Crime & Delinquency
Volume XX Number X
Month XXXX xx-xx

10.1177/0011128708319581
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Contagious Fire?

An Empirical Assessment of the Problem of Multi-shooter, Multi-shot Deadly Force Incidents in Police Work

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Recent police shootings in which multiple officers fired numerous rounds at suspects have led some observers to assert that such situations involve "contagious fire," where an initial officer's shots launch a cascade of gunfire from other officers present. Although there is anecdotal recognition of the contagious fire phenomenon among police and the media, there is not a single empirical study documenting its existence in more than 50 years of deadly force research. This article uses Philadelphia Police Department shooting data to explore the potential for police shootings to become contagious. The article provides a testable definition of contagious shootings and identifies predictors of three outcomes: multiple officer shootings, the average number of shots fired per officer, and multi-officer, multi-shot incidents. Findings show that the requisite preconditions for a contagious shooting rarely occur, and when the preconditions were met, there is no evidence to support the existence of a contagion effect.

Keywords: *contagious fire; deadly force; police shootings*

Introduction

The use of deadly force by police officers has long been the subject of notable attention in American society. For example, concerns among members of the general public about the appropriateness of particular police shootings have repeatedly led to civil disturbances and political upheaval in major urban areas (e.g., Geller & Scott, 1992; Klinger, 2004). In the academic community, researchers have conducted numerous studies

on topics such as the frequency of police shootings (e.g., Fyfe, 2002; Sherman & Langworthy, 1979), differences in shooting rates across jurisdictions (e.g., Jacobs & O'Brien, 1998; Milton, Halleck, Lardner, & Albrecht, 1977), and the role that race may play in deadly force decision making (e.g., Meyer, 1980; Plant & Peruche, 2005). Both independently and in concert with interested citizens and academics, law enforcement professionals have attempted to develop a better understanding of police shootings and reduce their frequency by, among other things, providing sound training for officers about how to handle potentially violent situations (e.g., Ederheimer & Fridell, 2005; Fyfe, 1996).

A specific aspect of the deadly force picture that has recently captured much attention and caused considerable concern among both the police and the public are incidents in which multiple officers fire numerous rounds at suspects. Two recent multi-officer, multi-shot shootings in major East Coast cities have focused attention on such incidents and raised a number of questions about how and why officers decide to fire their weapons. The first occurred on November 26, 2006, when five New York City police officers working an undercover assignment fired a total of 50 rounds during an encounter with a group of men whom the officers believed might be in possession of an illegal gun. When the officers attempted to stop the men as they tried to drive away, one officer opened fire and the other four followed suit. When the smoke cleared, police gunfire had killed the vehicle's driver and severely wounded the other two men inside the car ("50 Shots Fired," 2006). The second notable multi-officer, multi-shot shooting occurred on July 8, 2007, when seven uniformed members of the Philadelphia Police Department (PPD) fired more than 80 shots at a man who was brandishing a semiautomatic pistol on a south Philadelphia street corner. Some 20 rounds struck the armed man, killing him ("Police Fire 80 Rounds," 2007).

The number of officers who discharged their guns in each of these incidents and the number of rounds they collectively and individually fired (one of the New York officers fired 31 shots) have led some observers to refer to the process in which these events unfold as "contagious fire" or "contagious shootings," in which an initial officer's gunshot(s) prompt his or her fellow officers to shoot in a form of collective action. In the wake of the New York City Police Department (NYPD) shooting, for example, there were several stories in major media outlets about this alleged phenomenon, including the *New York Times*, the *Daily News*, and *ABC News*.[1] Among the more stark claims about contagious fire in police work came

in an *ABC News* story in November 2006, which stated that contagious shootings occur when multiple officers "start shooting once an officer opens fire—even if no real threat is present." Dr. Carol Lieberman, a forensic psychiatrist at UCLA's Neuropsychiatric Institute, asserted that the phenomenon is more common than people realize and that

> the officer who starts the shooting is responsible for where he aims and how many times he shoots at the alleged "criminal." . . . The other officers who become affected by the "contagion" are responsible for panicking, becoming blinded by the outbursts of gunfire, and not restraining themselves enough to assess the situation. ("How Common," 2006)

Although press accounts (and comments of some police observers[2]) suggest that contagious fire is both a well-established phenomenon and a notable aspect of deadly force in American police work, not a single empirical study exists that documents the contagion effect or examines its prevalence, characteristics, or causes. As a consequence, we know virtually nothing about the characteristics of multi-officer, multi-shot shootings, most notably, how they differ from other sorts of deadly force encounters and what portion, if any, of such shootings involves so-called contagious fire. Given the potentially severe consequences of police use of deadly force, and the especially sensitive nature of shootings involving large numbers of rounds fired by multiple officers, this lack of research is disconcerting. Moreover, it raises concerns about whether contagious fire is a real phenomenon or if the term is simply a catchphrase that inaccurately describes certain types of officer-involved shootings. If contagious fire is indeed a real phenomenon, there are clear implications for police departments in terms of training, policy, and accountability. Quite simply, in matters of life and death, police officers should never discharge their firearms out of an unconscious, uncontrolled reaction to their fellow officer's decision to shoot. The far-reaching consequences of police officer decisions to shoot—even when justified—necessitate an investigation into the veracity of the contagious fire thesis.

The lack of systematic evidence on the contagious fire thesis is a function of at least two factors. The first is that the term *contagious fire* has entered the lexicon of law enforcement with little concern about what, precisely, it means. This lack of conceptual clarity must be overcome before research can proceed. Consideration of the issue, fortunately, indicates that the elements of the thesis are implicit in popular treatments of it. Making these elements explicit, we argue that the contagious fire thesis has three

parts: two requisite preconditions and the actual contagion effect. The preconditions for contagious fire are that (a) multiple officers shoot during an incident and (b) a large number of rounds are fired. The last element is the contagion effect itself: Secondary officers fire as a panicked or unconscious response to an initial officer's firing.

The second reason that there has been no empirical research on the thesis is that data that can directly speak to the issue are not readily available. Because the thesis posits specific mental states on the part of officers who fire their weapons, information about what officers were thinking when they came to pull the trigger is required to directly assess whether any officer who discharged his or her weapon did so solely in response to shots being fired by other officers (i.e., whether any given officer's actions involved contagious firing). Information about why officers decided to fire their weapons is not routinely collected in any sort of national database.[3] Moreover, research on police use of deadly force (see literature review below) has yet to produce any sort of data set that includes detailed descriptions of even a small sample of how officers react when other officers in their presence fire their guns at suspects. As a consequence, no data exist that would permit researchers to conduct the type of research needed to undertake any sort of direct test of the contagious fire thesis.

It is fortunate that data do exist (from one of the two major East Coast agencies mentioned in the introduction that has recently had a highly visible multi-officer, multi-shot shooting) that afford the opportunity to examine several aspects of the general idea of contagious fire in police work. In 1996, the lead author reviewed the official case files of every reported incident in which Philadelphia police officers struck citizens with gunfire for the years 1970-1978 and 1987-1992, creating a data set that included several dozen variables about more than 800 officer-involved shootings (see below for more details). Using these shooting data, the authors explore determinants of two defining features of the contagious fire thesis—the number of officers who fire and the number of shots fired. Specifically, logistic and linear regression are employed to identify predictors of multi-officer, multi-shot incidents and to test whether the number of officers who fire in an incident predicts the average number of shots fired per officer, when controlling for other factors.

Following a review of the research literature on deadly force in American police work, the remainder of this article provides a more detailed description of the Philadelphia data, specifies the analytical plan used to examine it, presents the results of the analyses undertaken, and discusses the implications of these findings for understanding the use of deadly force by police officers.

Prior Research

The legal authority of police officers to use deadly force against citizens represents the most extreme facet of governmental power in our society. Despite the fact that the exercise of this power has been a topic of substantial controversy since officers began carrying firearms in the mid–19th century (e.g., Geller & Scott, 1992; Klinger, 2007), research on police shootings was virtually nonexistent until the 1970s. Since that time, researchers have devoted considerable attention to developing knowledge about the prevalence and determinants of officer-involved shootings. Among the first and most consistent findings of this research is that police officers rarely fire their guns in the line of duty. Fyfe (1988), for example, estimated that in the 1970s and 1980s, the average annual number of justifiable homicides by police officers in the entire United States was no more than 1,000.

The Bureau of Justice Statistics (2001) examined national data on police shootings of felons from 1976-1998 and concluded that the number of fatal shootings has not changed significantly (approximately 400 per year), despite large increases in the U.S. population older than age 13 (47 million) and the number of police officers (200,000). The source of the data used in this report—the FBI's Supplemental Homicide Reports (SHR)—is notoriously unreliable, however (see Fyfe, 2002, for a discussion of SHR liabilities), so it likely does not provide a sound picture of deadly force patterns over recent decades.[4]

More recent data from the two largest cities in America suggest that the use of deadly force by police officers has been trending downward since scholars first started studying the issue. Unpublished data from the NYPD and Los Angeles Police Department (LAPD) show that in the last half of the 1970s, NYPD and LAPD officers shot an average of 115 and 68 suspects per year, respectively, and in the first 5 years of the new millennium, New York officers shot an average of 34 people, whereas their peers in Los Angeles shot an average of 32.

Concerning the determinants of deadly force, research has focused on three basic classes of variables: features of the situations in which officers and suspects come together in time and space, conditions of the social environment in which officers work, and aspects of the police agencies that employ officers. Research on the organizational forces shaping police shootings is dominated by inquiry into the role that administrative policies and practices play in officers' decisions to employ deadly force. Research has consistently demonstrated that administrative policies—when enforced—can substantially curtail the rate of police shootings (Fyfe, 1988; Gain, 1971;

Geller & Scott, 1992). Alternatively, administrative permissiveness can also lead to higher rates of police shootings (Fyfe, 1979). White (2001), for example, found that the number of police shootings in Philadelphia increased significantly after a restrictive administrative policy was abolished in 1974. Research has also explored the influence of other organizational forces on police shooting rates, such as racial composition of the force (Fyfe, 1978; Geller & Karales, 1981a, 1981b).

The environmental forces most commonly considered by researchers are the laws that govern police behavior and features of the communities in which officers work. With regard to the legal climate of policing, research has focused on the roles that state statutes and federal court rulings concerning deadly force usage by police officers play in officers' decisions to fire their weapons. This research suggests that statutory and case law exert little direct influence on officers' use of their firearms (e.g., Skolnick & Fyfe, 1993; Tennenbaum, 1994; White, 2003). Research on the link between community characteristics and police shootings has examined the roles of several factors, such as racial composition, arrest rates, economic inequality, and various measures of public violence. The most consistent finding from this line of research is that levels of deadly force are positively related to the prevalence of violence between citizens (e.g., Kania & Mackey, 1977; Liska & Yu, 1992; Matulia, 1985).

As for situational features, scholars have focused on factors such as the degree of threat that suspects who were shot posed to officers or others, status characteristics of officers and suspects, and the role that third parties might play in police shootings. Research has found that the majority of suspects taken under fire by the police presented an imminent danger to officer(s) who fired (Binder & Fridell, 1984; Fyfe, 1980, 1981a; Klinger, 2004). Shooting victims are disproportionately minorities, especially Blacks, although the causes of this overrepresentation are unclear and may vary by location (Fyfe, 1981b; Geller & Karales, 1981b; Milton et al., 1977). Research has also examined a host of officer characteristics including officer race, gender, age, duty and uniform status, assignment type, and experience (Fyfe, 1978; Geller & Karales, 1981a, 1981b). Although research has established patterns between certain officer characteristics and elevated rates of deadly force (e.g., Black officers are disproportionately likely to shoot suspects), Fyfe (1989) states that "there is virtually no empirical support for assertions that individual officer characteristics are measurably related to any type of performance in office" (p. 478).

Several scholars have stressed the importance of viewing police–citizen encounters as fluid events, almost like a chess match where each participant

makes "moves" that influence the moves of the other participant (e.g., Bayley, 1986; Binder & Scharf, 1980). In the realm of deadly force, researchers have noted that how officers conduct themselves at earlier stages of encounters can influence the way in which encounters unfold and, hence, the likelihood that they will resort to gunfire (Fyfe, 1986, 1989; Geller & Karales, 1981b). Binder and Scharf (1980) assert, for example, that

> a police "decision" to use, or not to use, deadly force in a given context might be better described as a contingent sequence of decisions and resulting behaviors—each increasing or decreasing the probability of an eventual use of deadly force. (p. 116)

The notion that police shootings are social events that unfold in a series of stages in which what transpires during previous stages affects subsequent ones has substantial implications for the notion of contagious fire, as the core assertion of the contagious fire thesis is that the actions of an initial officer who pulls the trigger lead others to subsequently fire.[5] Scholars have yet to assess this aspect of the temporal sequencing of police–citizen interactions in which multiple officers discharge their weapons. There has, however, been a bit of research on other components of police shootings relevant to the contagious fire thesis: the number of officers who discharge their weapons and the number of rounds they fire (which has received the lion's share of scholarly attention).

Counted among the few studies that have addressed the number of officers who fire is White's (1999) study of officer-involved shootings in Philadelphia, which found that one quarter of the more than 800 Philadelphia police shootings during the years 1970 through 1992 involved multiple shooters. Klinger's study of 113 shootings involving officers from 19 police departments in four states found a substantially higher proportion of multiple shooters; at least two officers discharged their weapons in approximately 45% of the cases examined (Klinger, 2004).[6]

The number of shots fired has been examined in three general contexts: the widespread switch in American policing from revolvers to semiautomatic handguns that has taken place in the past several years, the portion of suspects hit by police gunfire who die from their wounds (i.e., fatality rates), and shooting accuracy (i.e., hit rates). There is some research to suggest that the adoption of semiautomatic handguns has resulted in more shots fired per incident (Verhovek, 1992). In an analysis of police shootings in Portland, Oregon, over a 4-year period, for example, Snell (1992) found that the average number of shots fired by officers using revolvers was 2.6,

compared with 4.6 for officers using semiautomatics. Other research, however, has shown little difference in rounds fired across handgun types (Brown, 1992; Cerar, 1990; Kindrick, 1992). Matulia (1982), whose research was undertaken when most agencies still equipped their officers with revolvers, reported that agencies using semiautomatic pistols experience a "significantly higher justifiable homicide rate" (see also Matulia, 1985). In Snell's (1992) study of Portland shootings, he reported that

> there is a strong relationship between the volume of shots fired by police and the probability of killing the suspect. In 17 incidents in which police fired three times or less, only two persons died. In 12 incidents in which four or more shots were fired, nine persons died. (p. A22)

A fair amount of research has examined the relationship between the number of shots fired and shooting accuracy, as well as the factors that influence accuracy (Geller & Scott, 1992; Morrison & Vila, 1998; Vila & Morrison, 1994). Research has consistently shown that hit rates (i.e., shooting accuracy) typically dip well below 50% (with significant variation by department; Copay & Charles, 2001; Geller & Scott, 1992). Research in New York City, for example, showed consistently low rates from year to year for the NYPD: 1987 (26%), 1988 (31%), and 1990 (23%) (Cerar, 1990; NYPD, 1988; Commanding officer, NYPD Firearms and Tactics Section, personal communication, 1989). Factors that have been linked to shooting accuracy include the following:

1. work environment and availability of back-up (Geller & Scott, 1992)
2. severity of the threat to the officer (Donahue & Horvath, 1991; Schade & Bruns, 1989; White, 2006)[7]
3. distance between participants (White, 2006)
4. officer approach and preparedness (White, 2006)

Although research on the number of officers shooting, the number of rounds they fire, and the number of rounds that find their mark has clear relevancy for the notion of contagious shootings, scholars have yet to tie such issues directly to the contagious fire thesis. In this article, we seek to do so by first examining the micro structure of officer-involved shootings to see how frequently the requisite preconditions for contagious fire exist during police–citizen interactions in which at least one officer discharges his or her weapon. We then conduct a series of statistical analyses to examine the role of potential predictors of officers' actions in multi-officer, multi-shot shootings to shed light on conditions that might give rise to such shootings. We also

conduct analyses to assess the effects of several potential predictors on the number of shots officers fire during shootings, including the role that other officers' actions play in an individual officer's firing behavior. Attention now turns to the data and methods we used to examine these issues.

Method and Data

This article uses a sample of shootings that includes all incidents in which members of the PPD struck citizens with gunfire during the years 1970-1978 and 1987-1992.[8] The data come from PPD Internal Affairs shooting investigation files, which were obtained as discovery material during civil litigation against the department. The lead author examined each case file and coded the material therein to yield a data set containing some 75 distinct variables for each case ($N = 808$). Among the variables measured were the number of officers who discharged their firearms in each incident and the number of rounds each shooter fired.

A Brief Note on the Data

There are two aspects of the data that warrant discussion. First, this study is based on 30-year-old shooting data. Although the age of the data may raise concerns over the study's applicability to 21st-century policing, the timing and locale allow for consideration of the contagious fire thesis in a historical context. Central to this historical context are the downward trends in police shootings over time and the increasing use of semiautomatic pistols with increased firepower. In effect, this study lays an important historical foundation for examination of multi-shooter, multi-shot incidents and the extent to which they might involve contagious fire by exploring data from a time period when shootings were more common (especially in the study site), but firearms were not as high powered as they are today.

Second, the Internal Affairs reports for the intervening years (1979-1986) were originally obtained through the discovery process but were lost in the early 1990s. PPD destroys all shooting investigations after 5 years, so the authors were unable to reconstruct the missing time period. Although the data gap limits exploration of the contagious fire thesis, this methodological limitation creates an interesting natural experiment because of changes that occurred during the intervening years. During the 1970s, the PPD operated under the formal and informal control of Frank Rizzo, and in 1979, the U.S. Justice Department took the unprecedented action of filing suit against the PPD for tolerating brutality. In 1980, the PPD instituted and

enforced rigorous administrative controls on police shooting behavior, resulting in a well-documented 60% drop in officer-involved shootings (Fyfe, 1988; White, 1999). In effect, we are able to explore the prevalence of multi-shooter, multi-shot incidents—and the extent to which they might involve contagious fire—under two very different internal environmental climates: one where decisions to shoot were essentially unfettered (1970-1978) and one where those decisions were strictly controlled (1987-1992).[9]

Contagious Fire Preconditions

An obvious precondition for contagious shootings is that at least two officers are present during an incident in which police bullets are discharged.[10] Therefore, the first step in any attempt to empirically examine issues related to contagious fire is to examine how frequently two or more officers are present in police shootings. In these data, slightly less than half of the shooting incidents (369 of 806, two cases missing; 46%) involved a single police officer. In nearly half of the cases, then, there existed no potential for contagious fire for the simple reason that the officer who fired was the only officer on-scene. Among the 437 cases in which at least two officers were present, just one officer fired any shots in 243 (56%) of them. Overall, then, three quarters of the cases in these data clearly involved no contagious fire, largely because (a) in almost half of the cases, the officer who fired was the only officer present, and (b) in another 25% of cases, there were multiple officers on scene but only one officer fired.[11]

Another precondition of the contagious fire thesis is the notion that the multiple officers who pull the trigger in such shootings fire a sizable number of rounds. Implicit in this notion is the idea that officers in multi-shooter incidents would tend to fire more rounds than officers who are sole shooters. Across all shootings, the total number of shots fired ranged from 1 to 42 (n = 795; 13 missing cases). As displayed in Table 1, the mean number of shots was 3.83 and a single shot fired was the modal category (which occurred in 36% of the cases). Table 1 also shows that 2 to 4 shots were fired in 35.4% of the cases, 5 to 9 shots were fired in 20.9%, 10 to 19 were fired in 6.6%, and 20 or more shots were fired in just 1.2% of the shootings.

Among the 598 cases in which just one officer fired, the number of shots fired ranged from 1 to 16, with a mean of 2.39 and a mode of 1 (which occurred in 47.7% of the cases; see Table 1). Among the 197 shootings in which two or more officers fired, the total number of shots fired ranged from 2 to 42, with a mean of 8.21 and a mode of 5 (which occurred in 10.7% of the cases; see Table 1). Finally, the mean number of shots fired

Table 1
Distribution of Shots Fired by Number of Shooters

Number of Shots Fired	All Shootings (n = 795)	Single-Shooter Incidents (n = 598)	Multiple-Shooter Incidents (n = 197)
1 shot	35.8% (285)	47.7% (285)	0.0% (0)
2-4 shots	35.4% (282)	38.2% (228)	27.5% (54)
5-9 shots	20.9% (166)	13.5% (80)	43.7% (86)
10-19 shots	6.6% (52)	0.9% (5)	23.7% (47)
20-39 shots	1.1% (9)	0.0% (0)	4.5% (9)
40 or more shots	0.1% (1)	0.0% (0)	0.5% (1)
Mean shots fired	3.83	2.39	8.21
Mode shots fired	1	1	5

per officer in multiple shooter incidents was 3.13, which indicates that officers tend to fire slightly more shots in incidents in which other officers also discharge their weapons.[12] This comparison of the number of shots fired by officers who are sole shooters and those who fire in concert with peers is consistent with the notion implicit in the contagious fire thesis that the average number of shots fired per officer would increase when more than one officer fires. It is not the last word on the topic, however, for it is possible that features of shootings beside the number of officers firing might account for the differences observed. This matter is one of the key topics we address in the following section, in which we report the results of several multivariate analyses of the Philadelphia data.

Multivariate Findings

The Number of Shooters

The first step we took in our multivariate analysis was to identify factors that predict whether two or more officers would discharge their weapons among the 437 shootings in which two or more officers were present (i.e., whether a given incident in which at least two officers could shoot would be a multi-shooter shooting). Table 2 shows the list of potential predictor variables, many of which either seem intuitively related to the number of shooters (or shots fired) or have been linked to these shooting outcomes by prior research (e.g., suspect weapon, lighting conditions, assignment to a specialized unit, officer approach, etc.). To predict the number of shooters,

Table 2
Incident-, Officer-, and Suspect-Related Variables

Incident-Related Characteristics
Incident type (assault on officer)
0 = gun
1 = non-gun assault
Time of day
0 = 8:00 p.m.-2:00 a.m.
1 = other
Location
0 = indoors
1 = outdoors
How officer became involved
0 = radio call/civilian advised
1 = officer initiated
Job type
0 = other
1 = robbery, man with gun, assault, rape, serving warrant, attempt arrest
Lighting conditions
0 = good
1 = dark/poor
Reason for shooting
0 = other
1 = defend self/others
Who fired first shot?
0 = officer
1 = suspect
Time period
0 = 1970-1978
1 = 1987-1992
Suspect/officer race/ethnicity
0 = White officer/non-White suspect
1 = other
Officer-Related Characteristics
Rank
0 = patrol officer
1 = other
Officer gender
0 = male
1 = female
Officer race/ethnicity
0 = White
1 = non-White

(continued)

Table 2 (continued)

Officer duty status
0 = on duty
1 = off duty
Officer assignment
0 = patrol
1 = specialized unit
Police officer actions prior to shooting
0 = approaching vehicle, confront suspect
1 = other
Officer's gun
0 = revolver
1 = semiautomatic
Prior knowledge suspect was armed
0 = no
1 = yes
Officer used cover
0 = no
1 = yes
Officer called for back-up prior to shooting
0 = no
1 = yes
Officer time to aim
0 = no
1 = yes
Officer injury
0 = no
1 = yes
Suspect-Related Characteristics
Suspect race/ethnicity
0 = White
1 = non-White
Suspect gender
0 = male
1 = female
Suspect actions at time of shooting
0 = fighting/attacking
1 = other
Suspect position
0 = standing, crouching, advancing
1 = other
Suspect weapon displayed
0 = no
1 = yes

we first created a dichotomous variable where single-shooter incidents were assigned scores of 0 and multiple-shooter incidents were assigned scores of 1 and then utilized logistic regression to regress this measure on the possible predictors listed in Table 2.

The results are shown in Table 3.[13] The predictors of multiple-officer shootings are as follows:

- the time period 1970-1978
- gun assault on the officer
- the officer called for back-up prior to the shooting
- the call involved a high-risk event such as a robbery, man with a gun, rape, and so on (hereafter referred to as a high-risk call)[14]
- the suspect fired a shot at the officer first

The odds ratios suggest that the variables vary notably in their predictive power. In particular, the type of call and the suspect firing first increase the likelihood of a multiple-shooter event by 1.7 times and 2.5 times, respectively.

We next explored the multiple-shooter precondition using a continuous-level variable to identify factors that predicted the number of officers who fired in those cases where at least two officers were present. To do this, an ordinary least squares (OLS) model was estimated with the same predictors included in the logistic regression model. The results of this procedure are displayed in Table 4, illustrating that the independent variables are equally effective in predicting the continuous-level version of the multiple-shooter outcome.

The Number of Shots Fired

The next component of our analysis included all cases and examined the average number of shots fired per shooter, per incident, calculated as follows: the total shots fired per incident / number of shooters per incident. As noted above, implicit in the contagious fire thesis is the notion that the average number of shots fired per officer should be higher when multiple officers shoot (as compared with situations in which just one officer shoots). As reported above, this is, in fact, the case; the average number of shots that officers fire when they are sole shooters is 2.39 and 3.13 when there are two or more shooters. But it is also implicit in the contagious fire thesis that the difference in number of shots fired should remain when other features of shooting incidents are taken into account.

To explore this matter, we first estimated a one-predictor OLS model with the average number of shots fired per officer (per incident) as the

Table 3
Logistic Regression Results Predicting the Number of Shooters: Multiple Shooter (no, yes)

Predictor Variable	*B*	*SE*	Wald	*OR*	*p* Value
Time period (1970-1978, 1987-1992)	–1.077	.310	12.094	.341	.001
Assault type on officer (gun, not a gun)	–.717	.254	7.997	.488	.005
Officer called for back-up (no, yes)	1.048	.256	16.793	.351	.000
Job type[a]	.579	.227	6.478	1.784	.011
Who fired first shot? (officer, suspect)	.930	.326	8.167	2.536	.004
Log Likelihood	476.555				
R^2 (Cox and Snell)	.152				
Chi-square	65.160				
df	5				
Significance	.000				
N	394				

a. Job type is coded as 0 = *other*, 1 = *robbery, man with gun, assault, rape, serving warrant, attempting arrest*.

Table 4
Ordinary Least Squares Regression Results Predicting the Number of Shooters: Multiple Shooter (continuous)

Predictor Variable	*B*	*SE*	Beta	*T*	*p* Value
Time period (1970-1978, 1987-1992)	–.410	.117	–.161	–3.513	.000
Assault type on officer (gun, not a gun)	–.208	.104	–.103	–1.992	.047
Officer called for back-up (no, yes)	.673	.102	–.298	–6.611	.000
Job type[a]	.250	.094	.123	2.661	.008
Who fired first shot? (officer, suspect)	.651	.129	.253	5.047	.000
R^2 (adjusted)	.223				
Sum of squares (total)	397.343				
F	23.587				
Significance	.000				
N	393				

a. Job type is coded as 0 = *other*, 1 = *robbery, man with gun, assault, rape, serving warrant, attempting arrest*.

dependent variable and the number of officers who fired as the predictor to simply establish the effect size of the previously reported difference between single- and multiple-shooter incidents. Table 5 (top section) shows that the number of shooters is statistically significant ($B = .430$, $p < .000$). With this baseline regression model in hand, we then estimated an OLS model that includes the number of shooters as well as the other officer-, suspect-, and incident-related variables that were included in the above-reported logistic and OLS models to assess whether the relationship between the number of shooters and the average number of shots fired holds when controlling for other situational factors.

The bottom portion of Table 5 shows the results of this model, indicating that the number of officers who shoot is no longer a significant predictor of the average number of shots fired. This finding suggests that the number of officers shooting does not independently affect the number of shots that officers fire. This model also identifies four other variables as the factors that drive the number of rounds that officers discharge: the degree of risk in the call officers were handling, who fired the first shot in gunfights, whether officers suffered injuries, and the type of gun officers carried. The number of shots fired increased when officers handled high-risk calls, when suspects fired the first shot, when officers were injured, and when officers carried semiautomatic handguns.[15]

Multi-shooter, Multi-shot Incidents

The analyses in the previous sections represent an indirect examination of the contagious fire thesis, as we explored each of the two requisite preconditions separately. To conduct a more direct assessment of contagious fire, we created a third outcome variable that isolates shootings that meet both preconditions: those with multiple shooters and a high number of rounds fired. This final analysis takes a conservative approach, as we define cases where multiple officers together fire 10 or more rounds as possible contagious shootings, to explore what might predict such cases.

Single-officer shootings have again been set aside, and we focus on the 437 incidents in which at least two officers were present. Among these cases, 53 or 12.1% involved more than one shooter and 10 or more rounds fired. We assigned a score of 1 to each of these cases and 0 to the rest and used logistic regression to see whether specific features of shooting incidents were significant predictors of multi-officer, high-round shootings. Table 6 shows that there are four predictors of multi-shooter, high-round incidents: a gun assault on the officer, a high-risk call, officer called for

Table 5
Ordinary Least Squares Regression Results Predicting the Average Number of Shots Fired per Officer per Incident

Predictor Variable	*B*	*SE*	Beta	*T*	*p* Value
Model 1					
Number of shooters	.430	.083	.182	5.218	.000
R^2 (adjusted)	.032				
Sum of squares (total)	2964.644				
F	27.227				
Significance	.000				
N	794				
Model 2					
Number of shooters	.159	.115	.060	1.385	.167
Officer injured (no, yes)	.402	.199	.086	2.025	.043
Who fired first shot? (officer, suspect)	1.547	.260	.261	5.941	.000
Job type[a]	.448	.182	.106	2.464	.014
Gun type (revolver or semiautomatic)	1.644	.292	.236	5.626	.000
R^2 (adjusted)	.182				
Sum of squares (total)	2131.991				
F	22.799				
Significance	.000				
N	491				

a. Job type is coded as 0 = *other*, 1 = *robbery, man with gun, assault, rape, serving warrant, attempting arrest*.

back-up prior to the shooting, and the suspect fired the first shot. Despite the small number of cases of interest ($n = 53$), we are able to model multi-shooter, multi-shot incidents quite successfully, and it is, perhaps, not surprising that the predictors of the combination outcome variable mirror those that emerged in the earlier individual precondition analyses.

Discussion and Conclusion

The foregoing findings shed considerable light on the contagious fire thesis by presenting evidence bearing on several hypotheses derived from it. Consideration of the implications of these findings begins with a discussion of those variables that turned out to be unrelated to the outcomes of interest. First, officer and suspect race—specifically, White officer and non-White suspect—were not associated with any of the three outcomes examined (i.e., multiple officer shootings, number of shots fired, and the

Table 6
Logistic Regression Results Predicting Multi-shooter, Multi-shot Incidents (10+ for high round)

Predictor Variable	*B*	*SE*	Wald	*OR*	*p* Value
Assault type on officer (gun, not a gun)	–1.408	.479	8.640	.245	.003
Job type[a]	.897	.354	6.416	2.453	.011
Officer called for back-up (no, yes)	1.509	.344	19.283	.221	.000
Who fired first shot? (officer, suspect)	.963	.378	6.487	2.619	.011
Log likelihood	231.951				
R^2 (Cox and Snell)	.151				
Chi-square	65.288				
df	4				
Significance	.000				
N	399				

a. Job type is coded as 0 = *other*, 1 = *robbery, man with gun, assault, rape, serving warrant, attempting arrest*.

combination of the two). That our analysis did not uncover any race effects places our research on a long list of empirical studies of police action (including the use of deadly force) that have found that race does not matter when it comes to explaining why officers act as they do. It should be noted in this connection, however, that there also exist a number of studies of police action that have found race effects and that the role that race plays in police behavior appears to be contingent on other factors (such as time and place; see Skogan & Frydell, 2004). Given this, it is important to keep in mind that our study was limited to a single police agency and that although our data cover a substantial time period, they are not temporally comprehensive.

The remaining nonsignificant factors are more closely tied to tactical aspects of deadly force encounters. That neither lighting conditions, the nature of the officers' assignment (i.e., plainclothes vs. uniform), nor officers' approach, preparedness, and position at the time of the shooting were associated with any of our outcome measures when controlling for other variables suggest that these factors might not be important when considering how to control officers' use of deadly force. If any of them had been significant predictors, it would suggest that police trainers and policy makers may be able to reduce the likelihood of multi-officer, multi-shot shootings by providing policy guidance and/or training about matters such as light control, field tactics for specific assignments, and so on.

Where factors that were significant determinants of police shooting behavior are concerned, several important themes emerged. First, the predictors of multi-shooter incidents are similar to the predictors of average number of shots fired per officer, which logically, then, are similar to the predictors of the combination variable. Two of the five predictors are common across all outcome measures: suspect firing the first shot and high-risk call. Other shared predictors include assault type on the officer (gun assault) and officer called for back-up. The overlap among predictors is explained, at least in part, by the shared relationship between the outcomes of interest: The number of shooters and the number of shots fired are components of the combination shooting dependent variable. And the number of shots fired is related to the number of shooters (e.g., as the number of shooters increases, so does the number of shots fired).

Second, there are a few variables whose association with the shooting outcomes makes intuitive sense because of their relationship to the study site or police work in general. The time period variable likely emerges as significant in the multi-shooter model because of the well-documented changes in the administrative oversight of police shooting decisions in the PPD. The restrictive administrative policy instituted in 1980 by the PPD was followed by a 60% decrease in deadly force incidents (Fyfe, 1988), including those involving multiple shooters.

Officer gun type—specifically use of semiautomatic handguns—emerges as a significant predictor of the average number of shots fired when controlling for the number of shooters and other relevant variables. Simply put, when controlling for other factors including the number of shooters, officers with semiautomatic handguns fired significantly more shots on average than officers armed with revolvers.[16] Given the nonsignificance of gun type in the multi-shooter models and the nonsignificance of number of shooters in the OLS model, this finding is likely a result of the increased firepower of semiautomatics and not the result of a contagion effect. This finding should also be considered in the context of the data. During the 1970s, the PPD standard-issue firearm was a .38 caliber revolver. During the late 1980s, the PPD began making semiautomatic firearms available, although the revolver continued to be the firearm of choice among Philadelphia police officers throughout the study period. Given the relationship between semiautomatics and an increase in shots fired, the potential for multi-shooter, multi-shot—or contagious fire—incidents may have been limited in this study. Additional research with more recent data is needed to further explore the relationship between gun type and the potential for contagious fire.

Last, and perhaps most important, the remaining significant predictors in the regression models represent or are indicative of an increased threat or lethality to the police. Nearly all of the remaining predictors intimate an armed and dangerous suspect:

- gun assault against the officer
- officers called for back-up prior to the shooting
- the suspect fired a shot at officers first
- the incident involved a high-risk call for service (robbery, man with gun, etc.)
- at least one officer was injured

Taken together, all of these findings suggest that there may not be much that police policy makers and trainers can do to reduce multi-officer, multi-shot shootings, as these events appear to involve situations where those types of outcomes might be expected: Armed and dangerous suspects present an imminent threat that leads officers to use deadly force to protect their own lives and/or the lives of others. Moreover, the nonsignificance of the number of shooters variable in the second OLS model suggests that the number of additional officers using deadly force at these highly dangerous incidents is unrelated to the average number of shots fired by each officer. This finding represents strong evidence against the existence of a persistent contagion effect in these officer-involved shootings.

This is by no means the last word on the contagious shooting thesis, however. Although it seems clear from this research that the rarely occurring multi-officer, high-shot shootings were a function of forces outside of the involved officers (i.e., forces that indicated a heightened degree of danger), it is still possible that some small number of officer-involved shootings involve contagious fire. Recall that the contagious shooting thesis maintains that a high volume of shots in multiple-officer shootings are the product of a panic response on the part of those officers who shoot after an initial officer discharges his or her weapon. As we noted previously, these data cannot speak to the critical question of how subsequent officers come to decide to fire their weapons. In short, we were only able to empirically address two of the three key facets of the contagious fire thesis. Further research that examines the decision-making processes in which officers involved in multi-officer, multi-shot shootings engage in is needed to examine the possibility that some small number of police shootings involve contagious fire. Such an inquiry would require data from interviews with officers following shootings—data that, as mentioned above, do not presently exist. In the meantime, this research indicates that even if some shootings do involve contagious fire,

such shootings are quite rare and multi-officer, multi-shot shootings seem to be a product of the increased danger that officers typically face in such incidents.

Notes

1. The media have also applied the contagious fire/shooting appellation to other incidents involving multiple officers and a large number of shots fired, most notably, the 1999 Amadou Diallo case in which four plainclothes NYPD officers fired 41 shots at an unarmed man when they mistook the wallet he was holding in his hand for a gun (e.g., "How Common," 2006; "Police Killing," 1999).

2. In fact, a *Daily News* story ("In a Flash," 2006) indicates that NYPD Police Commissioner Kelly acknowledged that the Bell incident could be a case of "contagious fire."

3. Indeed, there is no requirement that law enforcement agencies report to any sort of body any information about any aspect of incidents in which their officers discharge their firearms to anyone outside of their local criminal justice community.

4. Additional concern about the accuracy of the FBI's Supplemental Homicide Reports (SHR) data comes from a recent report from the Bureau of Justice Statistics (Mumola, 2007) that uses data from the Bureau's Deaths in Custody Reporting Program (DCRP) to count police shootings that result in suspect death and included a comparison of DCRP and SHR data for 2003-2005. The numbers differed substantially in many cases.

5. It is also possible that multiple officers will shoot at a suspect based solely on the actions of that suspect. For example, if a suspect has a revolver and fires at an officer, multiple officers may fire at the suspect. This is not a contagious fire incident, however. The contagious fire thesis is premised on the idea that secondary officers fire in an unconscious response to a primary officer's gunfire—not as a conscious response to a suspect's actions.

6. A disproportionate number of the officers interviewed by Klinger were assigned to SWAT units at the time of their shootings.

7. A few police departments have amended their shooting policies in an attempt to reduce the likelihood that unnecessary rounds are fired. For example, the NYPD's policy states that officers should reassess the threat after firing three rounds.

8. Accidental discharges, suicides, and shootings of animals have been removed. Also, the data include police shootings resulting in injury or death to a suspect only. Noninjurious shootings—those where all shots were off-target—were not reported by the Philadelphia Police Department during the first part of the study period, 1970-1978. As a result, noninjurious shootings from 1987 to 1992 have been set aside for the sake of consistency.

9. The administrative policy that was instituted in 1980 authorized officers to use deadly force in the following circumstances (White, 2001):

> 1. In defense of life;
> 2. When no alternative exists, to apprehend fleeing felons known to be in possession of deadly weapons that they have used or threatened to use, or who have committed forcible felonies (such as murder, voluntary manslaughter, rape, robbery, kidnapping, involuntary deviate sexual intercourse, arson, burglary, and aggravated assault). (p. 135)

This policy met the constitutional standard established by the Supreme Court in *Tennessee v. Garner* (1985) a few years later.

10. Recall that our definition of a contagious shooting includes three elements: multiple officers shooting and a high number of rounds fired (the preconditions), and the actual panicked response by secondary officers who fire unconsciously as a response to the first officer's fire.

11. The potential for multi-officer shootings may increase when departments employ two-officer-per-car patrols versus one officer, as well as when specialized units (e.g., anticrime units, SWAT) are involved, because the number of officers at potential shooting scenes necessarily increases.

12. An independent samples *t* test showed that the difference in mean number of shots fired per officer in single-shooter (2.39) and multiple-shooter incidents (3.13) is statistically significant ($t = -5.577$, $p < .000$).

13. In all of the multivariate analyses, we report the nested models only. That is, models were run to identify the significant predictors, and then a final model was run with just those variables.

14. The dichotomous "job type" variable was created by examining types of calls across Fyfe's (1981a) danger-based typology. This typology characterizes the lethality of each incident according to the type of assault against the officer: gun assault, knife assault, other weapon assault, physical assault, and nonassaultive. As one moves from top to bottom on the typology, the lethality of the encounter generally decreases, which may give the officer more options beyond the use of deadly force. The high-risk calls were identified based on a high percentage of nonelective shootings (e.g., robbery and man with gun calls were primarily nonelective shooting incidents).

15. There appears to be multicollinearity among two of the three predictors in this model: Officer injuries are more likely when the suspect shoots first, and the suspect is more likely to shoot first in high-risk calls. We ran the regression again using the Forward method, which selects predictors individually, and we closely examined the regression diagnostics at each stage of the model. The results indicate little change among the predictors at each stage, and the overall model results are virtually identical to the original model. Also, gun type is missing in 274 cases, which explains the smaller number of cases in the model. The model was run again without gun type and the number of shooters variable is still not significant.

16. Although there are only 51 shootings involving a semiautomatic handgun, the average number of shots fired per officer in those cases is significantly higher than in incidents where revolvers were used (4.27 vs. 2.40, respectively). Ideally, the authors would run the multivariate analyses separately for incidents when police used revolvers and when they used semiautomatic handguns—given differences in the number of potential rounds fired. It is unfortunate that there are not enough cases to support separate analyses.

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