Race, Crime, and the Micro-Ecology of Deadly Force

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Research Summary

Limitations in data and research on the use of firearms by police officers in the United States preclude sound understanding of the determinants of deadly force in police work. The current study addresses these limitations with detailed case attributes and a microspatial analysis of police shootings in St. Louis, MO, between 2003 and 2012. The results indicate that neither the racial composition of neighborhoods nor their level of economic disadvantage directly increase the frequency of police shootings, whereas levels of violent crime do—but only to a point. Police shootings are less frequent in areas with the highest levels of criminal violence than in those with midlevels of violence. We offer a provisional interpretation of these results and call for replications in other settings.

Policy Implications

Nationwide replications of the current research will require the establishment of a national database of police shootings. Informative assessments of a single agency's policies and practices require comparative information from other agencies. We recommend specific data elements to be included in such an information system that would shed further empirical light on the interconnections among race, crime, and police use of

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deadly force. The database also would contribute to the development of evidence-based policies and procedures on deadly force—an urgent public priority in light of recent controversial police shootings across the United States.

Keywords

race, crime, ecology, police, deadly force

The use of deadly force by police officers has recently emerged as the most visible and controversial aspect of the American criminal justice system. The protests and related civil unrest after the shooting of Michael Brown by Officer Darren Wilson in the St. Louis suburb of Ferguson, MO, in August 2014 captured the nation's attention and led to the convening of The President's Task Force on 21st Century Policing.[1] Both the visibility of police shootings and the public concern about the issue have grown since the summer of 2014 as other instances in which police officers shot citizens captured widespread media attention. Officer-involved shootings that preceded the Ferguson incident, such as the shooting of James Boyd by officers of the Albuquerque, NM, police department, received renewed public attention. Subsequent incidents in other cities, such as the shooting of Tamir Rice in Cleveland, OH, have added to general concerns about the use of deadly force by America's police officers and have prompted many questions about officer-involved shootings. Chief among these questions are the following: How often do American police officers use deadly force against citizens? And what is the role of citizen race in the deadly force picture? Unfortunately, neither question can be answered satisfactorily because existing national data on police use of deadly force have critical limitations that render sound empirical inquiry into these (and related) questions essentially impossible.

Many commentators have expressed astonishment at the paltry state of existing information systems on police use of deadly force. Even the Director of the Federal Bureau of Investigation (FBI) was surprised to learn that his own agency could not give him an accurate count of police shootings across the nation (Comey, 2015). As we will discuss in this article, prior academic research based on the flawed data that do exist has produced mixed results regarding the role of race in police use of deadly force. Some studies have found that race is unrelated to police killings, whereas others have reported that race matters. Many studies also have reported a link between crime rates and police killings, but such studies often have not incorporated controls for other influences, including the racial composition and socioeconomic characteristics of the places studied. In sum, the available data and prior research do not permit sound assessments of the social determinants of the use of deadly force by the police, racial disparities in police shootings, or the degree to which racial disparities may reflect biased or discriminatory police behavior. Therefore, they

1. See cops.usdoj.gov/default.asp?Item=2761.

cannot serve as a reliable guide for policy evaluation—a pressing public priority in light of recent events.

The current study seeks to overcome many of the data and research limitations in prior studies of police use of deadly force with data on 230 police shootings that occurred in St. Louis, MO, between 2003 and 2012. The analysis has two parts. We first present a detailed description of the officers and citizens[2] involved in the shootings, as well as of incident characteristics, such as the number of officers and citizens present, the number of officers who discharged their weapon, and the number of citizens wounded or killed in the encounter. The second part of the analysis examines the effect of racial composition on police shootings across St. Louis neighborhoods, controlling for neighborhood violent crime rates, socioeconomic disadvantage, and other potentially relevant factors. Our intent in presenting these analyses is twofold. First, they are of substantive interest in their own right because they disclose both individual and microspatial characteristics and correlates of police use of deadly force in a large American city with a sizable number of officer-involved shootings. Second, and equally important, we intend the study as an example of the kind of data and research that can become widespread were a national information system on the use of deadly force by the police to be established. We close with specific recommendations for the kind of data elements that should be included in a detailed, reliable, and comprehensive national database on officer-involved shootings, along with a brief discussion of how such a database could improve police practice and enhance understanding of the nature and determinants of deadly force in American policing.

Background

The question of the role that race plays in police officers' decisions to use their firearms against citizens has figured centrally in deadly force research since the dawn of social scientific inquiry on the topic in the 1960s. Early studies reported that Blacks were much more likely than Whites to die from police gunfire (e.g., Robin, 1963). Early explanations for this disparity mirrored many recent popular accounts. Takagi (1974: 30), for example, argued that differential crime patterns did not account for the heightened likelihood that Blacks would be killed by the police, stating that "police have one trigger finger for whites and another for blacks." Goldkamp (1976), on the other hand, maintained that the overrepresentation of Blacks among police-caused deaths in the United States could in fact be a result of a disproportionate amount of Black involvement in crime, and he called for careful empirical investigation into why Blacks are more likely than Whites to be killed by the police.

On the heels of this recommendation came a series of state- and city-level studies that examined the links among race, crime, and police use of deadly force. In the first state-level study to examine the roles of race and crime in police-caused homicides, Jacobs and Britt

2. We use the term "citizen" simply to refer to individuals who are not police officers and not as a description of their citizenship or legal status.

(1979) measured death counts with data from the National Vital Statistics System (NVSS). They reported that a strong bivariate association between racial composition and police-caused deaths disappeared in multivariate models including measures of economic inequality and crime, which remained significant predictors of police killings at the state level.

In the late 1970s, researchers also began conducting city-level analyses of the determinants of deadly force. Sherman and Langworthy (1979) used Vital Statistics and internal police department data to examine the effects of multiple predictors on police-caused deaths in several dozen large cities. They reported that the unemployment rate was not related to homicides by police officers but that both overall violence and murder rates were positively correlated with citizen deaths at the hands of the police. Sherman and Langworthy estimated only bivariate models, however, so their findings could well be attributable to omitted variables. Liska and Yu (1992) extended Sherman and Langworthy's study in a multivariate analysis of police-caused deaths in 45 large cities. They reported that police-caused death counts were higher in cities with higher levels of violent crime and larger minority populations.

Subsequent studies used data from the FBI's Supplementary Homicide Reports (SHR) to examine the determinants of police use of deadly force in U.S. cities. Sorensen, Marquart, and Brock (1993) reported that city percent Black, a measure of economic inequality, and the violent crime rate were all positive predictors of the number of citizens killed by the police in cities with 100,000 or more residents, based on SHR data for 1980–1984. Jacobs and O'Brien (1998) also used SHR data to examine police use of deadly force in cities with populations greater than 100,000 for the years 1980–1986. They found that economic inequality and violence, but not racial composition, were positively associated with the overall level of police-caused deaths. They also reported, however, that deadly force against Black citizens was higher in cities with larger Black populations and lower in cities with Black mayors.

Limitations of Prior Research

Macrolevel studies using the FBI's SHR data to investigate the determinants of police use of deadly force have continued in recent years (e.g., Smith, 2003, 2004). But this research, as well as the research reviewed in the previous section, suffers from three key limitations (in addition to possible omitted variable bias in some studies). The first is that the Vital Statistics and FBI measures of police-caused deaths have been shown to undercount substantially the number of citizens killed by police officers (Fyfe, 2002; Klinger, 2012; Loftin, Wiersema, McDowell, and Dobrin, 2003; Planty et al., 2015). The scope of the undercount in official data sources has become a topic of intense interest since the Ferguson events of 2014. Legacy media (e.g., Barry and Jones, 2014; Kindy, 2015), web-based crowd sourcing projects (e.g., Killed by Police website [killedbypolice.net] and Fatal Encounters website [fatalencounters.org]), and the Bureau of Justice Statistics (e.g., Planty et al., 2015) have sought to provide more accurate estimates of how often American police officers kill citizens. These various efforts use different methodologies and ask somewhat different questions,

but they converge in finding that approximately twice as many citizens die at the hands of the police across the nation in a given year than are recorded in the FBI and NVSS data.[3] The magnitude of the apparent undercount of persons killed by the police undermines confidence in the results of research based on "official" counts of police-caused deaths.

Beyond the demonstrated lack of accuracy of the police homicide counts used in the state- and city-level research is a deeper conceptual liability in prior research: Death at the hands of the police is not a sound operationalization of the concept "police use of deadly force." This is so for the simple reason that all available evidence indicates that no one is killed in most incidents in which police officers discharge their firearms. Bullets fired by the police miss their mark in many shooting incidents, and most people who are struck by police gunfire survive their wounds (Alpert, 1989; Geller and Scott, 1992; Klinger, 2012).[4] As such, measures that count only dead bodies understate by a large margin the extent of deadly force by the police because they omit the many officer-involved shootings in which no citizens die. As Fyfe (1978) put it in his ground-breaking study of shootings by New York City police officers more than three decades ago:

> Deadly force is physical force capable of or likely to kill; it does not always kill. The true frequency of police decisions to employ firearms as a means of deadly force, therefore, can best be determined by considering woundings and off-target shots as only fortuitous variations of fatal shootings. All are of a kind. (32; underline in original)

Counting only fatal police shootings might be appropriate if the ratio of nonfatal-to-fatal police shootings were constant across place and over time. But prior research has shown that this ratio varies considerably across jurisdictions and different time periods (Geller and Scott, 1992; Klinger, 2012).

Another limitation in the studies that have used states and cities as units of analysis to examine the determinants of deadly force by police officers is that these large spatial aggregations mask substantial heterogeneity within the units, especially at the state level. Sorensen et al. (1993) and Jacobs and O'Brien (1998) both cited the possible aggregation bias resulting from the use of states as units of analysis as one reason they examined cities in their analyses of deadly force. But they noted that even cities are suboptimal and suggested

3. An assessment of police-caused fatality counts undertaken for the Bureau of Justice Statistics (BJS), for example, recently reported the following: Although the FBI's SHR count of justifiable homicides for the years 2003–2009 and 2011 averaged slightly more than 423 annually, the researchers commissioned by BJS estimated that annual police-caused deaths stood at 928 for that 8-year period (Banks, Couzens, Blanton, and Cribb, 2015).

4. For example, Alpert (1989) reported that officers from the Metro-Dade, FL, Police Department hit only 31 of the 100 suspects they shot at in the mid-1980s. Klinger (2012) reported that just 31.4% of the suspects struck by police gunfire in New York City between 1974 and 2008 died from their wounds. Comparable hit and death patterns are provided later in the current study.

that within-city spatial aggregates would be superior units of analysis for empirically assessing the determinants of deadly force. The only published study of this kind is Fyfe's (1980) investigation of the link between crime levels and officer-involved shootings across 20 patrol zones of the New York City Police Department for the years 1971–1975. He included all shootings in which officers intentionally fired at suspects, regardless of whether they killed, injured, or missed suspects, thus avoiding the conceptual pitfall of restricting his analysis to fatal shootings. Fyfe found a positive relationship between crime levels and police shootings, but he looked only at the relationship between crime and shootings, ignoring the possible influence of the racial composition of the patrol areas on shootings and other possible confounds of the observed crime-shooting relationship.

In addition, with an average population of approximately 400,000 residents, the within-city spatial aggregates Fyfe (1980) used are still large and heterogeneous; they hardly qualify as "neighborhoods," even in New York City. This is important because research has clearly established that urban neighborhoods exhibit substantial variation in crime, demographic composition, and socioeconomic status (Bursik and Grasmick, 1993; Peterson and Krivo, 2012; Sampson, 2012). Moreover, some research has suggested that police behavior may vary systematically with race and class across neighborhoods (e.g., Bass, 2001; Smith, 1986) and that the nature of police–citizen interactions in heavily minority communities may be markedly different than in other neighborhoods (e.g., Brunson, 2007; Brunson and Miller, 2006).

In sum, given the limitations of previous research, knowledge concerning the interconnections of race, crime, and police use of deadly force remains limited.[5] The current study diverges from prior research by analyzing the relationship between *all* intentional police shootings at citizens and the racial composition, crime rates, and other characteristics of neighborhoods in a single large city. The next section describes the location of the study, the unit of analysis we employed, the shooting data we obtained, and the analyses we conducted.

Data and Methods

The police shootings examined in this study involved members of the St. Louis Metropolitan Police Department (SLMPD) and took place between 2003 and 2012. St. Louis is an older industrial city that has seen better days. Once one of the nation's very largest cities, St. Louis's population has declined from a peak of 857,000 residents in 1950 to its current level of approximately 318,000. The population is roughly 50% Black, 44% White, 2.5% Asian, and 3% two or more races. Hispanics of any race constitute 3.5% of the city's current

5. Researchers have conducted nonspatial studies, such as longitudinal analyses (e.g., MacDonald, Kaminski, Alpert, and Tennenbaum, 2001), to examine the determinants of deadly force. These studies have suffered from the same problems as the state- and city-level studies, however, because they have been based on inaccurate official data and have used police-caused deaths to operationalize police use of deadly force.

population.[6] The population's median income and poverty rate place St. Louis among the nation's most economically disadvantaged large cities, and its violent crime rate—1,866 murders, rapes, robberies, and aggravated assaults per 100,000 population—is more than twice the average for U.S. cities with populations greater than 250,000.[7] The city's racial composition, socioeconomic characteristics, and violent crime rate make St. Louis a highly pertinent setting for examining the relationship among race, crime, and police use of deadly force.

Outcome Measure

The data used to construct the outcome measure in the present study were retrieved from investigative case files and reports kept by the SLMPD of all incidents in which sworn officers intentionally discharged their firearms at citizens during the 10-year period 2003–2012.[8] Police records indicate that St. Louis officers intentionally fired shots at citizens in 239 separate incidents during this period. Because the investigation into one of these incidents was still in progress when the data for this study were being developed, the SLMPD did not release it to the researchers. Review of the 238 case files that were released disclosed that eight shootings occurred outside the boundaries of the city of St. Louis. These incidents were eliminated from the data set, leaving 230 cases available for analysis in which SLMPD officers purposely discharged their firearm at citizens within the city limits.

Case Attributes

The data set developed for these 230 cases consists of descriptive information on each incident (e.g., the date, time, and location of the shooting; the number of officers and suspects present; and the total number of shots fired by the police), the officers who discharged their weapon (e.g., sex, race, age, years in service, and weapon type), and suspects present (e.g., demographic characteristics, the weapons they possessed, the number of shots officers fired at them, and the degree of injury they suffered from police gunfire). We present selected aspects of this descriptive information in the Results section because they are of interest in their own right and to set the stage for the spatial analysis of officer-involved shootings that follows.

6. St. Louis population characteristics are from factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_QTP3&prodType=table.

7. The violent crime data are for 2011. The St. Louis data are from slmpd.org/crimestats/CRM0005-C_20120118.pdf. The national data are from fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2011/crime-in-the-u.s.-2011/tables/table_16_rate_number_of_crimes_per_100000_inhabitants_by_population_group_2011.xls.

8. Like all other major U.S. law enforcement agencies, the SLMPD requires that its officers report to the agency that they have discharged their firearm any time they do so. The SLMPD then initiates a formal investigation into the event that culminates in an Internal Affairs report on the incident. The present study drew from both initial investigative material and the final Internal Affairs reports to compile the data on police shootings. Case files on accidental firearm discharges and intentional shootings of animals were excluded from consideration.

It should be noted, however, that the descriptive information we will provide here is only as accurate as the information contained in the case files we reviewed. Like all data drawn from police (and all other official) records, the information presented in this article is subject to the vagaries of how officer-involved shooting case files are constructed. It is possible, for example, that the status characteristics of suspects (and other aspects of shooting events) contained in some reports is incorrect. Although any such errors would not affect the central matter of this article—the micro-ecology of police deadly force usage—they could render some of the descriptive information we provide less than fully accurate. We advise readers to keep this in mind when perusing the case descriptives provided.

Microspatial Analysis

The two key predictors of interest in the microspatial analysis are the racial composition and level of firearm violence in St. Louis neighborhoods. The measure of firearm violence consists of an additive index of the average yearly homicide rate, firearm assault rate, and firearm robbery rate per 1,000 population for the years 2003 through 2012 (α = .640). Our analyses also include the percentage of the neighborhood population that is Hispanic, multiple measures of neighborhood socioeconomic status (unemployment rate, median household income, and percentage of persons older than age 25 years with a college education), residential stability (percentage owner-occupied dwellings and percentage of the population residing at the same residence 5 years before), age composition (percentage of the population between 18 and 24 years old and percentage age 50 years and older), and population size. Both firearm violence and officer-involved shootings exhibit significant spatial dependence, and our analysis incorporates spatial lag terms for these measures.[9]

The 2003–2012 crime data were obtained from the SLMPD. The remaining data are from the 2005–2009 American Community Survey summary file and are measured at the block-group level.[10]

Units of Analysis

Census block groups are the smallest geographic unit for which a diverse set of population characteristics is available for the time period under investigation. Block groups consist of clusters of contiguous census blocks and house between 600 and 3,000 residents. The average population of the 355 St. Louis block groups used in the current study is 1,000 (standard deviation [SD] = 399).[11] The police shooting and crime data for this study

9. The spatial lag terms are estimated from first-order queen's contiguity matrices, which include all neighborhoods that share a border or point. Similar results were obtained by using inverse distance matrices to estimate neighborhood spatial lags.

10. See census.gov/acs/www/data_documentation/summary_file/.

11. St. Louis has 360 census block groups. For measurement reliability, the five block groups with fewer than 100 residents were omitted. No officer-involved shootings occurred in these areas during the time period under investigation.

were retrieved from the SLMPD at the address level and allocated to block groups.[12] Block groups are not perfect measures of "neighborhoods," but their large number, relatively small size, and internal homogeneity (compared with states, cities, or police districts) make them a suitable unit of analysis for our purposes.[13]

After discussing descriptive information on the 230 officer-involved shooting incidents, we present descriptive statistics for the variables included in the analysis of the microspatial determinants of the shootings across St. Louis block groups. We then present the results of an ordinary least-squares estimation of the effects of racial composition, socioeconomic status, and other block group characteristics on the index of firearm violence. The results of Poisson estimations of officer-involved shootings follow. The distribution of shootings across the 355 block groups is sparse and highly skewed (e.g., no shootings occurred in 208 of the census block groups; see Table 2), which warrants the use of the Poisson estimator in count models of those incidents. The Poisson is favored over the negative-binomial estimator because goodness-of-fit tests reveal no significant overdispersion in the count models. Given the large number of zeros in the distribution of shootings across block groups, supplementary analyses based on zero-inflated Poisson estimations also were conducted.

Results

The presentation of results begins with descriptive information on the 230 officer-involved shootings. We present these results in some detail because they offer relevant background information for the spatial analysis of the shootings to follow, as well as because they provide readers with some sense of the nature and circumstances of police shootings, which is an important objective given the absence of detailed information on police shootings nationwide (for other single-site studies, see Alpert, 1989; Meyer, 1980; White, 2006).

Incidents

Table 1 presents summary data on the shooting incidents, including the number of officers present, the number of suspects present, the number of officers who discharged their weapon, the number of suspects wounded by police gunfire, and the number of suspects who died from their wounds. The number of officers present in the immediate area where the shootings occurred ranged from 1 to 12, with two or more officers present in 58%

12. Shootings were allocated to block groups based on the street address where officers discharged their firearm (or, in a small number of cases, by officers' locations in landmarks such as public parks). The location of the shooting is not necessarily the same as that where the police–citizen contact that led to the shooting began. Nearly half (49%) of the incidents in which officers fired shots involved foot chases, for example. Few of these chases, however, crossed block group boundaries. Similarly, although 41 incidents involved vehicle pursuits, approximately half of them started in a block group different from the block group where the shooting occurred. These cases likely contribute to spatial dependence in the shooting data.

13. See Rosenfeld, Bray, and Egley (1999) for a study of crime patterns across St. Louis block groups and Desmond and Valdez (2013) for the use of block groups in a spatial analysis of law enforcement action.

TABLE 1

Selected Characteristics of Police Shooting Incidents in St. Louis, 2003–2012

Variable	Mean	SD	Min	Max	*n*
Officers present	2.00	1.58	1	12	225
Officers firing	1.37	.94	1	8	230
Shots by officers	6.50	12.46	1	132	226
Suspects present	1.65	1.10	1	5	228
Suspects fired at	1.05	.25	1	3	228
Suspects struck	.53	.60	0	4	230
Suspects killed	.16	.38	0	2	230

Source. Data provided by the SLMPD.

of the incidents (mean = 2.00, SD = 1.58).[14] The number of officers who discharged their firearms ranged from 1 to 8, with a single officer shooting in 78% of the incidents (mean = 1.37, SD = .94).

That multiple officers were present in 58% of the incidents and just one officer fired in 78% points to an issue worth mentioning. Many of the cases under study involved officers who witnessed fellow officers discharge their firearms while opting to hold their own fire. A closer look at the data discloses that all officers present fired in just 33, or 25%, of the 133 cases in which two or more officers were on the scene (see White and Klinger, 2012, for similar results). The total number of police shots fired per incident ranged from 1 to 132 (mean = 6.50, SD = 12.5). The median number of shots fired was three, and the mode was just one. This evidence indicates that although some police shootings produced scores of shots fired, SLMPD shootings typically involved few police bullets.

The number of suspects present during police shootings ranged from 1 to 5 (mean = 1.65, SD = 1.10).[15] In 217, or 94%, of the incidents in which officers discharged their weapon, they shot at a single suspect. Police shot at two suspects in ten incidents and three suspects in one, and the number of suspects fired on was unclear in two case files. The number of suspects struck by police bullets ranged from zero to four (mean = .53, SD = .60). None of the rounds fired by officers hit any suspects in 117, or 51%, of the shooting incidents.[16] Thirty-seven suspects were killed in the 230 police-shooting incidents (mean = .16, SD = .38).

14. The number of officers present was not clear in five cases. Each of these cases, however, involved more than one officer.

15. It is possible that a small number of the incidents involved more than the number of suspects indicated in the case file. One incident, for example, involved an officer who stated that he was not certain whether the group of suspects from whom gunfire emanated (all of whom escaped capture) included four or five suspects. We coded the case as involving four suspects.

16. Thirty-six of the cases in which officers discharged their weapon included suspects who escaped capture and were never identified. It is possible that some of these individuals were struck by police

The nature of the incidents that led to the officer-involved shootings under study was varied. One incident, for example, was an ambush in which a suspect drove his vehicle into the patrol car of an officer who was monitoring a closed road, jumped out, and then started shooting at the officer. The officer returned fire, as did five other nearby officers who quickly responded to assist the officer who had been ambushed. Several shootings occurred during police activities that are the regular fare of the typical patrol officer: routine traffic stops ($n = 13$), domestic disputes ($n = 8$), and traffic accidents ($n = 2$). SLMPD officers fired shots in many situations that involved apparent criminal activity from the outset, including 28 robberies, 17 stolen vehicles, 16 car prowls, and 13 burglaries. Officers discharged their weapon in 45 incidents that began when they observed persons who possessed firearms or responded to "man with a gun" or "shots fired" radio calls. The most common type of incident that gave rise to officer-involved shootings involved an encounter with one or more "suspicious persons" who were either on foot or in a vehicle ($n = 49$). In sum, SLMPD officers fired shots in many different types of situations, but more than half (53%) of the officer-involved shootings in the current study took place in just three types of incidents: robberies (28), persons with guns or shots fired (45), and investigations of suspicious persons or vehicles (49).

Officers

A total of 315 officers discharged their weapon in the 230 incidents under study.

Twelve officers had less than a year on the job when they were involved in the shootings, a sizable majority (71%) had 10 or fewer years of experience with the SLMPD, and just six had more than 30 years on the job. A large majority (93%) of the shooters held the rank of patrol officer.[17] The remainder held the rank of sergeant or lieutenant.

The average age of officers who shot at suspects was 34 years (range = 22–56). The shooters were overwhelmingly male (96%). Roughly two thirds of the shooters were Non-Hispanic Whites, and one third were Non-Hispanic Blacks; just two officers were identified as Hispanic or other race. The age, sex, and race distribution of officers who fired at suspects is very similar to that of all SLMPD officers during the period under investigation.[18]

bullets for which they did not seek medical attention. Because hospitals in St. Louis are required to report all gunshot injuries to the police, however, we assumed that no suspects were struck by police bullets in these cases and coded them as not involving injury to the suspect. If this assumption is incorrect, the error rate is likely small and, in any event, would not affect the primary outcome measure in our spatial analysis, incidents per neighborhood in which officers fired shots.

17. Forty-six of these officers were identified as "detectives" in the investigative case files. In the SLMPD, "detective" is not a rank, however, but a designation given to individuals holding the rank of patrol officer when they work specific sorts of nonpatrol assignments. Most detectives in the present study were working plain-clothes crime suppression details when they were involved in shootings.

18. In 2008, the midpoint of the period under study, the average age of SLMPD officers was 37.9 years; 85% were male; and 64% were White, 34% were Black, and 2% were classified as other race. Hispanics were not classified separately. See slmpd.org/images/SLMPD%20ARGÇö8-31-10.pdf.

Suspects

The case files contained information on 373 suspects across the 230 officer-involved shootings. It is important to note that the designation "suspect" pertains to how citizens immediately involved in the incidents in question were viewed at the time that officers fired shots. In some cases, it became apparent after the incident had concluded that some individuals classified as suspects were not involved in the criminal activity that led to the officer-involved shooting. One incident, for example, involved three individuals designated as suspects who were in a motor vehicle that officers pulled over during a narcotics investigation. One passenger produced a pistol, which led to the officer-involved shooting. The investigation into the incident disclosed that neither of the other individuals in the vehicle had committed a crime, nor even knew that the armed individual was carrying a gun.

It is also important to note that, as indicated, many suspects were never identified or apprehended, and therefore, the case files did not contain complete demographic information on all suspects. Complete demographic information was available only for those suspects who were arrested or otherwise identified, but partial information was available for most of the suspects who were not apprehended.

Most (96%) of the 369 suspects whose sex was known were male; just 14 suspects were identified as female. Officers could not determine the race of 13 suspects. Most (92.5%) of the 360 remaining suspects were Black, 25 were White, and 2 were Asian. The age of 89 suspects was unknown. Suspects with known ages ranged from 13 years old to 57 years old (mean = 24, median = 21.5, mode = 17). The sex, age, and race distribution of the 244 suspects officers shot at was nearly identical to all suspects in the police shootings. The demographic characteristics of suspects wounded by officer gunfire mirrored those of suspects officers fired at. The sex composition of the 37 suspects who died from their wounds was similar to that of those who survived their wounds. The racial composition of suspects who died, however, was somewhat less skewed than that of the cohort who survived their wounds: 30 (81%) were Black, 6 were White, and 1 was Asian. In addition, the suspects killed by police gunfire were older on average than those who survived (mean age = 30, median = 28, mode = 23). The sex, race, and age distribution of the suspects involved in police shootings is very similar to that of persons arrested for homicide and homicide victims in St. Louis during the period under study.[19]

At least one suspect possessed a firearm in 181 (78.7%) of the 230 incidents; at least one suspect discharged a firearm in 62 (34.2%) of these cases.[20] Suspects used motor vehicles as

19. In 2008, 95% of those arrested for homicide were male, 98% were Black, and 64% were between the ages of 15 and 29 years. The characteristics of murder victims were almost identical. See slmpd.org/images/SLMPD%20ARGÇö8-31-10.pdf.

20. Three cases involved suspects who were armed with multiple firearms. Thirteen other cases involved multiple suspects who were each armed with a single firearm. In four cases, suspects were armed with both firearms and another weapon (e.g., a handgun and a knife). These cases were coded as involving a firearm.

TABLE 2

Block Group Characteristics by Number of Officer-Involved Shootings ($N = 355$)

	Officer-Involved Shootings						
Variable	**0**	**1**	**2**	**3**	**4**	**5**	***p*[a]**
Index of firearm violence	.752	1.33	2.05	2.22	3.03	2.21	.000
Percent Black	38.6	59.7	78.9	85.4	71.6	92.7	.000
Percent Hispanic	2.90	2.93	1.26	4.78	0.00	1.13	.309
Percent age 18–24	8.35	10.9	9.18	11.4	6.04	18.6	.037
Percent age 50 and older	28.4	30.0	29.5	24.2	29.2	29.6	.514
Percent same household 5 yrs	66.6	66.0	72.1	62.3	62.1	75.1	.229
Percent owner-occupancy household	44.9	38.4	35.8	23.0	20.7	35.4	.001
Percent college	25.7	18.1	13.8	10.4	17.9	6.79	.000
Percent unemployed	7.15	8.48	9.68	8.60	21.6	6.34	.267
Median income ($)	38,778	33,699	29,263	23,913	34,696	33,518	.002
n	208	92	36	13	3	3	

Source. Data provided by the SLMPD and the American Community Survey.
[a]Evaluated by *F* test.

weapons in 12 of the remaining cases, were armed with edged weapons (e.g., knives) in 9 of them, were armed with blunt objects (e.g., baseball bats) in 3 cases, and possessed some other weapon (e.g., BB guns) in 3 other cases. In 15 cases, none of the suspects involved was armed with a weapon (i.e., all suspects were unarmed). Finally, in 7 cases, it was unknown whether any of the suspects were armed; these were cases in which all suspects evaded capture.

In summary, the 230 police shootings in this study typically involved young Black male suspects and White male police officers. Suspects were hit by police gunfire in less than half of the shooting incidents and were killed in approximately one sixth of them. The circumstances of the incidents were varied, but most involved suspected criminal activity, a suspect with a gun, response to a shots-fired call, or occurred during the investigation of a suspicious person or motor vehicle. These case attributes should be kept in mind as we turn to our analysis of the relationship between police shootings and the racial and crime characteristics of St. Louis neighborhoods.

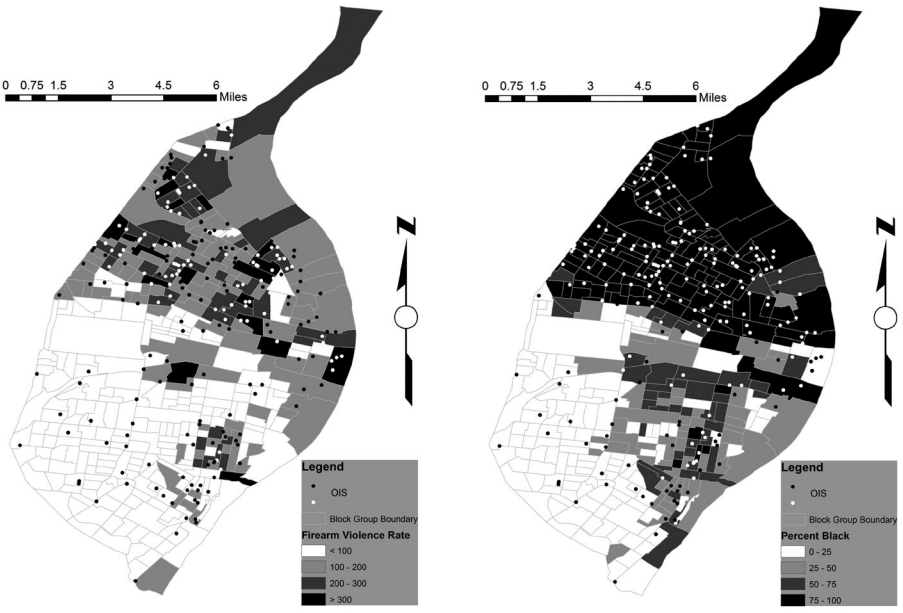
Block Group Characteristics

We begin our assessment of the micro-ecology of officer-involved shootings in St. Louis by describing relevant features of the 355 block groups that constitute the spatial units of analysis. Table 2 presents these attributes according to the number of officer-involved shootings that occurred in each block group between 2003 and 2012. These data indicate that police use of deadly force is higher in areas with larger minority populations and with higher levels of violent crime, as well as in areas with higher levels of economic disadvantage.

Officer-involved shootings are concentrated in a relatively small number of St. Louis neighborhoods. No shootings took place in 208, or 58.6%, of the 355 block groups during

FIGURE 1

Officer-Involved Shootings in St. Louis: (a) Block Groups by Firearm Violence Rate and (b) Block Groups by Racial Composition



(a) (b)

the 10-year period under investigation. One shooting occurred in 92 (25.9%) of the block groups, two occurred in 36 (10.1%) of the block groups, and between three and five shootings occurred in just 19 (5.4%) of the block groups. Neighborhoods with a comparatively large number of police shootings have significantly higher levels of firearm violence, lower rates of owner-occupancy, lower college graduation rates, a larger fraction of young residents, and lower median household incomes than those with fewer shootings. In addition, the larger the proportion of Black residents in a neighborhood, the greater the number of police shootings. The descriptive data in Table 2 reveal no significant relationship between police shootings and the proportion of neighborhood residents who are Hispanic, age 50 years or older, lived at the same residence during the past five years, or who are unemployed.

The maps shown in Figure 1(a and b) reveal the marked spatial concentration of officer-involved shootings in the northern sectors of St. Louis and highlight the spatial relationship between police shootings and neighborhood firearm violence and racial composition. But they also indicate that several shootings occurred in the southwest portion of the city, where the percentage of Black residents and the level of firearm violence are comparatively low.

The results shown in Table 2 and Figure 1(a and b) are largely consistent with expectations that the number of police shootings should be higher in neighborhoods with greater minority concentration and higher levels of crime. They also suggest, however, that the relationships between officer-involved shootings and several of the block group characteristics may not be strictly linear. Median income, for example, falls as the number of shootings increases across St. Louis neighborhoods but only until the number of shootings reaches three. The direction of the relationship then reverses; neighborhoods experiencing four or five shootings have higher incomes than those where three shootings took place. We observe a similar pattern in the relationship between police shootings and firearm violence: a steady rise in firearm violence in neighborhoods with increasing numbers of police shootings and then a drop in firearm violence in those with the maximum of five shootings.

Too much, of course, can be made of such nonlinear patterns when they are based on a small number of cases. But neither should they be ignored. Removal of several outliers did not eliminate the curvilinear relationship between officer-involved shootings and firearm violence depicted in Table 2 (see the Appendix). That is because the relationship is shaped not only by the few neighborhoods with high levels of firearm violence and few police shootings but also by the larger number of areas with midlevels of firearm violence and multiple shootings. In the multivariate analyses reported in the subsequent discussion, therefore, we take into account the nonlinear pattern in the relationship between police shootings and firearm violence and attempt to explain the similar pattern in the relationships among police shootings, median income, and other block group characteristics.

Multivariate analyses are needed for proper assessment of the effects that the variables of interest have on the use of deadly force by the police because, as elsewhere, St. Louis neighborhoods with higher levels of economic disadvantage and larger Black populations also tend to have higher violent crime rates. These expectations are confirmed by the results displayed in Table 3.

Significant correlations exist between the index of firearm violence and median income ($r = -.472$, $p < .05$), owner-occupancy ($r = -.428$, $p < .05$), percent college graduates ($r = -.451$, $p < .05$), and percent Black ($r = .690$, $p < .05$). The measures of neighborhood socioeconomic status and racial composition also are significantly correlated with one another. Attention now turns to the results of the multivariate analyses we conducted to isolate the independent effects of firearm violence and racial composition on the frequency of officer-involved shootings.

Multivariate Results

Our multivariate analysis of the effects of firearm violence, neighborhood racial composition, and controls on officer-involved shootings proceeds in two steps. We first estimate the effects of the measures of racial composition and socioeconomic status on the level of firearm violence in the 355 block groups. We then estimate the effects of these measures, plus the index of firearm violence, on the frequency of officer-involved shootings. In this way, the

TABLE 3

Correlations and Descriptive Statistics ($N = 355$)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ois	—							
(2) faviol	.463*	—						
(3) pctblack	.395*	.690*	—					
(4) pcthisp	−.040	−.157*	−.245*	—				
(5) pct50+	−.001	.067	.042	−.206*	—			
(6) md$	−.203*	−.472*	−.496*	−.006	.078	—		
(7) pctownocc	−.223*	−.428*	−.409*	−.015	.173*	.549*	—	
(8) pctcoll	−.291*	−.451*	−.537*	.012	−.044	.521*	.194*	—
Mean	.641	1.12	50.6	2.77	28.8	35.9	41.2	21.7
SD	.958	1.07	38.0	5.35	10.3	17.2	22.3	16.4

Source. Data provided by the SLMPD and the American Community Survey.
Notes. The abbreviations used in the table are defined as follows:
ois = no. of officer-involved shootings
faviol = index of firearm violence
pctblack = percentage of population Black
pcthisp = percentage of population Hispanic
pct50+ = percentage of population age 50 years and older
md$ = median household income (thousands)
pctownocc = percentage of households owner-occupied
pctcoll = percentage of population college graduates
*$p < .05$.

analysis can detect possible indirect effects of the class and race measures on officer-involved shootings through their effects on firearm violence.

Firearm violence. Table 4 displays the results of ordinary least-squares estimations of the determinants of neighborhood firearm violence. In preliminary analyses, we incorporated each variable shown in Table 3 in these regression models. Only the variables with significant effects ($p < .10$) on the index of firearm violence are shown in Table 4.

Model 1 of Table 4 displays the effects of the socioeconomic status measures and spatial diffusion on neighborhood firearm violence. The measure of racial composition is omitted from this model. The results indicate that firearm violence levels are higher in neighborhoods with lower median incomes, owner-occupancy rates, and college graduation rates. Neighborhoods adjoining those with higher levels of firearm violence also have higher levels themselves. When neighborhood racial composition is added to the analysis in Model 2 of Table 4, it has a significant effect on firearm violence ($b_{\text{pctblack}} = .564$, $p < .01$). The spatial diffusion measure also remains significant. The effects of median income and the owner-occupancy rate are significant at the .10 level. The effect of the education measure is no longer significant in this specification.

Model fit improves somewhat with the addition of racial composition, which suggests that racial composition is not simply a redundant measure of neighborhood socioeconomic

TABLE 4

OLS Regression Results for Firearm Violence ($N = 355$)[a]

Variable	Model 1	Model 2
md$	−.005*	−.004†
	(.002)	(.002)
pctownocc	−.505*	−.478†
	(.241)	(.244)
pctcollege	−.520†	−.365
	(.268)	(.255)
spatial lag	.008**	.006**
	(.001)	(.001)
pctblack	—	.564**
	—	(.196)
R^2	.559	.569
F	111**	107**

Source. Data provided by the SLMPD and the American Community Survey.
Note. See note to Table 3 for variable descriptions.
[a]Standard errors (in parentheses) adjusted for clustering within block groups.
†$p < .10$. *$p < .05$. **$p < .01$.

status in its effect on firearm violence. This interpretation is buttressed by a test for multicollinearity among the predictors in Model 2. The mean variance inflation factor (VIF) for the model is 2.58, and the maximum VIF is 3.84 (for percent Black), which is well below the commonly used collinearity threshold of 5.00. It appears then that a neighborhood's socioeconomic status and its racial composition are independently associated with its level of firearm violence.

Officer-involved shootings. We now turn to an analysis of the effects of the measures of firearm violence, racial composition, and socioeconomic status on the frequency of officer-involved shootings in St. Louis neighborhoods. Model 1 of Table 5 displays Poisson regression results for the number of police shootings modeled as a linear function of these measures.[21] The results indicate that, with the exception of the spatial lag term, each neighborhood measure has a significant effect on the frequency of police shootings. No evidence of multicollinearity was found for this model (mean VIF = 1.95, max VIF = 2.51).

We conducted additional analyses to test for possible nonlinear associations between police shootings and the racial composition, socioeconomic status, and level of firearm violence in St. Louis neighborhoods. Model 2 of Table 5 includes the square of the percentage of the population that is Black (*pctblack)* to account for possible nonlinearity in the relationship between neighborhood racial composition and police shootings. We

21. The number of police shootings is normalized by including block group population size as the exposure indicator in the Poisson models.

TABLE 5

Poisson Regression Results for Officer-Involved Shootings[a]

Variable	Model 1	Model 2	Model 3	Model 4	Model 5[b]
faviol	.520**	.520**	.522**	1.45**	1.26**
	(.062)	(.062)	(.060)	(.256)	(.294)
pctblack	.589†	.478	.591*	−.064	−.054
	(.303)	(.971)	(.297)	(.333)	(.488)
md$	.012*	.012*	.024	.012*	.007
	(.006)	(.006)	(.015)	(.005)	(.007)
pctownocc	−.660†	−.674†	−.726*	−.267	−.361
	(.348)	(.370)	(.361)	(.345)	(.416)
pctcollege	−1.12†	−1.12†	−1.18†	−.960	−.441
	(.624)	(.628)	(.619)	(.607)	(.771)
spatial lag	.153	.151	.154	.105	.003*
	(.117)	(.118)	(.117)	(.109)	(.001)
pctblack^2	—	.098	—	—	—
	—	(.847)	—	—	—
md^2	—	—	−.0001	—	—
	—	—	(.0001)	—	—
faviol^2	—	—	—	−.174**	−.140**
	—	—	—	(.047)	(.050)
pseudo R^2	.208	.208	.209	.225	.246
Wald chi^2	226**	226**	230**	218**	189**
(N)	(355)	(355)	(355)	(355)	(320)

Source. Data provided by the SLMPD and the American Community Survey.

Note. See note to Table 3 for variable descriptions.

[a]Standard errors (in parentheses) adjusted for clustering within block groups.

[b]Shootings that occurred when the officer was off duty omitted.

†$p < .10$. *$p < .05$. **$p < .01$.

find no evidence of a nonlinear relationship between racial composition and police shootings. Adding the quadratic term to the equation (*pctblack*^{2}) produces no improvement in model fit, and the effects of the other neighborhood variables remain largely unchanged from those in Model 1.

We evaluated possible nonlinearity in the relationship between police shootings and neighborhood socioeconomic status in like manner. As shown in Model 3 of Table 5, when specified as a quadratic function, police shootings are not significantly related to neighborhood median income. Nor do we find a nonlinear association between police shootings and neighborhood educational attainment, owner-occupancy, or unemployment (results not shown).[22]

By contrast, we do find strong evidence of a nonlinear association between police shootings and the level of firearm violence. The quadratic specification in Model 4 reveals

22. All results not shown are available from the authors on request.

both a positive association ($b_{\text{faviol}} = 1.45$, $p < .01$) and a negative association ($b_{\text{faviol}^2} = -.174$, $p < .01$) between firearm violence and the frequency of police shootings.[23] As expected from the bivariate results discussed earlier, the multivariate findings indicate that police shootings are more prevalent in neighborhoods with somewhat higher levels of firearm violence than others, but they occur less frequently in neighborhoods with the highest levels of firearm violence. The turning point can be computed by using the formula $-b_1/(2 \times b_2)$, where b_1 is the linear coefficient and b_2 is the quadratic coefficient of firearm violence in Model 4 of Table 5 (Mitchell, 2012). The frequency of police shootings in St. Louis neighborhoods reaches a maximum at a firearm violence rate of 4.17 per 1,000 population.

When the curvilinear relationship between police shootings and firearm violence is modeled, the percentage of Black residents in a neighborhood no longer has a significant effect on the number of police shootings ($b_{\text{pctblack}} = -.064$, $p > .10$). The measures of neighborhood socioeconomic status similarly have no significant relationship with police shootings in this model, with the exception of median income. As in the linear model, the effect of median income is significant and positive ($b_{\text{md\$}} = .012$, $p < .05$). We sought a substantive explanation for the positive effect of median income on police shootings, as well as for the curvilinear association between police shootings and firearm violence. When we return to the descriptive data drawn from the SLMPD case files on officer-involved shootings, we see that several shootings occurred when officers were off-duty, typically at or near their homes. Police officers generally do not live in low-income or high-crime neighborhoods. Perhaps this might explain why shootings are more frequent in more affluent areas and why they are less frequent in areas with both low and exceptionally high levels of firearm violence.

We identified 35 incidents from the case files in which the shooting took place when officers were off-duty. With these cases omitted from Model 5 of Table 5, median income no longer has a significant effect on police shootings. The results for firearm violence, however, remain similar to those in Model 4, which includes off-duty shootings. Those incidents do help to explain the positive effect of median income on the total number of police shootings, but they do not explain the curvilinear association between police shootings and the level of firearm violence in St. Louis neighborhoods.

Finally, given the excess of zeros in the police shooting data, in supplementary analyses, we estimated zero-inflated Poisson regressions based on Model 4 of Table 5. Zero-inflated count models adjust the estimated nonzero counts for the prevalence of zeros in the data (Greene, 2003). We estimated both intercept-only models to account for the prevalence of zeros and models variously specified with the variables shown in Table 3. The results (not shown) do not differ substantively from those presented earlier. In all instances, firearm violence retains its significant curvilinear association with the frequency of police shootings

23. The results are similar with influential cases removed from the analysis (see the Appendix).

and the effects of the racial and socioeconomic characteristics of neighborhoods remain nonsignificant.

In general, the multivariate results indicate that crime is the primary driver of police shootings. Neighborhood racial composition and socioeconomic status do have indirect effects on police shootings through their effects on firearm violence, but only the level of firearm violence is directly associated with the frequency of police shootings across neighborhoods.

Discussion

Prior aggregate-level research on police use of deadly force has been limited by a narrow conception of deadly force, measurement error in its operationalization, the omission of key variables in many studies, and units of analysis that mask substantial internal variation in the application of deadly force and its covariates. The current neighborhood-level study overcomes those limitations but, of course, has limitations of its own.

We examined the nature and determinants of 230 officer-involved shooting incidents across 355 St. Louis census block groups for the years 2003 to 2012. Descriptive information from police case files indicates that most of the shootings involved White male officers and young Black male suspects armed with guns and were precipitated by perceived criminal activity or "suspicious" behavior by suspects. Approximately half of the shootings resulted in injury to suspects, but only about one in six involved fatal wounds.

The shootings tended to occur in socioeconomically disadvantaged neighborhoods with relatively large Black populations and elevated levels of firearm violence. But several also took place in more affluent areas with midlevels of firearm violence. A sufficient number of these "off-diagonal" cases existed to produce a significant curvilinear association between firearm violence and the frequency of police shootings. When this curvilinear association is modeled, neither neighborhood racial composition nor socioeconomic status is significantly associated with the frequency of police shootings. Only the level of firearm violence has a direct effect on police shootings in St. Louis neighborhoods. These results suggest that police use of deadly force is a function of serious crime—firearm violence in particular. Race does matter but only insofar as it increases the level of firearm violence and, even then, only to a point.

The finding that neighborhood violence affects the frequency of police shootings is consistent with what previous studies that used far larger spatial units of analysis reported about the link between crime and the use of deadly force by police officers (Jacobs and Britt, 1979; Jacobs and O'Brien, 1998; Liska and Yu, 1992; Sherman and Langworthy, 1979; Sorensen et al., 1993). What our analysis adds to prior research on the link between violent crime and police shootings is the curvilinear form of the relationship, which is an important finding that warrants further empirical investigation.

We believe that two important questions about this matter should guide future research on the spatial distribution of police deadly force usage: Why are police shootings somewhat

less likely to occur in neighborhoods with the highest levels of criminal violence? And why do some neighborhoods with moderate levels of violence experience multiple police shootings? One possibility, of course, is that the curvilinear pattern in the relationship between police shootings and firearm violence derives from local circumstances. St. Louis may differ from other large cities with respect to the relationship between police shootings and neighborhood characteristics, or in other ways not captured in the data used in the current study. That possibility indicates the need for multilevel research based on both neighborhood- and city-level data covering multiple jurisdictions.

If future research replicates the nonlinear association between police shootings and violent crime found in the current study, how might that result be explained? One plausible explanation is that citizens adapt to conditions in extremely violent neighborhoods in ways that reduce the frequency of police shootings. It is possible that, on average, individuals in such neighborhoods who carry weapons, commit crimes, or otherwise engage in activities that are likely to draw the attention of the police behave in ways that reduce the likelihood that officers will fire at them. Research has demonstrated that how citizens perceive and interact with the police varies with neighborhood characteristics, including crime levels (Brunson and Weitzer, 2009). By knowing that they reside in a highly violent space, savvy suspects may well have a sense that the police officers who patrol these dangerous areas will not hesitate to use deadly force to protect themselves from the heightened hazards they face. As a consequence, they may be less confrontational in their dealings with the police to avoid being shot. Ethnographic research has indicated that many criminals take the possibility of police intervention into account when planning and executing their crimes, seeking to avoid contact with the police (Wright and Decker, 1997). Perhaps a similar calculus extends to how shrewd criminals behave once they do come into contact with police officers.

Other plausible explanations lie with the police. One is rooted in police training. Officers are trained that how they structure encounters with citizens (e.g., how many officers are present, how they approach citizens, and where and how they stand) can affect the chances they will resort to their firearms. When officers are attentive to the dangers they face and use sound tactics in encounters with potentially dangerous citizens, according to this line of reasoning, the odds are lower that suspects will take actions that would warrant deadly force and that officers might misidentify innocuous citizen actions as a threat necessitating gunfire (Fyfe, 1986). Terrill and Reisig (2003), who examined police use of nonlethal force in neighborhood context, have argued that levels of neighborhood violence strongly influence officers' views of the degree of danger they face on patrol. It is therefore reasonable to suggest that when officers are working in exceptionally high-crime areas they are especially careful to use the tactics they were trained in to protect themselves and avoid needless shootings. If so, other things equal, the greater attentiveness of officers in the highest crime areas should reduce the number of officer-involved shootings.

A second police-based account for the finding that relatively fewer officer-involved shootings occur in the highest-crime neighborhoods is related to Klinger's (1997) argument

that as crime levels rise, police officers tend to invest less energy in dealing with specific types of crime and other forms of disorder and deviance. According to this perspective, increases in crime and disorder encourage officers to withdraw from engagement with criminal and other deviant activity of a given level of seriousness because police resources become more limited, officers come to view crime victims as less deserving, officers become more cynical, and officers come to view more sorts of crime as "normal" for the areas they patrol. It may, therefore, be that comparatively fewer police shootings occur in the highest crime neighborhoods because the officers working those areas are less engaged than are their peers patrolling less crime-ridden neighborhoods. Relatively fewer contacts with citizens and less effort expended in the average contact could translate into comparatively fewer situations escalating to the point where officers discharge their weapons.

Whatever accounts for the curvilinear relationship between firearm violence and police shootings revealed in the current study, additional research is needed on the determinants of police use of deadly force across the urban landscape. Policing is a territorially organized enterprise, with agency demarcation determined by political boundaries, patrol and other sectors of large agencies demarcated by district boundaries within which police work groups operate, and work responsibilities within districts delimited by the beats that officers routinely patrol (Klinger, 1997). Within beats, officers' territorial knowledge involves understanding of the threat contours of specific neighborhoods (Klinger, 2004; Sobol, Wu, and Sun, 2013), including "hot spots" with particularly high levels of crime (Weisburd, Groff, and Yang, 2012). Because policing is spatially organized, and because officers' work orientations include such high doses of spatial awareness, future research should build on the current study by investigating how officers adapt their behavior to the threat environments in which they exercise their coercive power, including the ultimate power to take life.

By examining the ultimate exercise of state power in a comprehensive, multicity ecological framework that nests neighborhoods (and other potentially relevant spatial units) within cities, social scientists can shed fresh empirical light on the links among race, crime, other aspects of communities, and police shootings. Such research, however, confronts a major obstacle: the absence of sound national data on officer-involved shootings. This is so despite repeated calls from researchers for the development of such a database (e.g., Fyfe, 2002; Geller and Scott, 1992; Klinger, 2012). Moreover, the limited information on fatal police shootings (e.g., the FBI and NVSS counts) does not include information that would permit researchers to locate these incidents in any spatial unit smaller than the jurisdiction in which it occurred. Thus, the major policy implication of our study is to move as rapidly as possible to develop a reliable national database of all officer-involved shootings that includes the address of the incident, or similarly precise spatial information, as well as the kinds of individual and incident characteristics included in the current study.[24] Attention now turns

24. The lead author is currently working with others to develop a pilot study involving major police departments to this end.

to a more detailed discussion of the information that we believe should be gathered in the national officer-involved shooting data collection system we envision.

Policy Recommendation: Establish a National Database on Police Use of Deadly Force

If we are to augment knowledge regarding police use of deadly force, the following information, at a minimum, is needed: (a) the number of incidents in which police officers discharge firearms at citizens; (b) the demographic characteristics of the officers and citizens involved in each incident; (c) the agency/agencies employing the involved officers and location of each incident; (d) the particular weapon(s) used by police officers and citizens; and (e) the injuries, if any, suffered by officers and citizens. Most, but not all, large police departments compile this information for purposes of internal review. All departments should routinely collect it and report it to a designated data collection entity (e.g., the Bureau of Justice Statistics), which in turn should provide annual reports to the public. In addition, the information should be posted online in user-friendly formats and be updated monthly.

Counting the Incidents

Seemingly, the most straightforward of these recommendations is to produce an accurate count of instances in which police officers use deadly force. This can be tricky, however, because suspects can receive serious injuries and even die during incidents in which officers use force that normally does not hold the potential to seriously injure or kill (e.g., the use of electronic control weapons) and because officers sometimes use instruments other than firearms that do hold the inherent potential to maim or kill someone (e.g., when police officers purposely strike suspects with their squad cars at a high rate of speed). To expedite the implementation of a deadly force national data system, we propose that, at least initially, the system include only those instances in which police officers discharge their firearms at citizens. By following the definition of deadly force proposed by Fyfe (1978) and used in the current study, the national database should include all incidents in which a police officer intentionally discharged a firearm at a citizen, regardless of whether the round(s) fired missed, wounded, or killed anyone. A related objective of our proposed officer-involved shooting data collection system would be to collect information on all incidents in which lethal rounds accidentally discharged by police officers injure or kill a human being.[25] In sum, the proposed officer-involved shooting database would include counts of all cases in which American police officers purposely fired their guns at fellow human

25. Officers with some frequency (how often is not known) discharge their duty firearms when they do not intend to do so. Law enforcement professionals refer to such instances as "accidental" or "negligent" discharges. The best evidence indicates that most accidental discharges do not strike anyone. See Klinger and Rojek (2005) for a discussion of the phenomenon and the frequency of accidental discharges among SWAT team members.

beings and all cases in which any rounds accidentally discharged by any police officer struck anyone.

Describing the Participants

A national data system on police use of force should record the sex, age, race, and ethnicity (e.g., Hispanic or Non-Hispanic) of all officers and citizens involved in each incident. The same information should be collected for citizens not directly involved in the incident (e.g., hostages, victims, and bystanders in the immediate vicinity). These descriptors, especially race and ethnicity, are needed to assess possible group disparities in police use of deadly force. The rank and years in service of officers who fired, the number of prior shootings in which they had been involved, and their assignment at the time of the shooting also should be included. In addition, the system should compile information on the criminal history, mental health status, and use of intoxicants by suspects.

Jurisdiction and Location of Incidents

The state, county, and municipality in which each incident took place, and the name and ORI number[26] of the law enforcement agencies (including federal agencies) employing the officer(s) who discharged firearms should be recorded in a national officer-involved shooting data system. In addition, the street address or other descriptor (e.g., intersection, park name, or highway mile-marker) should be recorded so that the place where the incident occurred can be located in a census tract, census block group, or other spatial covering for which other areal characteristics are available. This will be essential for conducting the kind of research on the social context of police shootings reported here.

Weapons

A national data system should compile detailed information on the weapons fired by police officers and fired or possessed by citizens. The type (handgun, shotgun, or rifle) and caliber of each weapon discharged and the number of rounds fired should be recorded. The officer-involved shooting database also should include information about any less-lethal force that officers used during incidents that included police gunfire. The database would indicate whether any officers on the scene deployed electronic control weapons; struck suspects with police batons; sprayed suspects with chemical agents; shot at suspects with impact munitions; or used bodily force before, during, or after the time shots were fired. It also would include information about the types of weapons each suspect possessed (or was within his or her reach and grasp) and how he or she used them. Suspect weapons may include firearms, explosives, blunt objects (such as a club or bat), cutting instruments (such as a knife), motor vehicles, or any other instrument likely to cause serious injury if used as

26. The ORI number is the Originating Agency Identifier assigned to law enforcement agencies by the FBI (see fbi.gov/about-us/cjis/fingerprints_biometrics/ordering-fingerprint-cards).

a weapon. This would require at least two primary fields in the database: one for weapon type(s) and one for how the suspect in question used it (e.g., holding vs. firing a shotgun or brandishing a knife vs. slashing with it).

Outcomes

A national officer-involved shooting data system should record the degree of injury that each officer and citizen, including nonsuspects at the scene, sustained. Injuries for each individual should be coded as none, minor (requiring little or no medical attention), serious (requiring hospitalization or comparable medical treatment), and fatal. The source of each wound to each participant (i.e., officers, suspects, and nonsuspect citizens) should be recorded as well for police bullets may strike not only the intended suspects but also other officers and nonsuspect citizens. And suspects may injure officers, crime victims, hostages, or bystanders. Finally, suspects have been known to shoot or otherwise injure (e.g., stab) themselves during incidents in which officer-involved shootings occur. The national officer-involved shooting data collection system also should seek information about self-inflicted injuries to suspects.

Practical Benefits

Beyond the value that a national database on officer-involved shootings would have for researchers, such a system is necessary to evaluate policy proposals regarding police use of deadly force. Specific proposals to improve police training and practice on deadly force are difficult to evaluate when so little is known about how often and under what circumstances the police discharge their firearms against citizens. It is not sufficient to evaluate an individual agency's deadly force policies, practices, and outcomes based on information for that agency alone. Comparative information is needed to determine whether a given agency is in line with or diverges from comparable agencies and to assist agencies in revising their policies and training protocols based on best practices elsewhere.

When the only comprehensive information about police shootings a given agency possesses pertains to those incidents in which its own officers were involved, lessons that may be available from the experiences of other agencies cannot be learned. Moreover, because many police agencies experience few or no shootings (e.g., Geller and Scott, 1992), they must turn to the experiences of other agencies to develop understanding of how to best train and guide (through policy) their own officers. By lacking systematic knowledge about important matters such as the number of shots officers fired, the kinds of weapons suspects possess, and related issues, police trainers and policy makers have to rely on anecdotal evidence from particular officer-involved shootings that they somehow become aware of (e.g., Adams, McTernan, and Remsberg, 1980). This practice of rooting police training and policy in anecdotes is suboptimal (see Sherman, 1998). The national database we propose would provide trainers and policy makers with valuable information that would likely lead to better police deadly force training and practice. In other words, the proposed national

database holds promise for the development of a truly evidence-based approach (see Lum, 2009; Weisburd and Neyroud, 2011) to how police agencies train and guide their officers in the critical area of the use of deadly force.

Sound information about the number of officer-involved shootings and the details of these events also should prove valuable in informing public dialogue on this critical issue. The protests and civil unrest noted at the outset of this article reflect the prominence of public concern about police use of deadly force. If public concern is to yield sound public policy, the public discourse must be informed by comprehensive and reliable evidence (e.g., Mays and Rudell, 2015). The lack of evidence about even the most basic aspects of deadly force, such as how often police officers discharge their firearms at citizens, means that public debate will remain ill-informed about this important social issue. And it will remain so until the national officer-involved shooting database that we, and so many others, have called for is established.

Conclusion

The President's Task Force on 21th Century Policing (2015) has called for the development of a national officer-involved shooting database that includes some of the information detailed earlier (see Action Item 2.2.4 of the Final Report). We hope those charged with taking up Action Item 2.2.4 will consider our recommendations as they move forward. A comprehensive national data system containing all of the components we have proposed will likely take years to implement fully (and will likely require congressional action), but much can be accomplished in the meantime. States and localities need not wait for national action to establish their own information systems on police use of deadly force. Whatever the eventual scope and nature of a national officer-involved shooting database, given recent community unrest in St. Louis, Baltimore, and elsewhere across the nation, increasing awareness and understanding of the nature of, and social circumstances associated with, the use of deadly force by the police are urgent policy priorities.

Appendix

To capture the nonlinear relationship between police shootings and firearm violence, we regressed the officer-involved shootings on the measure of firearm violence and its square (see Table A). We then calculated DFBETA influence values for the coefficient on the squared term. The DFBETAs measure the difference between the regression coefficient when each influential observation is included and excluded. We used a standard formula to identify the influential observations ($|\text{DFBETA}| > 2/\sqrt{n}$) (Belsley, Kuh, and Welsch, 1980). This procedure yielded 19 influential observations. We then reestimated the original equation with these cases omitted. As shown in Table A, the results reveal that removing the influential cases from the regression equation does not produce substantive changes in the results.

TABLE A

OLS Regression Results for the Nonlinear Effect of Firearm Violence on Officer-Involved Shootings[a]

Variable	Model 1	Model 2
faviol	.746** (.104)	.932** (.106)
faviol^2	−.090** (.026)	−.144** (.028)
R^2	.240	.268
F	55.6**	60.9**
N	355	336

Source. Data provided by the SLMPD.

[a]Standard errors (in parentheses) adjusted for clustering within block groups.

**$p < .01$.

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