicle	0.89	0.261	0.72 – 1.09
Threats	1.68**	0.001	1.23 – 2.30
Traffic stop	0.81**	0.008	0.69 – 0.95
Trespassing	1.05	0.779	0.76 – 1.44
Warrant or arrest	1.24*	0.018	1.04 – 1.48
Weapon complaint	0.99	0.956	0.79 – 1.24
Wellbeing check	1.55*	0.016	1.09 – 2.21
Other[3]	1.06	0.695	0.80 – 1.40
Fire	1.21	0.668	0.51 – 2.85
Hostage	**1.67**	**0.068**	**0.96 – 2.90**
Involuntary commitment	0.84	0.677	0.36 – 1.95
Pedestrian stop	0.56	0.157	0.25 – 1.25
Subject initiated, not otherwise specified	1.15	0.679	0.60 – 2.21
Vandalism	1.22	0.623	0.56 – 2.65
Unknown	**0.75**	**0.152**	**0.50 – 1.11**
Behavioral health involvement, incident[4]			
None	*Ref*	-	-
Any	1.89***	<0.001	1.71 – 2.08

Notes: *p < 0.05, **p < 0.01, ***p <0.001. [1] = Includes only on duty and on and off duty multiple-responder incidents. [2]= OR represents change in odds of fatality for each additional victim age. [3] = In addition to the specified subgroups listed below, included within "other" incidents are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc. [4] = Behavioral health incidents include suicidal or self-harming behaviors, substance use, diagnosis of serious mental illness relevant to the incident, disability that may have been misinterpreted as a mental or behavioral health issue, and transportation or response to inpatient behavioral health facility. **Bold** indicates change in statistical significance.

Appendix C

Sensitivity Analysis Testing Restrictive Duty-status Inclusion Criteria

Table C1. Fatal and nonfatal injurious shooting incidents, by event characteristic[1]

Incident Characteristic	Nonfatal Injurious Incident	Fatal Incident	% Fatal	Total Injurious Shooting Incidents (%)
Total	4,529	5,877	56.5	10,406 (100)
Officer Duty Status				
On-duty	4,344	5,735	56.9	10,079 (96.9)
On- and off-duty	3	6	66.7	9 (0.1)
Off-duty acting as on-duty	61	43	41.3	104 (1.0)
Off-duty, second job	29	17	37.0	46 (0.4)
Off-duty acting as off-duty	30	20	40.0	50 (0.5)
Unknown	77	41	34.7	118 (1.1)
Incident Weapon				
Unarmed	366	428	53.9	794 (7.6)
Firearm	2,399	3,349	58.3	5,748 (55.2)
Handgun[2]	892	1,355	60.3	2,247 (21.6)
Rifle[2]	216	334	60.7	550 (5.3)
Shotgun[2]	118	201	63.0	319 (3.1)
Multiple types, unspecified [2]	39	68	63.6	107 (1.0)
Service weapon[2]	42	58	58.0	100 (1.0)
Unknown[2]	1,141	1,396	55.0	2,537 (24.4)
Multiple, with firearm	25	25	50.0	50 (0.5)
BB or replica gun	176	230	56.7	406 (3.9)
Total firearm or gun, including "multiple with firearm" & "BB or replica gun"	2,600	3,604	58.1	6,204 (59.6)
Knife or other cutting/stabbing instrument	494	1,058	68.2	1,552 (15.0)
Vehicle	517	293	36.2	810 (7.8)
Blunt object	83	126	60.3	209 (2.0)
Multiple, without firearm	8	14	63.6	22 (0.2)
Service weapon concern[3]	16	30	65.2	46 (0.4)
Other	31	59	65.6	90 (0.9)
Weapon unknown	66	53	44.5	119 (1.1)

Armed status unknown	348	212	37.9	560 (5.4)
Single Law Enforcement Officer Response				
No	3,492	4,900	58.4	8,392 (80.7)
Yes	854	862	50.2	1,716 (16.5)
Both[4]	0	3	100.0	3 (<0.1)
Unknown	182	112	38.1	294 (2.8)
Agency type				
Local police	2,915	3,510	54.6	6,425 (61.7)
Sheriff's office	992	1,416	58.8	2,408 (23.1)
State police	227	342	60.1	569 (5.5)
National agency	75	104	58.1	179 (1.7)
Special jurisdiction	51	29	36.3	80 (0.8)
Constable or marshal	6	5	**45.5**	11 (0.1)
Multiple shooting agencies	209	441	67.8	650 (6.3)
Unknown	54	30	35.7	84 (0.8)
Response type				
On view	1,795	1,981	52.5	3,776 (36.3)
Dispatched to 911 call	2,593	3,784	59.3	6,377 (61.3)
By subject	67	62	**48.1**	129 (1.2)
Unknown	74	50	40.3	124 (1.2)
Incident Type				
Shooting	448	532	54.3	980 (9.4)
Assault	159	250	61.1	409 (3.9)
Crash (includes hit-and-run)	45	61	57.5	106 (1.0)
Disorderly conduct or dispute/disturbance	163	238	59.4	401 (3.9)
Domestic disturbance, dispute, or violence	570	1,051	64.8	1,621 (15.6)
Investigative	243	294	54.7	537 (5.2)
Robbery or carjacking	430	408	48.9	838 (8.1)
Burglary	125	104	45.4	229 (2.2)
Stolen vehicle	79	57	41.9	136 (1.3)
Suicidal or behavioral health crisis	239	392	62.1	631 (6.1)
Suspicious person or vehicle	266	289	52.1	555 (5.3)
Threats	75	145	65.9	220 (2.1)
Traffic stop	792	814	50.7	1,606 (15.4)
Trespassing	77	103	57.2	180 (1.7)

Warrant or arrest	376	592	61.2	968 (9.3)
Weapon complaint	203	246	54.8	449 (4.3)
Wellbeing check	54	101	65.2	155 (1.5)
Other[5]	108	142	56.8	250 (2.4)
Fire	10	14	58.3	24 (0.2)
Hostage	19	40	67.8	59 (0.6)
Involuntary commitment	11	11	50.0	22 (0.2)
Pedestrian stop	14	10	41.7	24 (0.2)
Subject initiated, not otherwise specified	16	24	60.0	40 (0.4)
Vandalism	11	16	59.3	27 (0.3)
Unknown	77	58	43.0	135 (1.3)

Notes: [1] = Includes all on and off duty statuses. [2] = Values may exceed total firearm-involved incidents because multiple gun types in a single incident were possible. [3] = Service weapon concern indicates that an officer stated they thought the subject might gain control of their service weapon. [4] = Both single and multiple officer involvement could occur if multiple shooting scenes were involved. [5] = In addition to the specified subgroups listed below, included within "other" incidents are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc. **Bold** indicates at least 2 percentage points deviation from main table estimate.

Table C2. Fatally and nonfatally injured persons, by event or person characteristic[1]

Incident or Person Characteristic	Nonfatally Injured	Fatally Injured	% Fatal	Total Injured Persons (%)
Total	4,811	5,911	55.1	10,722 (100)
Officer Duty Status				
On-duty	4,593	5,783	55.7	10,376 (96.8)
On- and off-duty	4	7	63.6	11 (0.1)
Off-duty acting as on-duty	68	43	38.7	111 (1.0)
Off-duty, second job	33	17	34.0	50 (0.5)
Off-duty acting as off-duty	35	20	36.4	55 (0.5)
Unknown	78	41	34.5	119 (1.1)
Person Weapon				
Unarmed	485	480	49.7	965 (9.0)
Firearm	2,446	3,360	57.9	5,806 (54.2)
Multiple, with firearm	13	17	56.7	30 (0.3)
BB or replica gun	155	212	57.8	367 (3.4)
Total firearm or gun, including "multiple with firearm" & "BB or replica gun"	2,614	3,589	57.9	6,203 (57.9)
Knife or other cutting/stabbing instrument	495	1,045	67.9	1,540 (14.4)
Vehicle	498	280	36.0	778 (7.3)
Blunt object	77	123	61.5	200 (1.9)
Multiple, without firearm	7	5	41.7	12 (0.1)
Other	111	119	51.7	230 (2.1)
Unknown	524	270	34.0	794 (7.4)
Agency type				
Local police	3,039	3,527	53.8	6,620 (61.7)
Sheriff's office	1,040	1,424	57.8	2,464 (23.0)
State police	237	346	59.3	583 (5.4)
National agency	82	105	56.1	187 (1.7)
Special jurisdiction	54	29	34.9	83 (0.8)
Constable or marshal	7	5	**41.7**	12 (0.1)
Multiple shooting agencies	241	445	64.9	686 (6.5)
Unknown	57	30	34.5	87 (0.8)
Age[2]				

Range	<1 to 93	6 to 91		
Mean of known ages (n=9,552; 59.6% fatal)	33	37	-	35.3 years
Median of known ages (n=9,552; 59.6% fatal)	30	35	-	33 years
Total juvenile count	220	109	33.1	329 (3.1)
Total adult count	4,371	5,765	56.9	10,136 (94.5)
Unknown	220	37	14.4	257 (2.4)
Gender				
Man	4,435	5,650	56.0	10,085 (94.1)
Woman	289	248	46.2	537 (5.0)
Transgender	1	10	90.9	11 (0.1)
Unknown	86	3	3.4	89 (0.8)
Race/Ethnicity				
Non-Hispanic, white	393	2,409	86.0	2,802 (26.1)
Non-Hispanic, Black	448	1,339	74.9	1,787 (16.7)
Hispanic, any race	326	988	75.2	1,314 (12.3)
American Indian or Alaskan Native	14	105	88.2	119 (1.1)
Asian or Pacific Islander	12	104	89.7	116 (1.1)
Other, including Middle Eastern-North African	4	13	76.5	17 (0.2)
Unhoused				
Yes	93	185	66.5	278 (2.6)
Response type				
On view	1,969	1,999	50.4	3,968 (37.0)
Dispatched to 911 call	2,696	3,800	58.5	6,496 (60.6)
By subject	70	62	**47.0**	132 (1.2)
Unknown	76	50	39.7	126 (1.2)
Incident Type				
Shooting	475	537	53.1	1,012 (9.4)
Assault	165	251	60.3	416 (3.9)
Crash (includes hit-and-run)	45	61	57.5	106 (1.0)
Disorderly conduct or dispute/disturbance	176	239	57.6	415 (3.9)
Domestic disturbance, dispute, or violence	577	1,055	64.6	1,632 (15.2)
Investigative	280	298	51.6	578 (5.4)
Robbery or carjacking	475	410	46.3	885 (8.3)

Burglary	129	105	44.9	234 (2.2)
Stolen vehicle	90	58	39.2	148 (1.4)
Suicidal or behavioral health crisis	240	392	62.0	632 (5.9)
Suspicious person or vehicle	279	290	51.0	569 (5.3)
Threats	77	145	65.3	222 (2.1)
Traffic stop	860	820	48.8	1,680 (15.7)
Trespassing	85	103	54.8	188 (1.8)
Warrant or arrest	402	600	59.9	1,002 (9.3)
Weapon complaint	210	246	53.4	456 (4.3)
Wellbeing check	55	101	64.7	156 (1.5)
Other[3]	114	142	55.5	256 (2.4)
Fire	10	14	58.3	24 (0.2)
Hostage	20	40	66.7	60 (0.6)
Involuntary commitment	12	11	47.8	23 (0.2)
Pedestrian stop	15	10	40.0	25 (0.2)
Subject initiated, not otherwise specified	16	24	60.0	40 (0.4)
Vandalism	11	16	59.3	27 (0.3)
Unknown	77	58	43.0	135 (1.3)
Behavioral health involvement, incident[4]				
Yes	792	1,616	67.1	2,408 (22.5)

Notes: [1] = Includes all on and off duty statuses. [2] = Age was entered as specified, where applicable. Otherwise, age was categorized as juvenile (ages 0-17), adult (ages 18+), or unknown. [3] = In addition to the specified subgroups listed below, included within "other" incidents are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc. [4] = Behavioral health incidents include suicidal or self-harming behaviors, substance use, diagnosis of serious mental illness relevant to the incident, disability that may have been misinterpreted as a mental or behavioral health issue, and transportation or response to inpatient behavioral health facility. **Bold** indicates at least 2 percentage points deviation from main table estimate.

Table C3. Unadjusted logistic regression models predicting odds of fatal versus nonfatal injury[1]

Incident or Person Characteristic	OR	p-value	95% CI
Officer Duty Status			
On-duty	*Ref*	-	-
On- and off-duty	1.39	0.600	0.41 – 4.75
Off-duty acting as on-duty	0.50***	<0.001	0.34 – 0.74
Off-duty, second job	0.41**	0.003	0.23 – 0.74
Off-duty acting as off-duty	0.45**	0.005	0.26 – 0.79
Unknown	0.42***	<0.001	0.29 – 0.61
Person Weapon			
Unarmed	*Ref*	-	-
Firearm	1.39***	<0.001	1.21 – 1.60
Multiple, with firearm	1.32	0.456	0.63 – 2.75
BB or replica gun	1.38**	0.009	1.08 – 1.76
Knife or other cutting/stabbing instrument	2.13***	<0.001	1.81 – 2.52
Vehicle	0.59***	<0.001	0.47 – 0.69
Blunt object	1.61**	0.003	1.18 – 2.20
Multiple, without firearm	0.72	0.580	0.23 – 2.29
Other	1.08	0.586	0.81 – 1.44
Unknown	0.52***	<0.001	0.43 – 0.66
Agency type			
Local police	*Ref*	-	-
Sheriff's office	1.20***	<0.001	1.09 – 1.32
State police	1.28**	0.005	1.08 – 1.52
National agency	1.12	0.438	0.84 – 1.50
Special jurisdiction	0.47**	0.001	0.30 – 0.74
Constable or marshal	0.63	0.425	0.20 – 1.98
Multiple shooting agencies	1.62***	<0.001	1.37 – 1.91
Unknown	0.46**	0.001	0.30 – 0.72
Single Law Enforcement Officer Response			
No	*Ref*	-	-
Yes	0.72***	<0.001	0.65 – 0.80
Both[4]	2.27	0.479	0.24 – 21.79

Unknown	0.47***	<0.001	0.37 – 0.59
Age			
Where specified (n=9,552)[2]	1.03***	<0.001	1.02 – 1.03
Adult	*Ref*	-	-
Juvenile	0.38***	<0.001	0.30 – 0.47
Unknown	0.13***	<0.001	0.09 – 0.18
Gender			
Man	*Ref*	-	-
Woman	0.67***	<0.001	0.57 – 0.80
Transgender	7.85	0.050	1.00 – 61.3
Unknown	0.27***	<0.001	0.01 – 0.09
Race/Ethnicity			
Non-Hispanic, white	*Ref*	-	-
Non-Hispanic, Black	0.49***	<0.001	0.42 – 0.57
Hispanic, any race	0.49***	<0.001	0.42 – 0.58
American Indian or Alaskan Native	1.22	0.487	0.69 – 2.16
Asian or Pacific Islander	1.41	0.263	0.77 – 2.59
Other, including Middle Eastern-North African	0.53	0.269	0.17 – 1.63
Unknown or unspecified	0.04***	<0.001	0.04 – 0.05
Unhoused			
No/Unknown	*Ref*	-	-
Yes	1.26	0.075	0.98 – 1.63
Response type			
On view	*Ref*	-	-
Dispatched to 911 call	1.38***	<0.001	1.28 – 1.50
By subject	0.87	0.441	0.62 – 1.23
Unknown	0.65*	0.019	0.45 – 0.93
Incident Type			
Shooting	*Ref*	-	-
Assault	1.35*	0.028	1.07 – 1.70
Crash (includes hit-and-run)	1.20	0.379	0.80 – 1.80
Disorderly conduct or dispute/disturbance	1.22	0.089	0.97 – 1.54
Domestic disturbance, dispute, or violence	1.61***	<0.001	1.37 – 1.89

Investigative	0.94	0.563	0.77 – 1.16
Robbery or carjacking	0.76**	0.003	0.64 – 0.91
Burglary	0.72*	0.024	0.54 – 0.96
Stolen vehicle	0.57**	0.002	0.40 – 0.81
Suicidal or behavioral health crisis	1.44***	<0.001	1.18 – 1.77
Suspicious person or vehicle	0.92	0.423	0.75 – 1.13
Threats	1.67***	0.001	1.23 – 2.25
Traffic stop	0.84*	0.033	0.72 – 0.99
Trespassing	1.07	0.664	0.78 – 1.47
Warrant or arrest	1.32**	0.002	1.11 – 1.58
Weapon complaint	1.04	0.753	0.83 – 1.29
Wellbeing check	1.62**	0.007	1.14 – 2.31
Other[3]	1.10	0.491	0.84 – 1.45
Fire	1.24	0.610	0.54 – 2.81
Hostage	1.77*	0.042	1.02 – 3.07
Involuntary commitment	0.81	0.619	0.35 – 1.85
Pedestrian stop	0.60	0.201	0.26 – 1.33
Subject initiated, not otherwise specified	1.33	0.390	0.70 – 2.53
Vandalism	1.29	0.525	0.59 – 2.80
Unknown	0.67*	0.028	0.46 – 0.96
Behavioral health involvement, incident[4]			
None	*Ref*	-	-
Any	1.91***	<0.001	1.74 – 2.10

Notes: *p < 0.05, **p < 0.01, ***p <0.001. [1] = Includes all on and off duty statuses. [2]= OR represents change in odds of fatality for each additional victim age. [3] = In addition to the specified subgroups listed below, included within "other" incidents are: escaped prisoner responses, immigration-related incidents, disaster responses, evictions, parole checks, dog complaints, fraud and fare evasion, etc. [4] = Behavioral health incidents include suicidal or self-harming behaviors, substance use, diagnosis of serious mental illness relevant to the incident, disability that may have been misinterpreted as a mental or behavioral health issue, and transportation or response to inpatient behavioral health facility. **Bold** indicates change in statistical significance.

Appendix D

Defining the Urban-Rural Continuum

Table D1. Comparison of select county-based and zip-code-based urban-rural designation schemes

Source	Geographic Area	Aggregation Scheme	Rurality Classification Rules	Categories along Urban-Rural Continuum
National Center for Health Statistics' (NCHS)[150]	County	6-level scheme, collapsible into an urban-versus-rural binary	Based on population of Metropolitan Statistical (MSA) area and portion MSA contained within county	**Metropolitan:** Large central metro Large fringe metro Medium metro Small metro **Non-metropolitan:** Micropolitan Noncore
US Department of Agriculture's (USDA)[88]	County	9-level scheme, collapsible into non-binary groupings.	Based on population density and metro-area proximity	**Metropolitan:** 1 = ≥1 million people; 2 = 250,000-999,999 people; 3 = <250,000 people **Non-metropolitan:** 4 = Urban population ≥20,000, adjacent to metro area 5 = Urban population ≥20,000, not adjacent to metro area 6 = Urban population 2,500-19,999, adjacent to metro area 7 = Urban population 2,500-19,999, adjacent to metro area

				8 = Completely rural or <2,500 urban population, adjacent to metro area 9 = Completely rural or <2,500 urban population, not adjacent to metro area
National Center for Education Statistics' (NCES)[89]	Zip Code	12-level scheme, collapsible into binary or nonbinary rurality groupings	Based on population size and proximity to an urban area	**City and Suburban locales** Large = population of ≥250,000 Midsize = population of 100,000–249,999 Small = population <100,000). **Town and Rural locales** Fringe Town = ≤10 miles from an Urbanized Area Fringe Rural = ≤5 miles from an Urbanized Area and ≤2.5 miles from an Urban Cluster Distant Town = >10–35 miles from an Urbanized Area Distant Rural = >5–25 miles from an Urbanized Area and >2.5–10 miles from an Urban Cluster Remote Town = >35 miles from an Urbanized Area Remote Rural = >25 miles from an Urbanized Area and >10 miles from an Urban Cluster
US Census[151]	Zip Code	Areas and clusters	Identifies densely populated urban areas and clusters by Census blocks	Urbanized Area = ≥50,000, densely populated Urbanized Cluster = <2,500 - <50,000 and incorporated or census-designated place Rural = Any population, outside of areas and clusters

Appendix E

Sensitivity Analyses Testing Outlier Year and County Effects

Table E1. Social and policy correlates of shootings by police within counties of the United States, 2015-2019

Characteristic	Bivariate Model[1]			Multivariate Model[2]		
	IRR	**p-value**	**95% CI**	**IRR**	**p-value**	**95% CI**
Social Context – Social Stratification & Exposure						
State-level Characteristics						
Population Total	1.00***	<0.001	1.00 – 1.00	Excluded, county value used		
Income Inequality (Gini, percent)	1.27***	<0.001	1.24 – 1.30	Excluded, county value used		
Poverty Rate	1.01	0.318	1.00 – 1.03	Excluded for county gini		
Percent Population Non-White	1.04***	<0.001	1.03 – 1.04	Excluded, county value used		
Incarceration Rate (prisons)	1.00	0.831	1.00 – 1.00	Excluded for parsimony		
Percent Unemployment	**1.59*** **	**<0.001**	**1.50 – 1.69**	0.98	0.560	0.90 – 1.06
Percent Population Veterans	0.85***	<0.001	0.82 – 0.87	1.00	0.884	0.96 – 1.05
Population Unhoused (per 100k)	1.01***	<0.001	1.00 – 1.01	1.00	0.315	1.00 – 1.00
Violent Crime Rate (per 100k)	1.00***	<0.001	1.00 – 1.00	1.00*	0.034	1.00 - 1.00
Estimated Gun Prevalence (FS/S)[3,4]	0.05***	<0.001	0.03 – 0.08	0.60	0.583	0.10 – 3.67
Prevalence of Any Mental Illness (% Adults)	0.90***	<0.001	0.87 – 0.92	1.01	0.674	0.97 – 1.04
Unmet Mental Health Needs (% Adults, 2019)	**0.97***	**0.039**	**0.94 – 1.00**	0.98	0.633	0.90 – 1.07
Unmet Alcohol Use Disorder Needs (% Adults, 2019)	1.02	0.063	1.00 – 1.05	0.94	0.202	0.86 – 1.03
Unmet Substance Use Disorder Needs (% Adults, 2019)	1.22***	<0.001	1.17 – 1.28	1.25***	<0.001	1.10 – 1.43
Assaults on Law Enforcement Officers (firearm, knife)	1.09***	<0.001	1.07 – 1.10	1.00	0.708	0.99 – 1.01
County-level Characteristics						
Population Total	1.00***	<0.001	1.00 – 1.00	1.00***	<0.001	1.00 – 1.00
Income Inequality (gini, percent)	1.19***	<0.001	1.17 – 1.20	1.05***	<0.001	1.03 – 1.07

Percent Population Non-White[4]	1.04***	<0.001	1.04 – 1.05	1.04***	<0.001	1.02 – 1.06
Sworn Law Enforcement Officers (2017 estimate)	1.00***	<0.001	1.00 – 1.00	1.00	0.762	1.00 - 1.00
Percent Population 65 or Older	0.84***	<0.001	0.83 – 0.85	0.95***	<0.001	0.94 – 0.97
Rurality Designation Urban	*Ref*	n/a	n/a	*Ref*	n/a	n/a
Rural	0.06***	<0.001	0.05 – 0.06	0.25***	<0.001	0.20 – 0.31
Suburban	0.13***	<0.001	0.12 – 0.14	0.30***	<0.001	0.27 – 0.34
Reporting Presence: County had no newspapers in 2019	0.36***	<0.001	0.29 – 0.44	0.65**	0.003	0.49 – 0.86
State-level & County-level Interaction Characteristics						
Gun ownership + County Percent Population Non-White[4]	0.70***	<0.001	0.67 – 0.72	0.94***	<0.001	0.91 – 0.97
Policy Context – Social Stratification & Exposure						
State-level Characteristics						
High School Grad Rate, Black Residents	0.97***	<0.001	0.97 - 0.98	Excluded, ratio used		
High School Grad Rate, AI/AN Residents	**0.99****	**0.005**	**0.99 – 1.00**	Excluded, ratio used		
High School Grad Rate, Hispanic Residents	**0.99***	**0.030**	**0.98 – 1.00**	Excluded, ratio used		
High School Grad Rate, White Residents	0.95***	<0.001	0.94 – 0.96	Excluded, ratio used		
High School Grad Rate Ratio, Black : White Residents	**0.58**	**0.117**	**0.29 – 1.15**	0.88	0.749	0.42 – 1.87
High School Grad Rate Ratio, AI/AN : White Residents	1.60	0.075	0.95 – 2.68	0.95	0.897	0.47 – 1.94
High School Grad Rate Ratio, Hispanic : White Residents	13.02***	<0.001	5.75 – 29.47	0.95	0.926	0.30 – 3.00
Permitless Concealed Carry Weapons Policy (CCW)	0.73***	<0.001	0.65 – 0.83	1.23**	0.007	1.06 – 1.44
Permit to Purchase Policy (PTP)	0.77***	<0.001	0.69 – 0.87	0.56**	0.001	0.39 – 0.79
Extreme Risk Protection Order Policy (ERPO)	2.85***	<0.001	2.46 – 3.29	0.94	0.251	0.84 – 1.05
Per Capita Spending, Total	1.00*	0.042	1.00 – 1.00	Excluded, itemized spending used		
Per Capita Spending on Corrections	1.01***	<0.001	1.00 – 1.01	Excluded, police spending used		
Per Capita Spending on Health	1.00***	<0.001	1.00 – 1.00	1.00*	0.048	1.00 – 1.00
Per Capita Spending on Police	1.00	0.128	1.00 – 1.00	1.00	0.532	1.00 – 1.00
Per Capita Spending on Public welfare	1.00***	<0.001	1.00 – 1.00	1.00	0.589	1.00 – 1.00
Per Capita Spending Ratio, Police : Public Welfare	0.85***	<0.001	0.82 – 0.89	Excluded, itemized spending used		

Per Capita Spending Ratio, Corrections : Public Welfare	0.98	0.067	0.97 – 1.00	Excluded, itemized spending used		
Per Capita Spending Ratio, Policing : Health	1.91***	<0.001	1.74 – 2.09	Excluded, itemized spending used		
County-level Characteristics						
Residential Segregation – Non-White vs White	1.04***	<0.001	1.03 – 1.04	1.01***	<0.001	1.01 – 1.02
Poverty Rate Ratio – Black vs White	**0.97***	**0.021**	**0.94 – 1.00**	0.96**	0.008	0.93 – 0.99
Poverty Rate Ratio – Native vs White	1.07***	<0.001	1.04 – 1.10	1.01	0.527	0.99 – 1.03
Nongeographic Characteristics - Time						
Year	1.02	0.279	0.99 – 1.05	1.07*	0.015	1.01 - 1.12

Notes: Washington, D.C. excluded. *p < 0.05, **p < 0.01, ***p <0.001. AI/AN = American Indian or Alaskan Native. **Bold** indicates change from original analysis. 1=The bivariate model only controls for year, allowing for time variance within a cross-sectional analysis of a panel dataset. 2=The adjusted, fixed effects model includes all indicated variables, including a gun ownership interaction variable to improve the county-level estimation of the state gun ownership proxy, and allows for two levels of clustering (year within county, within state). 3=State-level gun prevalence is estimated by the portion of suicides in a state completed with a firearm (i.e., firearm suicides (FS) / suicides (S)). 4= Within the otherwise unadjusted (after controlling for year) interaction model, each unit increase in state firearm prevalence and percentage increase in non-white county population (main effects) were associated with 19.8-times (p<0.001, 95% CI: 9.31 – 42.11) and 1.29-times (p<0.001, 95% CI: 1.26 – 1.32) higher prevalence of injurious shootings by police, respectively.

Table E2. Social and policy correlates of shootings by police within non-outlier counties of the United States, 2015-2020

Characteristic	Bivariate Model[1]			Multivariate Model[2]		
	IRR	**p-value**	**95% CI**	**IRR**	**p-value**	**95% CI**
Social Context – Social Stratification & Exposure						
State-level Characteristics						
Population Total	1.00***	<0.001	1.00 – 1.00	Excluded, county value used		
Income Inequality (Gini, percent)	1.22***	<0.001	1.19 – 1.25	Excluded, county value used		
Poverty Rate	**1.02***	**0.030**	**1.00 – 1.03**	Excluded for county gini		
Percent Population Non-White	1.03***	<0.001	1.03 – 1.03	Excluded, county value used		
Incarceration Rate (prisons)	1.00	0.850	1.00 – 1.00	Excluded for parsimony		
Percent Unemployment	1.12***	<0.001	1.09 – 1.15	0.97	0.480	0.90 – 1.05
Percent Population Veterans	0.87***	<0.001	0.86 – 0.91	1.02	0.525	0.97 – 1.07
Population Unhoused (per 100k)	1.00***	<0.001	1.00 – 1.00	1.00	0.350	1.00 – 1.00
Violent Crime Rate (per 100k)	1.00***	<0.001	1.00 – 1.00	1.00*	0.016	1.00 - 1.00
Estimated Gun Prevalence (FS/S)[3,4]	0.10***	<0.001	0.07 – 0.15	0.61	0.571	0.11 – 3.42
Prevalence of Any Mental Illness (% Adults)	0.95***	<0.001	0.93 – 0.97	0.97	0.466	0.90 – 1.05
Unmet Mental Health Needs (% Adults, 2019)	**0.97***	**0.015**	**0.94 – 0.99**	0.98	0.633	0.90 – 1.07
Unmet Alcohol Use Disorder Needs (% Adults, 2019)	0.99	0.448	0.97 – 1.01	0.95	0.259	0.87 – 1.04
Unmet Substance Use Disorder Needs (% Adults, 2019)	1.18***	<0.001	1.14 – 1.23	1.20**	0.003	1.06 – 1.36
Assaults on Law Enforcement Officers (firearm, knife)	1.07***	<0.001	1.06 – 1.08	1.00	0.920	0.99 – 1.01
County-level Characteristics						
Population Total	1.00***	<0.001	1.00 – 1.00	1.00***	<0.001	1.00 – 1.00
Income Inequality (Gini, percent)	1.15***	<0.001	1.14 – 1.17	1.04***	<0.001	1.02 – 1.05
Percent Population Non-White[4]	1.04***	<0.001	1.03 – 1.04	**1.02**	**0.062**	**1.00 – 1.04**
Sworn Law Enforcement Officers (2017 estimate)	1.00***	<0.001	1.00 – 1.00	1.00	0.249	1.00 - 1.00
Percent Population 65 or Older	0.86***	<0.001	0.85 – 0.87	0.96***	<0.001	0.95 – 0.98

Rurality Designation Urban	*Ref*	n/a	n/a	*Ref*	n/a	n/a
Rural	0.06***	<0.001	0.06 – 0.07	0.28***	<0.001	0.23 – 0.35
Suburban	0.15***	<0.001	0.14 – 0.16	0.35***	<0.001	0.31 – 0.39
Reporting Presence: County had no newspapers in 2019	0.43***	<0.001	0.36 – 0.52	0.71*	0.014	0.54– 0.93
State-level & County-level Interaction Characteristics						
Gun ownership + County Percent Population Non-White[4]	0.75***	<0.001	0.72 – 0.77	**0.97**	**0.101**	**0.94 – 1.01**
Policy Context – Social Stratification & Exposure						
State-level Characteristics						
High School Grad Rate, Black Residents	0.99***	<0.001	0.98 - 0.99	Excluded, ratio used		
High School Grad Rate, AI/AN Residents	0.99***	<0.001	0.99 – 1.00	Excluded, ratio used		
High School Grad Rate, Hispanic Residents	0.98***	<0.001	0.98 – 0.99	Excluded, ratio used		
High School Grad Rate, White Residents	0.96***	<0.001	0.95 – 0.97	Excluded, ratio used		
High School Grad Rate Ratio, Black : White Residents	**2.41*** **	**<0.001**	**1.54 – 3.76**	0.82	0.642	0.38– 1.79
High School Grad Rate Ratio, AI/AN : White Residents	**2.53*** **	**<0.001**	**1.63 – 3.92**	0.93	0.845	0.45 – 1.91
High School Grad Rate Ratio, Hispanic : White Residents	**6.42*** **	**<0.001**	**3.25 – 12.70**	1.07	0.907	0.34 – 3.42
Permitless Concealed Carry Weapons Policy (CCW)	0.64***	<0.001	0.57 – 0.72	1.25**	0.004	1.07– 1.46
Permit to Purchase Policy (PTP)	0.78***	<0.001	0.70 – 0.86	0.60**	0.003	0.43 – 0.84
Extreme Risk Protection Order Policy (ERPO)	2.49***	<0.001	2.19 – 2.83	0.97	0.568	0.86 – 1.09
Per Capita Spending, Total	**1.00**	**0.084**	**1.00 – 1.00**	Excluded, itemized spending used		
Per Capita Spending on Corrections	**1.00*** **	**<0.001**	**1.00 – 1.01**	Excluded, police spending used		
Per Capita Spending on Health	1.00**	0.003	1.00 – 1.00	1.00*	0.013	1.00 – 1.00
Per Capita Spending on Police	1.00	0.866	1.00 – 1.00	1.00	0.347	1.00 – 1.01
Per Capita Spending on Public welfare	1.00***	<0.001	1.00 – 1.00	1.00	0.821	1.00 – 1.00
Per Capita Spending Ratio, Police : Public Welfare	0.91***	<0.001	0.88 – 0.95	Excluded, itemized spending used		
Per Capita Spending Ratio, Corrections : Public Welfare	1.00	0.739	0.98 – 1.01	Excluded, itemized spending used		
Per Capita Spending Ratio, Policing : Health	1.67***	<0.001	1.54 – 1.81	Excluded, itemized spending used		
County-level Characteristics						

Residential Segregation – Non-White vs White	1.03***	<0.001	1.03 – 1.04	1.01***	<0.001	1.01 – 1.02
Poverty Rate Ratio – Black vs White	0.97**	0.003	0.95 – 0.99	0.96**	0.003	0.93 – 0.99
Poverty Rate Ratio – Native vs White	1.05***	<0.001	1.03 – 1.07	1.01	0.579	0.99 – 1.03
Nongeographic Characteristics - Time						
Year	1.02	0.180	0.99 – 1.04	1.06*	0.025	1.01 - 1.12

Notes: Washington, D.C.; San Bernardino County, CA; Clark County, NV; Cook County, IL; Harris County, TX; Maricopa County, AZ; Los Angeles County, CA excluded. *p < 0.05, **p < 0.01, ***p <0.001. AI/AN = American Indian or Alaskan Native. **Bold** indicates change from original analysis. 1=The bivariate model only controls for year, allowing for time variance within a cross-sectional analysis of a panel dataset. 2=The adjusted, fixed effects model includes all indicated variables, including a gun ownership interaction variable to improve the county-level estimation of the state gun ownership proxy, and allows for two levels of clustering (year within county, within state). 3=State-level gun prevalence is estimated by the portion of suicides in a state completed with a firearm (i.e., firearm suicides (FS) / suicides (S)). 4=Within the otherwise unadjusted (after controlling for year) interaction model, each unit increase in state firearm prevalence and percentage increase in non-white county population (main effects) were associated with 9.47-times (p<0.001, 95% CI: 4.90 – 18.33) and 1.23-times (p<0.001, 95% CI: 1.20 – 1.25) higher prevalence of injurious shootings by police, respectively.

CURRICULUM VITAE

Julie A. Ward

Revised: March 8, 2023

CONTACT

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jward52@jhu.edu

EDUCATION AND TRAINING

PhD, 2023 (expected)	**Johns Hopkins University, Bloomberg School of Public Health** Concentration: Health and Public Policy *Dissertation: Beyond urban fatalities: An analysis of shootings by police in the United States (in-progress)*
Certificate, 2020	**Johns Hopkins University, Bloomberg School of Public Health** Graduate Certificate: Injury and Violence Prevention
MN, 2009	**University of Washington, School of Nursing** Master of Nursing, Advanced Practice Community Health Systems Concentration: Occupational and Environmental Health *Scholarly Project: Preventing injuries among teen restaurant workers: Washington State's ProSafety Project*
BSN, 2005	**University of Washington, School of Nursing** Bachelor of Science, Nursing
BA, 2003	**University of Oregon, Clark Honors College** Bachelor of Arts, Spanish Minor: Exercise and Movement Science (now: Human Physiology) *Honors Thesis: Diabetes among Latinos: Combatting an epidemic through culture-specific prevention*

PROFESSIONAL LICENSURE AND CERTIFICATION

State	Type	Number	Expiration
Maryland	Registered Nurse (RN)	#R243249	March 28, 2025
Oregon	Registered Nurse (RN)	#201405008RN	March 25, 2025
Washington	Registered Nurse (RN)	#00161108	March 25, 2024
National, AHA	Basic Life Support, Provider	n/a	October 2023
National, ANCC	Board Certified Adv. Public Health Nurse (PHNA-BC)	#2012004631	May 11, 2027

PROFESSIONAL EXPERIENCE

Johns Hopkins University

2020-present **Graduate Research Assistant and Project Coordinator**, Center for Gun Violence Solutions, Department of Health Policy and Management, Bloomberg School of Public Health
Associate Professor Cassandra Crifasi, PhD, MPH

Literature review, project conceptualization, scenario development, and debriefing scripts for study of weapon-related decision making in virtual reality environment. Quantitative data collection for study of young adult homicide victimization. Quantitative public opinion survey development and data analysis using Stata. Project lead, recruitment, and training for Gun Violence Archive data abstraction project. Diversity Summer Internship Program mentor.

2020-present **Teaching Assistant**, Bloomberg School of Public Health
Vice Dean for Public Health Practice & Community Engagement Joshua Sharfstein, MD
Commonwealth Fund Journalist in Residence Joanne Kenen, BA
Professor Shannon Frattaroli, PhD, MPH
Professor Jon Vernick, JD, MPH
Professor Daniel Webster, ScD, MPH
Associate Professor Cassandra Crifasi, PhD, MPH
Assistant Professor Alex McCourt, JD, PhD, MPH
Associate Scientist Michelle Spencer, MS
Research Associate Rebecca Williams, MSPH
Associate Larry Orr, PhD

Lead didactic sessions; facilitate online and in-person discussion groups; develop course materials; grading of undergraduate, masters, and doctoral student assignments; course organization and course communications. Contributed to the development of three new graduate-level courses: "Crafting Effective Solutions to Gun Violence: Problem Solving Seminar" (Term 4, 2021), "Special Studies/Research: The Media and the Message: What Public Health Needs to Know About the News" (Term 4, 2022), and "Policing and Public Health" (Term 1, 2022).

2021-2022 **Graduate Research Assistant**, Center for Gun Violence Solutions, Department of Health Policy and Management, Bloomberg School of Public Health
Professor Daniel Webster, ScD, MPH

Analysis of Safe Streets Community Based Violence Prevention Programs and Concealed Carry Permitting Statutes using Synthetic Control Modeling in Stata and R.

2020-2022 **Graduate Research Assistant and Project Coordinator**, Office of Public Health Practice and Training, Bloomberg School of Public Health
Assist. Dean for Public Health Practice Beth Resnick, DrPH, MPH

Project management for mixed methods data collection and analysis, including quantitative survey, qualitative and quantitative media content analysis, and member-checking interviews.

2021 **Registered Nurse Volunteer,** COVID-19 Vaccine Administration

2020-2021 **Graduate Research Assistant**, COVID Behind Bars Data Project, Department of Health Policy and Management, Bloomberg School of Public Health in partnership with UCLA Law
Associate Professor Brendan Saloner, PhD

Time-sensitive project conceptualization, quantitative data collection, epidemiologic analysis and visualization using Excel.

Other Professional Experience

2021-present **Registered Nurse – Employee Health**, University of Maryland Medical Center, Baltimore, MD

2019-2023 **Adjunct Assistant Professor**
2018-2019 **Assistant Professor, Clinical Nursing**
2014-2018 **Instructor, Clinical Nursing**, Oregon Health & Science University, School of Nursing, Monmouth, OR

2015-2019 **Employee Health Nurse Specialist**, Legacy Health System, Portland, OR

2014-2015 **Wellness Consultant**
2013-2014 **Program Manager, Wellness & *lifepath***
2011-2013 **Employee Wellness RN Case Manager**, Northern Arizona Healthcare, Employee Health and Wellness, Flagstaff, AZ, Cottonwood, AZ, Sedona, AZ

2011-2014 **Registered Nurse Volunteer – Primary Care**, Poore Medical Clinic, Flagstaff, AZ

2010-2011 **Grant Writer**, Global Visionaries, Seattle, WA

2009-2011 **Clinical Instructor and Program Manager,** University of Washington, School of Nursing, Occupational and Environmental Health Nursing Program, Seattle, WA

2008-2010 **Registered Nurse – Emergency Department**, Group Health Cooperative Emergency Department, Seattle, WA

2009-2010 **RN Community Health Consultant**, Becoming Parents Program, Inc., Seattle, WA

2008-2009 **Project Coordinator**, Washington Restaurant Association, *ProSafety* Project, Olympia, WA

2008 **Interim Project Director**
2007-2009 **Director of Quality Assurance**
2007-2009 **RN Family Resource Partner**, SHM Policy Research Project, Becoming Parents Program Site, Seattle, WA

2005-2008	**Director of Spanish-Language Becoming Parents Program**
2005-2008	**Curriculum Consultant, Trainer**, Becoming Parents Program, Inc., Seattle, WA
2005-2008	**Registered Nurse – Emergency Department**, Swedish Medical Center Emergency Department, Seattle, WA

CONSULTATIONS

Northern Arizona Healthcare (Flagstaff, Sedona, and Cottonwood, AZ). Consulted on employee wellness program expansion, integration with population health services, online platform design and implementation, and change management, 2014-2015.

Becoming Parents Program, Inc. (Seattle, WA). Consulted on scenario planning for mission-driven business sustainability, qualitative and quantitative evaluation of social capital program components, evidence-based revisions to programming, and development of curriculum reinforcement training tools for the nursing staff, 2009-2010.

Family Expectations (Oklahoma City, OK). Consulted on the implementation of the Spanish- and English-language Becoming Parents Program curricula, 2005-2009.

Becoming Parents Program, Inc., (Seattle, WA). Consulted on the Latino cultural adaptation of the original English-language health education curriculum, including the development of a 32-chapter leaders' manual, a 50-page participants' manual, and filming/editing of Spanish-language supplemental videos, 2005-2008.

PROFESSIONAL ACTIVITIES

Society Membership and Leadership

2010-present	American Public Health Association *Publications Board Student Representative, 2020-2022* *Occupational Safety and Health Policy Committee, 2020-2022*
2019-present	Society for Advancement of Violence and Injury Research
2017-present; 2008-2010	Association for Prevention Teaching and Research *Policy Committee, 2018-2020; Paul Ambrose Scholar, 2008*

Participation on Advisory Panels and Boards

2022-present	Doctor of Philosophy Board, Johns Hopkins Univ., Baltimore, MD
2021	Protecting Public Health Steering Committee, Johns Hopkins Bloomberg School of Public Health Office of Practice & Training, Baltimore, MD
2019	Northwest Immunization Conference Planning Committee, Portland, OR
2014	Financial Advisory Group, *PathfinderHealth* Accountable Care Organization, Flagstaff, AZ

2013-2014	Managers' Advisory Council, Flagstaff Medical Center, Flagstaff, AZ *Nominated and Elected Position*
2013-2014	Yavapai County Community Health Improvement Plan (CHIP) Committee Member, Cottonwood, AZ
2013-2014	Population Health Steering Committee, Northern Arizona Healthcare, Flagstaff & Cottonwood, AZ
2011-2014	Wellness Committee, Northern Arizona Healthcare, Flagstaff & Cottonwood, AZ *Co-Chair*
2013	Tobacco-free Campus Taskforce, Northern Arizona Healthcare, Flagstaff & Cottonwood, AZ
2011	Workplace Violence Prevention Taskforce, Northern Arizona Healthcare, Flagstaff & Cottonwood, AZ
2003-2005	Student Providers Aspiring to Rural and Underserved Experiences (SPARX) and Community Health Advancement Program (CHAP) member, University of Washington, Seattle, WA
2002-2003	Student Health Advisory Committee, University of Oregon, Eugene, OR

EDITORIAL AND OTHER PEER REVIEW ACTIVITIES

Journal Peer Review Activities

AJPM Focus (2023), *American Journal of Public Health* (2022), *Injury Epidemiology* (2022, 2021), *Journal of General Internal Medicine* (2022, 2021), *American Journal of Preventive Medicine* (2021, 2020), *Medical Care* (2020), *Emerging Infectious Diseases* (2020)*, Injury Prevention* (2020, 2014, 2012, 2011).

Proposal Reviews

2009-2020	Association for Prevention Teaching and Research Paul Ambrose Scholars Program, reviewer of graduate student training program applications and microgrant proposals

Review of Reports and Other Documents

2021	*APHA Press*
2022	APHA Annual Meeting and Expo, Public Health Nursing Program (Topics: Public Health Nursing Workforce)
2017-2022	APHA Annual Meeting and Expo, Occupational Health and Safety Program (Topics: Healthcare and community health workers, Intersection of patient safety and worker safety, Work organization and health, Injuries related to work, Violence in the workplace, Worksite wellness/worksite health promotion, Utilizing workplace programs/interventions/best practices to protect workers)

2020-2021	APHA Annual Meeting and Expo, Injury Control and Emergency Services (Topics: Firearm violence, Violence prevention/control)
2020	Office of Disease Prevention and Health Promotion, Healthy People 2030, pre-launch website reviewer
2017-2018	APHA Annual Meeting and Expo, Public Health Education and Health Promotion (Topics: Innovative teaching strategies in health communication, Worksite wellness and health promotion)

HONORS AND AWARDS

Honors

2023	2022 *Journal of Urban Health* Best Paper Award (coauthor)
2022	Student Concluding Plenary Speaker, Society for the Advancement of Violence and Injury Prevention (SAVIR) 2022 Conference
2020	Star(s) of the Month. SOURCE Community Engagement and Service-Learning Center, Johns Hopkins Bloomberg School of Public Health
2019	LGBTQ+ Ally Invited Attendee, Western Oregon University Lavender Graduation
2016	Invited Visiting Faculty, Guangxi Medical University, Nanning, China, in partnership with Western Oregon University's International Education and Development Department
2014	Affiliate Instructor, Northern Arizona University, School of Nursing
2011-2014	Affiliate Instructor, University of Washington, School of Nursing
2003	Pass with Distinction thesis designation, University of Oregon, Clark Honors College
2003	Spanish Departmental Honors, University of Oregon
2003	Phi Beta Kappa Honor Society, University of Oregon

Awards

2022	Trainee/Early Career Researcher Travel Award, 2022 National Research Conference on Firearm Injury Prevention
2022	The Susan P. Baker Scholarship in Injury Prevention and Control, Johns Hopkins Bloomberg School of Public Health, Department of Health Policy and Management
2020	James P. Keogh Memorial Scholarship, American Public Health Association Occupational Health and Safety Section

2019	T32 Predoctoral Fellow Award, Interdisciplinary Research Training in Trauma and Violence, National Institute of Child Health and Human Development (T32-HD 094687)
2014	Caught you Caring Colleague Recognition, Northern Arizona Healthcare
2013	Champion of Worksite Wellness, Wellness Council of Arizona
2013	Process, Progress, and Leadership in Workplace Wellness, Wellness Council of Arizona
2012	Process and Leadership in Workplace Wellness, Wellness Council of Arizona
2009	Masters Outstanding Student Award, University of Washington, School of Nursing
2008	Paul Ambrose Scholar, Association for Prevention Teaching and Research
2007	T42 Graduate Trainee Award, National Institute for Occupational Safety and Health (T42 OH008433)
2004	Citizens of the World Scholar, San Lucas Toliman, Guatemala, University of Washington School of Nursing

PUBLICATIONS

Journal Articles

13. **Ward, J. A.**, Uzzi, M., Hudson, T., Webster, D. W., Crifasi, C. K. (In press). Differences in perceptions of gun-related safety by race and gun ownership in the United States. *Journal of Law, Medicine, and Ethics.*

12. Stone, E. M., Crifasi, C. K., **Ward, J. A.**, Vernick, J. S., Webster, D. W., McGinty, E. E., & Barry, C. L. (2022). National support for gun policies among US adults in 2019 and 2021. *Preventive Medicine, 165*(2022)*,* 107242. https://doi.org/10.1016/j.ypmed.2022.107314

11. **Ward, J. A.**, McGinty, E. E, Hudson, T., Stone, E. M., Barry, C. L. Webster, D. W., Crifasi, C. K. (2022). Reimagining public safety: Public opinion on police reform and gun violence prevention by race and gun ownership in the United States. *Preventive Medicine, 165*(2022), 107180. doi.org/10.1016/j.ypmed.2022.107180

10. Doucette, M. L., **Ward, J. A**., McCourt, A., Webster, D. W., Crifasi, C. K. (2022). Officer-involved shootings and concealed carry weapons permitting laws: Analysis of Gun Violence Archive data, 2014-2020. *Journal of Urban Health, 99*, 373-384. doi.org/10.1007/s11524-022-00627-5

9. Crifasi, C. K., **Ward, J. A.**, McGinty, E. E., Barry, C. L., & Webster, D. W. (2022). Public opinion on laws regulating public gun carrying. *Preventive Medicine, 159*(2022), 107067. doi.org/10.1016/j.ypmed.2022.107067

8. **Ward, J. A**., Stone, E. M., Mui, P., & Resnick, B. (2022). Pandemic-related workplace violence and its impact on public health officials, March 2020 – January 2021. *American Journal of Public Health, 112*(5), 736-746. doi.org/10.2105/AJPH.2021.306649

7. Marquez, N., **Ward, J. A.,** Parish, K., Saloner, B., & Dolovich, S. (2021). COVID-19 incidence and mortality in federal and state prisons compared with the US population, April 5, 2020 to April 2, 2021. *JAMA*, *326*(18), 1865-1867. doi.org/10.1001/jama.2021.17575

6. Crifasi, C. K., **Ward, J. A.,** McGinty, E. E., Webster, D. W., & Barry, C. L. (2021). Gun purchasing behaviours during the initial phase of the COVID-19 pandemic, March to mid-July 2020. *International Review of Psychiatry, 33*(7), 593-597. doi.org/10.1080/09540261.2021.1901669

5. Crifasi, C. K., **Ward, J. A.,** McGinty, E. E., Webster, D. W., Barry, C. L. (2021). Public opinion on gun policy by race and gun ownership status. *Preventive Medicine, 149*(2021),106607. doi.org/10.1016/j.ypmed.2021.106607

4. **Ward, J. A.,** Parish, K., DiLaura, G., Dolovich, S., & Saloner, B. (2021). COVID-19 cases among employees of US federal and state prisons. *American Journal of Preventive Medicine, 60*(6), 840-844. doi.org/10.1016/j.amepre.2021.01.018

3. Saloner, B., Parish, K., **Ward, J. A.,** DiLaura, G., & Dolovich, S. (2020). COVID-19 cases and deaths in federal and state prisons. *JAMA, 324*(6), 602. doi.org/10.1001/jama.2020.12528

2. **Ward, J. A**., Beaton, R. D., Bruck, A. M., & de Castro, A. B. (2011). Promoting occupational health nursing training: An educational outreach with a blended model of distance and traditional learning approaches. *AAOHN Journal. 59*(9), 401-6. doi.org/10.1177/216507991105900904

1. **Ward, J. A.,** de Castro, A. B., Tsai, J. H.-C., Linker, D., Hildahl, L., & Miller, M. E. (2010). An injury prevention strategy for teen restaurant workers: Washington State's ProSafety Project. *AAOHN Journal*. *58*(2), 57-65. doi.org/10.3928/08910162-20100127-01

PRACTICE ACTIVITIES

Practice-Related Reports

The Advisory Board Company. (2015, December). *Focus on attainable behavioral health goals drives case management results: Northern Arizona Healthcare, Flagstaff AZ case study*. Retrieved from www.advisory.com

Testimony

Cited in: *Hybrid Hearing on "Upgrading Public Health Infrastructure: The Need to Protect, Rebuild, and Strengthen State and Local Public Health Departments."* 117th Congress House Select Subcommittee on the Coronavirus Crisis (2021). Testimony by Dr. Beth Resnick. https://docs.house.gov/Committee/Calendar/ByEvent.aspx?EventID=114079

Cited in: *COVID Outbreaks and Management Challenges: Evaluating the Federal Bureau of Prisons' Pandemic Response and the Way Forward.* 117th Congress House Appropriations Committee. 00:45:40 (2021-2022). Congressman C.A. Dutch Ruppersberger. C-span.org/video/?509989-1/covid-19-pandemic-federal-prisons

Ward, J. A. (2019, February 25). Re: Oregon SB754 [Public Testimony, Senate Committee on Healthcare, Exhibit 21]. https://olis.leg.state.or.us/liz/2019R1/Committees/SHC/2019-02-25-13-00/SB754/Details

Ward, J. A. (2017, May 1). Re: Docket ID No. EPA-HQ-OA-2017-0190 [Public Testimony, Document ID EPA-HQ-OA-2017-0190-0042 Comment Tracking number 1k1-8w5f-783e]. https://www.regulations.gov/document?D=EPA-HQ-OA-2017-0190-37480

Media Dissemination

Traditional Media

Rizzo, S. (2022, March 17). Local health officials report threats, vandalism and harassment during the pandemic, study finds. *The Washington Post.* https://www.washingtonpost.com/health/2022/03/17/public-health-official-harassment/

Mulunkika, A. H. (2022, March 17). "Is it worth it?": New report lays bare harassment of public health officials during the pandemic. *STAT.* https://www.statnews.com/2022/03/17/public-health-harassment-covid19-pandemic/

Quoted in: Wilkie, W. (2021, April 15). NC prisons running out of people willing to be vaccinated. *Carolina Public Press.* https://carolinapublicpress.org/44281/nc-prisons-running-out-of-people-willing-to-be-vaccinated/

Quoted in: Wilkie, W. (2021, March 26). Incarcerated individuals in North Carolina to receive vaccines. *Carolina Public Press.* https://carolinapublicpress.org/43668/incarcerated-individuals-in-north-carolina-to-receive-vaccines/

Sternlicht, A. (2020, July 8). Prisoners 550% more likely to get COVID-19, 300% more likely to die, new study shows. *Forbes.* https://www.forbes.com/sites/alexandrasternlicht/2020/07/08/prisoners-550-more-likely-to-get-covid-19-300-more-likely-to-die-new-study-shows/

Simpson, T. (2020, July 8). Coronavirus infecting America's prison inmates 5 times more than outside, new study finds. *ABC News.* https://abcnews.go.com/Health/coronavirus-infecting-americas-prison-inmates-times-ucla-study/story?id=71668086

Featured in: Stayner, W. (2019, March 1). Measles vaccination clinics put focus on prevention. *The Columbian.* https://www.columbian.com/news/2019/mar/01/measles-vaccination-clinics-put-focus-on-prevention/

Social Media, Podcasts, Blog Posts, Videos

Kutsch, T. (2022, August 8). More polling reveals the popularity of public safety reforms. *The Trace Daily Bulletin* [newsletter]. https://www.thetrace.org/newsletter/popularity-public-safety-reform/

Resnick, B., Mui, P., **Ward, J. A**., Stone, E. (2021, June). *Public Health Under Threat: An Examination of State Laws Protecting Public Health Officials from Harassment.* Non-presenting co-author, Network for Public Health Law [webcast], June 24, 2021. Virtual.

Mui, P., **Ward, J. A.**, Resnick, B. (2021, February). *Examination of the Problem: Public Health Officer Harassment, Threats and Departures*. Non-presenting co-author, We Stand with Public Health [webcast], February 24, 2021. Virtual.

PART II

TEACHING

Academic Advisees

Oregon Health & Science University, Bachelor of Science, Nursing

10 undergraduate students annually, Advisor, 2014-2019

Northern Arizona University, Master of Science in Nursing

Jennifer Meiser-Hayes, Mentor, 2013-2014

University of Washington, Master of Nursing

Rachel Sousa, Advisor, 2010
Alison Crollard, Advisor, 2010
Kelli Barber, Advisor, 2010

Classroom Instruction

Lead Teaching Assistant, Johns Hopkins University, Bloomberg School of Public Health

The Media and the Message: What Public Health Needs to Know about the News
T4/2022, Theory: 50
Principles and Practice of Injury Prevention Summer Institute
Su/2021, Theory: 29

Teaching Assistant, Johns Hopkins University, Bloomberg School of Public Health

Policing and Public Health
T1/2022, Theory: 29
Crafting Effective Solutions to Gun Violence: Problem Solving Seminar
T4/2022, Theory: 55
T4/2021, Theory: 35
Research and Evaluation Methods for Health Policy
T3/2022, Theory: 59
T3/2021, Theory: 38
Understanding & Preventing Violence
T2/2020, Theory: 48

Public Health Policy
Su2020, Theory: 189, Discussion Section: 31
Summer Youth Institute on Gun Violence Prevention
Su2020, Theory: 58

Lead Instructor/Course Coordinator, Oregon Health & Science University, School of Nursing

Population Health Practice (NRS 410)
Sp2019, Theory: 31, Clinical: 4
Sp2018, Theory: 33, Clinical: 2
Sp2017, Theory: 29, Clinical: 4
Sp2016, Theory: 34 (30 in US & 4 in Thailand), Clinical: 4
Foundations of Nursing: Chronic Illness I (NRS 211)
W2019, Skills/Simulation: 31
W2018, Skills/Simulation: 32
W2017, Skills/Simulation: 32
Chronic Illness II & End-of-Life (NRS 321)
W2016, Theory: 34
Foundations of Nursing: Health Promotion (NRS 210A)
F2018, Theory: 32

Instructor, Oregon Health & Science University, School of Nursing

Foundations of Nursing: Health Promotion (NRS 210)
F2020, Theory: 32
Foundations of Nursing: Health Promotion (NRS 210B)
F2018, Skills/Simulation: 32, Clinical: 8
F2017, Skills/Simulation: 32, Clinical: 8
F2016, Skills/Simulation: 32, Clinical: 8
F2015, Skills/Simulation 32, Clinical: 8
F2014, Skills/Simulation: 32, Clinical: 8
Chronic Illness II & End-of-Life (NRS 321)
W2019, Theory: 31
W2018, Theory: 32
W2017, Theory: 30
W2015, Theory: 30
Foundations of Nursing: Chronic Illness I (NRS 211)
W2016, Skills/Simulation: 32
W2015, Skills/Simulation & Clinical: 32
Population-Based Care (NRS 410)
Sp2015, Theory: 30, Clinical: 3
Epidemiology (NRS 411)
Sp2016, Theory Grader: 31
Sp2015, Theory: 19
Nursing Leadership in Health Care Delivery Systems (NRS 412)
F2017, Clinical: 4
F2015, Clinical: 5
F2014, Clinical: 4

Instructor, University of Washington, School of Nursing

Partnerships in Community Health (NCLIN 409AB)
F2010, Seminar & Clinical: 10

Visiting Faculty, Guangxi Medical University, Nanning, China, Health Care Management

社区及公共卫生, The Community and Public Health
December 2016, Theory: 43

Other Teaching, Guest Lectures

Johns Hopkins Bloomberg School of Public Health, Department of Health Policy and Management, Virtual, "Lessons from a mixed methods analysis of workplace violence against public health officials," 305.861.71, Graduate Seminar in Injury Research and Policy - Occupational Injury, T1 2023, November 21, 2022.

Johns Hopkins Bloomberg School of Public Health, Department of Health Policy and Management, Virtual, "Back to Step 1 (of the Public Health Model): A National Re-examination of Shootings by Police," 310.635.81, Policing and Public Health, F2022, September 15, 2022.

Oregon Health & Science University, School of Nursing, Monmouth/Virtual, "Cultural Humility and Social Justice," NRS 410, Population Health Practice, Sp2021, April 13, 2021.

Oregon Health & Science University, School of Nursing, Monmouth/Virtual, "Health Equity: A Life-Course Question," NRS 410, Population Health Practice, Sp2021, April 13, 2021.

Johns Hopkins Center for Gun Violence Prevention, Summer Youth Institute, Virtual, "Prohibitions for Gun Ownership – Balancing Rights vs Risks," July 14, 2020

University of Washington, School of Nursing, Seattle, "Program Implementation and Evaluation Design," NSG 554, Occupational Perspectives on Worker Populations, W2010.

Other Teaching, Continuing Education

University of Washington, Northwest Center for Occupational Health & Safety, Occupational Health Nursing Institute, Seattle/Virtual, Sp2010.

RESEARCH GRANT PARTICIPATON

2019-2021	***Interdisciplinary Research Training in Trauma and Violence*** (T32-HD 094687), National Institute of Child Health and Human Development. **PI:** Jacquelyn Campbell, PhD, MSN & Tina Cheng, MD, MPH **Mentors:** Daniel Webster, ScD, MPH & Cassandra Crifasi, PhD, MPH **Role:** Predoctoral Trainee
2016	***Polk County Inter-Professional Care Access Network: Neighborhood Collaborative for Academic-Practice Partnership***

	(GSONO0435A), Willamette Valley Community Health Coordinated Care Organization Healthy System Innovation Grant **PI:** Angie Docherty, Nurs.D., MPH, $90,030 over 2 years **Role:** Grant Editor/Contributor, Steering Committee Member, Inaugural Faculty-in-Residence
2012	***Workers' Compensation RN Case Management***, Flagstaff Medical Center Evidence Based Practice **Co-I:** Julie Ward, MN & Kerry Cassens, MSN, MPH, $4,990 **Role:** Grant Writer and Co-Investigator
2011	***Global Visionaries***, CFO Selections **PI:** Chris Fontana, $11,000 **Role:** Grant Writer
2010	***Global Visionaries Program for Establishing Quality Education and Learning Opportunities for All Ages,*** Seattle International Foundation **PI:** Chris Fontana, $12,500 **Role:** Grant Writer
2007-2009	***Northwest Education and Research Center Training*** (T42-OH008433), National Institute for Occupational Safety and Health, Education and Research Center **PI:** Noah Seixas, PhD, MS **Mentor:** Butch de Castro, PhD, MSN/MPH **Role:** Graduate Trainee
2008	***ProSafety Youth Occupational Injury Prevention*** (2008-XB-00062), Washington State Department of Labor and Industry's Safety and Health Investment Projects (SHIP) Program. **PI:** Lyle Hildahl, $141,947 **Role:** Grant Writer, Intervention Designer, Project Coordinator
2007-2009	***Supporting Healthy Marriage (SHM) Evaluation, Seattle Becoming Parents Program Site*** (No. HHS-223-03-0034), US Department of Health and Human Services, Administration for Children and Families. **PI:** Pam Jordan, PhD & Aly Frei, MN, $4 million over 2-3 years **Role:** Director of Quality Assurance and Interim Project Director

ACADEMIC SERVICE

Departmental

Johns Hopkins Bloomberg School of Public Health, Dept. of Health Policy & Management

2020-2022	Academic Policy and Admissions Committee, PhD Student Representative
2020	Summer Youth Institute on Gun Violence Prevention, Planning Committee Member

Oregon Health & Science University, School of Nursing-Monmouth

2015-2019	Monmouth Curriculum Innovation and Evaluation Committee, *Chair*, 2016-2018
2014-2015	Monmouth Quality Improvement Committee
2014-2015	Monmouth Team Affairs Committee

School-wide

Johns Hopkins University, Bloomberg School of Public Health

2021	Protecting Public Health Steering Committee
2021	COVID-19 Mental Health Taskforce, Facilitator
2020-2021	Student Assembly, HPM Department Representative

Oregon Health & Science University, School of Nursing

2015-2018	Care Coordination and Transition Management, Training Group and Taskforce Member
2016	Inter-professional Care Access Network (ICAN), Steering Committee Member

University of Washington, School of Nursing

2010	Nurse Camp Minority Nurse Outreach/Recruitment Committee

University

Johns Hopkins University

2022-present	Doctor of Philosophy Board, Student Representative
2019-2020	Nursing Public Health Network *Executive Committee, Member-at-Large*

PRESENTATIONS ***** *Indicates a mentored undergraduate student*

Scientific Meetings

International

22. **Ward, J. A**. (2019, June). *Using course structure to facilitate population health interest and understanding among pre-licensure nursing students.* Poster session presented at the International Council of Nurses Congress. Singapore.

National

21. **Ward, J. A.**, Hudson, T., Uzzi, M., Webster, D. W., Crifasi, C. K. (2022, December). *Uncovering a paradox: American perceptions of gun-related safety by race and gun ownership.* Podium presentation at the 2022 National Research Conference on Firearm Injury Prevention. Washington, DC.

20. **Ward, J. A.**, Webster, D. W., Crifasi, C. K. (2022, December). *Fatal and nonfatal shootings by police in the United States, 2015-2020.* Poster presentation at the 2022 National Research Conference on Firearm Injury Prevention. Washington, DC.

19. Uzzi, M., **Ward, J. A.,** Buggs, S., Mooney, G., Jackson, J., Webster, D. W., Crifasi, C. K. (2022, December). *Assessing the intersection of historic contemporary structural racism on firearm violence in Baltimore City.* Non-presenting co-author of podium presentation at the 2022 National Research Conference on Firearm Injury Prevention. Washington, DC.

18. Crifasi, C. K., **Ward, J. A**., McCourt, A. D., Doucette, M. L., Webster, D. W. (2022, December). *Permit-to-Purchase laws and shootings by police.* Non-presenting co-author of podium presentation at the 2022 National Research Conference on Firearm Injury Prevention. Washington, DC.

17. Doucette, M. L., Crifasi, C. K., McCourt, A. D., **Ward, J. A**., Fix, R. L., Webster, D. W. (2022, December). *Deregulation of public civilian gun carrying and violent crime: A longitudinal analysis 1993-2019.* Non-presenting co-author of podium presentation at the 2022 National Research Conference on Firearm Injury Prevention. Washington, DC.

16. **Ward, J. A.,** Doucette, M., Webster, D. W. & Crifasi, C. K. (2021, October). *Fatal and non-fatal officer involved shootings, 2014-2020.* Podium presentation at the American Public Health Association Annual Meeting. Denver, CO and Virtual.

15. **Ward, J. A.,** Crifasi, C. K., McGinty, E. E., Barry, C. L., Webster, D. W. (2021, October). *American views on public safety by race and gun ownership status.* Virtual poster presentation at the American Public Health Association Annual Meeting. Denver, CO and Virtual.

14. Doucette, M., **Ward, J. A.**, Crifasi, C., McCourt, A. D., & Webster, D. (2021, October). *Officer-involved shootings and concealed carry weapons permitting laws: Analysis of Gun Violence Archive data, 2014-2020.* Non-presenting co-author of podium presentation at the American Public Health Association Annual Meeting. Denver, CO and Virtual.

13. McCourt, A. D., Doucette, M., Crifasi, C., **Ward, J. A.,** Webster, D. (2021, October). *Changes to the legal landscape for civilian gun carrying and impacts on homicide.* Non-presenting co-author of podium presentation at the American Public Health Association Annual Meeting. Denver, CO and Virtual.

12. Webster, D., Crifasi, C., McGinty, E. E., **Ward, J. A.**, Barry, C. (2021, October). *Public opinion on laws regulating civilian gun carrying.* Non-presenting co-author of podium presentation at the American Public Health Association Annual Meeting. Denver, CO and Virtual.

11. Mui, P., **Ward, J. A.**, Resnick, B. (2021, October). *Addressing a threat to our nation's health: Public health officer harassment, threats and departures.* Non-presenting co-author of roundtable presentation at the American Public Health Association Annual Meeting. Denver, CO and Virtual.

10. Stone, E. M., **Ward, J. A**., Mui, P., Resnick, B. (2021, August). *A threat to our nation's health: Local health official harassment, threats, and departures.* Podium presentation at National Association of Local Boards of Health (NALBOH) Annual Conference. Virtual.

9. **Ward, J. A**., Stone, E. M., Mui, P., Resnick, B. (2021, June). *Threats, departures, and a strained workforce: Unpacking local public health officials' experiences during the COVID-19 pandemic*. Podium presentation at NACCHO 360 Annual Conference. Virtual.
8. Resnick, B., Mui, P., **Ward, J. A.,** Stone, E. (2021, May). *A threat to rural health: Health official departures.* Non-presenting co-author of podium presentation National Rural Health Association (NRHA) Annual Conference. Virtual.
7. **Ward, J. A**. (2018, April). *Reimagining behavioral health education in the rural context: Literature as a tool for understanding*. Podium presentation at the annual meeting of the Association for Prevention Teaching and Research, Philadelphia, PA.
6. **Ward, J. A**., Miller, M. E., Hildahl, L., & de Castro, A. B. (2009, February). *Innovative program design: ProSafety school-to-work teen restaurant worker injury prevention*. Poster presentation at the annual meeting of the Association for Prevention Teaching and Research, Los Angeles, CA.

Regional/Local

5. Espineli, N.*, **Ward, J. A.,** Crifasi, C. K. (2022, July). *Fatal & nonfatal injuries: Shootings by police, January – March 2021.* Poster presentation at the Diversity Summer Internship Program Poster Session, Baltimore, MD.
4. Johnson, K.*, & Watson, C.* (2019, October). *Harm reduction strategies related to opioid use.* Poster presentation at the annual meeting of the Oregon Public Health Association, Corvallis, OR.
3. Gutierrez, X.*, & Rauch, N*. (2018, May). *Faulconer-Chapman Elementary School: Creating a drug and alcohol prevention initiative.* Poster presentation at Western Oregon University Academic Excellence Showcase, Monmouth, OR.
2. Hendrick, J.* (2017, May). *Increasing participation in a college violence prevention program.* Poster presentation at the annual meeting of the Oregon Public Health Association's Public Health Nursing Section, Portland, OR.
1. Freiheit, H., Cooper, H., Hagan, C., Marcus, A., Matthews, L. R., Nichols, M., Richards, J., Rose, T., Saifkhani, T., Truong, T., **Ward, J. A**., Leitch, J., & Nielsen, A. (2017, May). *Working together to improve care coordination and transitions management: An academic practice partnership.* Poster presentation at the Oregon Consortium for Nursing Education Faculty Development Conference. Eugene, OR.

Invited Seminars

National

10**. Ward, J. A.** (2022, April). *Reflections on mentorship.* Inaugural Student/Early Career Professional Concluding Plenary, Society for Advancement of Violence and Injury Research 2022 Conference, Washington, D. C.
9**. Ward, J. A.** et. al. (2007, November). Invited panel member. Advanced Training in Family Support Coordination and Supervision. University of Central Florida, Orlando, FL.

8. **Ward, J. A.** et al. (2006, May). Invited panel member for national researchers' conference. National Hispanic Healthy Marriage Initiative Conference. U. S. Department of Health and Human Services Administration for Children and Families. San Antonio, Texas.

Regional/Local

7. **Ward, J. A.** (2023, February). *From police shootings to policy reforms: A research agenda for improving equity in public safety*. Department of Health Systems, Management & Policy. Colorado School of Public Health, Aurora, CO.
6. **Ward, J. A.** (2023, February). *Improving health systems to meet public safety needs: Violence, injury, and workforce solutions.* Division of Health Policy and Management. University of Minnesota, Minneapolis, MN.
5. **Ward, J. A.** (2023, January). *From police shootings to policy reforms: A research agenda for improving equity in public safety*. Department of Medicine, Health, & Society. Vanderbilt University, Nashville, TN.
4. **Ward, J. A.** (2021, November). *Developments in research on shootings by law enforcement*. Johns Hopkins Department of Mental Health, Public Health in the Juvenile Legal System Seminar Series. Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
3. **Ward, J. A.**, & Patel, E. (2019, November). *A policy workshop with Dr. Jacquelyn Campbell*. Moderator. Johns Hopkins University, Baltimore, MD.
2. **Ward, J. A.** (2012, February). *Creating an organizational wellness program*. Podium presentation. Verde Valley Human Resources Association, Prescott, AZ.
1. **Ward, J. A.** & Hildahl, L. (2009, June). *Merging research and practice: The ProSafety partnership for young workers' safety*. Paper presented at the University of Washington School of Nursing Health Resource and Services Administration (HRSA) Training Grant Spring Conference, Bellevue, WA.

ADDITIONAL INFORMATION

My primary research goal is to understand and prevent violence and violence-related trauma in community spaces. My research focuses on gun violence prevention, police use of deadly force, public safety interventions, and the intersection of workplace health and community health. Health equity, community engagement, and social justice are values that are woven throughout my research and practice.

Keywords: Gun Policy, Police Violence, Violence Prevention, Structural Determinants of Health, Occupational Health, Health Equity, Community Health Systems, Population Health, Urban and Rural Health, Public Health Workforce