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Exploring the relationship between foot and car patrol in violent crime areas

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Abstract

Purpose – The purpose of this paper is to describe how the Philadelphia Police Department instituted a large-scale randomized controlled trial of foot patrol as a policing strategy and experienced 23 percent fewer violent crimes during the treatment period. The authors examine whether activities patrol officers were conducting might have produced the crime reduction. The activities of foot and car patrol officers research takes a closer look at what types are examined separately and differences between car patrol activities pre-intervention and during the intervention are explored. Activities of foot versus car patrol officers during the study period are compared across treatment and control areas.

Design/methodology/approach – Official data on police officer activity are used to compare activities conducted by foot patrol officers with those by car patrol officers in 60 treatment (foot beat) and 60 control areas consisting of violent crime hot spots. Activities of car patrol officers are described pre-intervention and during the intervention. Foot patrol officers' activities are described within treatment and control areas during the treatment phase of the experiment. Car patrol officers' activities are reported separately. The statistical significance of changes in car patrol activity pre and during intervention is evaluated using a series of mixed model ANOVAs.

Findings – There were noticeable differences in the activities conducted by foot and car patrol. Foot patrol officers spent most of their time initiating pedestrian stops and addressing disorder incidents, while car patrol officers handled the vast majority of reported crime incidents. Car patrol activity declined in both treatment and control areas during the intervention but there was no statistically significant difference between the treatment and the control areas.

Research limitations/implications – The major limitation of this study is the restricted set of data describing officer activity that is captured by official records. Future studies should include a more robust ethnographic component to better understand the broad spectrum of police activity in order to more effectively gauge the ways in which foot patrol and car-based officers' activities interact to address community safety. This understanding can help extend the literature on "co-production" by highlighting the safety partnerships that may develop organically across individual units within a police organization.

Practical implications – The study provides evidence that individual policing strategies undertaken by agencies impact one another. When implementing and evaluating new programs, it would be beneficial for police managers and researchers to consider the impact on activities of the dominant patrol style, as necessary, to understand how a specific intervention might have achieved its goal or why it might have failed to show an effect.

Originality/value – The research contributes to the understanding of the separate and joint effects of foot and car patrol on crime. In addition, it provides police managers with a clearer picture of the ways in which foot patrol police and car-based officers work to co-produce community safety in violent inner-city areas.

Keywords United States of America, Policing, Violent crime, Policing strategies, Cities, Foot patrol, Car patrol, Randomized controlled experiment, Police activity

Paper type Research paper

> But in our view, […] the citizens of Newark […] knew what the foot patrol officers were doing, they knew it was different from what motorized officers do, and they knew that having officers walk beats did in fact make their neighborhoods safer (Wilson and Kelling, 1982, p. 29).

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1. Introduction

Throughout the history of American policing, the idea of foot patrol has swung in and out of popularity (Rosenbaum *et al.*, 1994). In the late 1960s, The President's Commission on Law Enforcement and Administration of Justice heavily promoted community policing programs (prominently featuring foot patrol) as a method for addressing the nation's crime problems (Greene, 1987). However, the expected reduction in crime from foot patrol did not materialize (Esbensen, 1987; Pate, 1986), at least not before the recent Philadelphia foot patrol experiment (PFPE) which found a 23 percent reduction in crime in foot patrol areas as compared to control areas (Ratcliffe *et al.*, 2011).

The PFPE is one of the few studies of foot patrol which documented successful crime reduction. Thus, the finding is unusual enough to warrant further investigation. Typical of randomized-controlled experiments, the PFPE provided a solid answer to "what worked" but nothing about "why it worked." As part of the experimental design we included several components aimed at trying to understand the "how" and "why" questions, i.e. to look inside the black box of the experiment. These included walk-alongs with foot patrol officers, focus groups, and an examination of foot and car patrol activities via official incident data.

One important dimension concerns the activities of both foot and car police officers that may have led to the crime reduction. During our field observations and focus groups with police officers, we observed and heard that foot patrol officers did not operate in isolation from the rest of the department. Car patrol officers would occasionally lend a hand (bringing paperwork, taking someone to the station house, etc.), although not always. We started to wonder whether the treatment was the result of a co-production relationship – that is, foot patrol did not yield this effect in isolation. Foot patrols are typically implemented as one component of an organization's overall policing strategy; yet, when foot patrol is evaluated, car patrol officers working the same area are usually not considered. In other words, little is done to understand how the introduction of a foot patrol strategy might lead to the co-production of public safety by foot and car patrol officers working with one another as well as in concert with the community. More broadly, our question is whether, and how, foot patrol activities served to alter, and even re-calibrate car patrol activities.

This research explicitly puts foot patrol in context by separating and then comparing the activities of foot patrol officers from those undertaken by car patrol officers. The results of our examination contribute to our understanding of the separate and joint effects of foot and car patrol on crime. In addition, they provide police managers with a clearer picture of the ways in which foot patrol police and car-based officers might work with one another and with the public to co-produce community safety in violent inner-city areas. This information can be used to more effectively deploy foot and car patrol officers.

2. Overview of the PFPE

The PFPE developed when the Philadelphia police department (PPD) decided to address summer violence by assigning the graduates of its March and June 2009 classes to foot patrol beats (Ratcliffe *et al.*, 2011). The first step was to identify potential areas for foot beats. Three years (2006-2008) of violent incident data were weighted such that later incidents counted more than prior ones and aggregated to polygons constructed around every intersection in the city[1]. Police commanders worked with researchers to create areas feasible for foot patrol from the highest weighted score

intersections. From these, the 120 highest violent crime areas were retained for the study. A randomized block design was used to assign the 120 areas to treatment (added foot patrol) and control (business as usual/car patrol) conditions[2].

Treatment areas (i.e. the ones assigned foot patrol officers) were patrolled by two pairs of officers over two staggered 12-week-evaluation periods. Officers received a one-week orientation around their foot beat, and then were shadowed by an experienced officer on the beat for a couple of weeks. Officer pairs were initially assigned to the morning (10 a.m.-6 p.m.) or evening shift (6 p.m.-2 a.m.) which they patrolled Tuesday through Saturday night. The pairs assigned to each beat alternated between morning and evening shifts every two weeks. As a result, treatment areas were not patrolled from 2 a.m. to 10 a.m. each day, and from 2 a.m. Sunday through 10 a.m. Tuesday every week. Considering the timeframe of both phases, it was estimated that 57,000 hours of foot patrol activity would take place. District captains were responsible for staffing foot beats and ensuring that they were fully operational over the study period. Foot beat officers were given an intelligence brief about their foot patrol area by the criminal intelligence unit, in addition to whatever information they acquired during the orientation period. Officers were not formally instructed on appropriate policing styles from police headquarters.

The results of the experiment indicated violent crime hotspots that received foot patrol had a reduction in violence of about 23 percent as compared to the control hotspots. This translates to a total crime reduction in the target areas of 90 violent crimes. During the same time period there was an increase of 37 violent crimes in the displacement areas leaving a total net effect of 53 violent crimes prevented.

The goal of the original experiment was to identify whether foot patrol reduced violent crime. The original study did not attempt to separate the activities of foot patrol officers from those of car patrol officers. Additionally, the original study did not attempt to examine the time periods when foot patrol officers were on patrol, but focussed on officer activity and criminal activity which occurred at any time during the treatment period. This is important because if it was the case that foot patrol officers were temporally displacing crime, the finding of a 23 percent reduction in violent crime over the entire period may be a conservative measure compared to one which considers only the times during which the officers were on duty. By separating the activities of foot patrol officers from those done by car patrol officers, and temporally limiting the measures of crime and officer activity, the current study is able to directly measure officer activity by the type of patrol and examine the effect of foot patrol on the activities of car patrol officers in the same areas.

3. The relationship of foot and car patrol to crime

There are several explanations which provide the basis for understanding how the activities of foot patrol and car patrol might work both individually and jointly to reduce crime. Deterrence is the simplest and most direct mechanism for crime reduction. In addition, the emphasis on co-production of community safety inherent in both community policing and broken windows policing is salient to understanding how the police reduce crime.

Deterrence is the basic mechanism underlying the connection between increased police presence and reductions in crime. According to classical theorists such as Beccaria (1764/1963) and Bentham (1789/1948), potential offenders weigh the potential costs against potential benefits when deciding whether or not to commit crime. As rational beings, people will engage in crime if the benefits exceed the potential costs

associated with the act. Thus, deterrence theorists argue the state can adjust the likelihood of someone engaging in crime by altering the costs. Three costs which are of critical importance include the swiftness by which punishment for criminal acts is administered, the certainty that the behavior will be discovered, and the severity of the sanction (Nagin and Pogarsky, 2001). Patrol officers, whether on foot or in cars, represent tangible evidence of increased certainty that criminal behavior will be detected. Given the immediacy of foot patrol officers in an environment, it follows that the offending public might be more deterred by the increased presence of foot patrol officers than officers in cars.

The co-production of community safety literature as currently framed centers on police and communities working in partnership (Innes and Roberts, 2008; Ostrom and Gordon, 1973). Put simply, it explicitly recognizes the necessity of the role of citizens, the community, police, and other city agencies in achieving public safety. Various policing strategies incorporate elements of co-production such as broken windows policing (Kelling and Coles, 1996; Sousa and Kelling, 2006; Wilson and Kelling, 1982), community policing (Skogan, 1995, 2006, 2008), third-party policing (Mazerolle *et al.*, 1998), reassurance policing (Innes and Roberts, 2008), and problem-oriented policing (Eck and Spelman, 1987; Goldstein, 1990). They differ on the degree to which the community (including residents, business owners, organizations, and users) is expected to play an active role in co-production (Innes and Roberts, 2008). We focus our discussion on the two most salient to foot patrol in the PFPE, community policing and broken windows policing.

Although community policing is at its core an organizational strategy, some of its principles were evident in the activities of foot patrol officers. Community policing encompasses four principles: first, a reorientation toward communication with members of the public that goes both ways; second, a dedication to problem solving; third, a commitment to addressing the concerns expressed by the community; and finally, a dedication to employing non-law enforcement resources to solve problems (Skogan, 1995, p. 87). Foot patrol officers, because of their accessibility, can easily become the conduits for "two-way communication between police and the public" (Skogan, 1995, p. 87).

Broken windows policing emphasizes the role foot patrol officers can play in establishing a minimum level of order (Wilson and Kelling, 1982). Speaking about the Newark foot patrol experiment, Wilson and Kelling (1982, p. 30) note "[w]hat foot-patrol officers did was to elevate, to the extent they could, the level of public order in these neighborhoods. Though the neighborhoods were predominantly black and the foot patrolmen were mostly white, this 'order-maintenance' function of the police was performed to the general satisfaction of both parties." They outline how foot patrol officers were able to negotiate order by establishing rules that "were defined and enforced in collaboration with the 'regulars' on the street" (Wilson and Kelling, 1982, p. 30). They saw foot patrol as establishing the basic threshold of order upon which residents and business owners could build. In this way, the policing component of broken windows theory views police officers as co-producing public safety with the public. Our observations suggested there were co-production dynamics at work within the police department as well as between the police and the community, i.e. different officers with different roles complementing each other's activities to jointly produce the observed crime reduction effect in Philadelphia.

4. Activities of foot and car patrol officers

The relative merits of car patrol vs foot patrol are widely recognized. In Newark, officers often noted foot patrol "was hard work, it kept them outside on cold, rainy

nights, and it reduced their chances for making a 'good pinch.' In some departments, assigning officers to foot patrol had been used as a form of punishment" (Wilson and Kelling, 1982, p. 29). At the same time, car patrol officers often resent foot patrol because the limited mobility of foot patrol reduces the number of officers available to answer calls for service. But little is known about how the two different roles might work together to jointly reduce crime in foot patrol areas.

We could identify only one study, conducted by Payne and Trojanowicz (1985), that examined both foot and car patrol activities. In that case, the authors were focussed on developing measures to evaluate officer performance. Even so, their findings have relevance to the question of what types of activities are typically undertaken by foot vs car patrol officers. Using the officers' daily report forms, they found that car patrol officers conducted approximately six times the number of felony arrests and five times the amount of misdemeanor arrests as foot patrol officers. However, foot patrol officers conducted twice the number of investigations and seven times the number of public service activities as car patrol officers. It appeared that foot patrol officers were more likely than their car patrol counterparts to interact with the public using what Payne and Trojanowicz (1985) described as a "non-adversarial" approach (public service, friendly interaction) while car patrol officers were more likely to take on "adversarial" roles (where a citizen is perceived as a threat and possibly arrested).

The above findings suggest that foot patrol officers emphasize different policing styles and activities than their car patrol counterparts. Our goal here is to describe the types of activity undertaken by both foot and car patrol officers in Philadelphia as an empirical basis for theorizing how such styles and activities might work in tandem to generate crime reduction benefits. The differences between foot and car patrol officers in the number and type of activities undertaken provide evidence to suggest that when trying to interpret why foot patrol works as a dedicated intervention, car patrol may be an important component of the equation. Empirically, it was assumed in both the design and evaluation of the PFPE that the amount of car patrol activity experienced by the experimental areas would be essentially unbiased across treatment and control groups. Was that an accurate assumption? Specifically, we ask two empirical questions. First, did the activities of foot patrol officers substantially differ from their vehicle-based colleagues? Second, did the amount of car patrol received vary between treatment and control beats in the pretreatment period (i.e. prior to the implementation of foot patrol) and during the treatment period (i.e. while foot patrol officers were on duty)? We also examine how the co-production of community safety literature might be conceptually extended to include contributions by different roles within the police department such as foot and motor patrol.

5. Analytical approach

This research takes advantage of the deployment of foot patrol during the PFPE (Ratcliffe *et al.*, 2011) to more closely examine the activities of both foot and car patrol officers. To explore potential relationships between foot and car patrol tactics we extracted crime incident data from the PPD's incident database (INCT). Data included violent, burglary, theft, vehicle, disorder, firearm, and drug offenses. In addition, the data included information on the circumstances under which incidents were discovered (e.g. in the course of conducting a pedestrian stop, or issuing a traffic violation).

All incidents were geocoded using XY coordinates provided by the police department. We focussed only on the time periods when foot patrol was operational. Excluded from this analysis were incidents occurring from 2 a.m. to 10 a.m. each day,

and from 2 a.m. Sunday through 10 a.m. Tuesday every week. The original PFPE study examined all crime that occurred during the pre-treatment and treatment periods regardless of time or day of week. By including only the incidents occurring when foot patrol officers were on duty, we restrict our measures to only the time periods when the incident could have been addressed by foot patrol officers. The strategy also allows the activities undertaken during the time periods when both foot and car patrols were on duty to be isolated from activity occurring at other times but in the target areas.

Since foot patrol officers graduated from two different classes of the police academy (within the same year), they were assigned to foot patrol in two phases. Phase 1 foot beats began on March 31, 2009 with 24-foot beats and lasted through September 26. Phase 2 began on July 7, 2009, included 26 beats, and also terminated on September 26. In keeping with the original analysis of PFPE, we compare the three months of each phase (the intervention period) with the three months immediately preceding each phase (pre-intervention period)[3].

There is some potential for measurement error on several fronts when using official data. For example, the incident dataset only includes cases deemed serious enough for police officers to have an interaction with the dispatcher (e.g. assignment to a call, requesting an individual's identity be checked, filling out a crime report, etc.). Therefore, informal interactions with citizens are not represented in these data. Informal interactions are likely to represent a larger percentage of foot patrol than car patrol officers' activity. An additional drawback is that property crimes are logged when reported and represent the time of discovery rather than the time the event occurred. This makes it impossible to say with certainty whether the crime occurred while foot patrol officers were on duty.

5.1 Identification of incidents addressed by foot patrol and car patrol officers

When officers report to duty to begin their shift, each officer is assigned an identification number (or call sign) and these were used to distinguish between foot and car patrol officers. Call signs are attributed to every incident in the dataset, allowing us to parcel out whether two-foot patrol officers or a car unit provided the primary response. We were provided with the call signs used by foot patrol officers during the experiment. Using this information, a dummy variable was created within the dataset indicating whether an incident was addressed by a foot patrol officer or a car unit. This technique allows us to separate the activities of foot patrol officers from those of car patrol officers[4].

A geographic information system was used to identify foot patrol and car patrol incidents taking place within control and treatment areas. Counts of violent, burglary, theft, vehicle, disorder, firearm, and drug offenses were then aggregated to the areas in which they occurred. Nature code indicators (where the police department record a code representing the original nature of the incident) of pedestrian stops and traffic violations were also aggregated to treatment and control areas.

Descriptive statistics were used to paint a picture of the activities of foot patrol and car patrol officers within foot patrol areas, during the treatment phase of the experiment and answer the question of whether the activities of foot patrol officers differed substantially from the vehicle-based counterparts in the same areas. A central aim of this research is to determine whether the addition of foot patrol led to a significant change in the types of activity undertaken by car patrol or to a reduction of car patrol activity within foot patrol areas. To this end, we employed a series of mixed

model ANOVAs. The mixed model design, allows for the analysis of change over time, across a number of cases within multiple groups (Meyers *et al.*, 2006).

6. Results

6.1 How do the activities of foot patrol differ from car patrol?

To answer the question of whether the activities of foot patrol and car patrol officers differ, we first describe them separately and then compare them.

Table I displays the proportions of activities conducted by foot patrol officers during the intervention phase of the study, inside treatment and control beats. Officer work is divided into two categories, proactive actions and actions related to criminal offenses. The proactive category measures the frequency with which officers stop civilians and reflects the circumstances under which incidents were discovered (e.g. in the course of conducting a pedestrian stop, or issuing a traffic violation). Proactive measures are also counted in the crime category if they turn into crimes. The actions in the crime category reflect incidents for which an official action was recorded.

Foot patrol officers conducted over three times as many pedestrian stops ($n = 6{,}631$) as vehicle stops ($n = 1{,}852$)[5]. Those unfamiliar with Philadelphia may wonder how foot patrol officers were making vehicle stops at all. Within the city, Philadelphia is dominated by one-way narrow streets on which most automobile traffic rarely exceeds 20 miles per hour. Thus stopping cars is much easier than would seem at first glance. The authors personally observed officers making vehicle stops for failure to come to a complete stop at a stop sign or for defective vehicles.

Disorder offenses were the most frequent crime type recorded ($n = 2{,}372$). Disorder offenses tend to be those that allow for the greatest amount of officer discretion. The following types of disorder-related offenses were included in our analysis: simple assault, vandalism, pandering, prostitution, public drunkenness, disorderly conduct, crowd-related issues such as failure to disperse and obstructing public passageways, loitering, and minor disturbances[6]. Following disorder offenses, the final major category of incidents (with >20 incidents) were for the sale, possession, or intent to distribute illicit drugs (Table I). Violence, theft-related offenses, vehicle crime, and firearms-related offenses occurred much less frequently.

	Treatment		Control	
	%	*n*	%	*n*
Proactive activity				
Pedestrian stops[a]		6,631		606
Vehicle stops[a]		1,852		182
Crime				
Disorder	91.6	2,372	84.5	191
Drugs	6.0	156	7.5	17
Violence	0.7	19	4.9	11
Theft	0.7	18	0.4	1
Burglary	0.5	12	2.2	5
Vehicle crime	0.3	8	0.4	1
Firearm	0.2	4	0	0
Total	100	2,589	100	226

Note: [a]Pedestrian stops and vehicle stops are not included in the total (see footnote 4)

Table I.
Activities of foot patrol officers

Table I includes foot patrol actions within the control area to provide a check on whether foot patrol officers were working in control areas. Although foot patrol officers were instructed to spend most of their time in assigned treatment areas, our primary observations indicated they sometimes expanded the boundaries by a couple of blocks. In occasional cases where treatment beats and control beats were geographically proximal, expanding the boundaries by even a couple of blocks would have them briefly patrolling in a control site. To quantify the extent of contamination, we report the activity of foot patrol officers in control areas as well as treatment areas. We find evidence of activity by foot patrol officers in control beats but it was relatively infrequent, accounting for only 8 percent of all foot patrol officer activity. Within control areas, the highest volume of activity was related to pedestrian stops followed by disorder offenses, vehicle stops, and drug offenses. When foot patrol officers conducted activities in control areas they were more likely to handle a violent crime incident, which suggests that officers may have been responding to calls for service related to violent crime incidents.

Turning to car patrol activities, Table II displays the activity of car patrol officers by proactive actions and crime incidents within treatment and control beats. Because car patrol officers were working before the experiment began and continued to work during the intervention we were able to examine the pre-intervention and intervention time periods for both treatment and control areas. The pre-intervention period provides a baseline for car patrol activities when no foot patrol was implemented. Of the two types of proactive actions we measured, pedestrian stops were once again the highest volume activity but unlike foot patrol the second most frequent activity is vehicle stops. Crimes most frequently addressed were the same for car and foot patrol. Disorder offenses were the most frequently encountered crime category accounting for about 78 percent of all crime-related officer activity and, similar to foot patrol, they far outstrip other actions taken by car patrol officers. Drugs and violent crime incidents account for another 16 percent of crime-related activity by car patrol officers. The remaining 6 percent consists of vehicle crime, theft, burglary, and firearm violations. Car patrol proactive and crime-related activities in the control areas followed the same pattern as in the treatment areas. These findings are consistent with the experimental framework in which control areas received "business as usual" policing.

6.2 What was the effect of foot patrol on car patrol activity types and volume?

Now that we have a better sense of what foot patrol and car patrol officers do with their time, we turn to the question of whether the presence of foot patrol officers was associated with changes in the number or type of activity conducted by car patrol officers working in the treatment areas. Table II displays counts of incidents addressed by car patrol officers within treatment and control areas before and during intervention as well as the relative percent change.

The left half of Table II compares the treatment beat's pre-intervention level of car patrol activity with activity after the foot patrols were initiated. While the foot patrol officers were deployed, car patrol activity declined about 3 percent. Proactive activities such as pedestrian and vehicle stops conducted by car patrol officers were only slightly reduced (by 2 percent each in the treatment areas) between the pre-intervention and intervention periods. The relative proportions of crime-related activities changed very little but there were differences in the magnitude and direction of change by crime type. For some crimes such as disorder, drugs, and violent crime, car patrol activity went down. Most obvious are the proportional changes in violent crime responses

	Pre-intervention		Treatment beats Intervention		Relative change in treatment areas (%)	Pre-intervention		Control beats Intervention		Relative change in control areas (%)
	%	*n*	%	*n*		%	*n*	%	*n*	
Proactive activity										
Pedestrian stops[a]		6,791		6,662	−1.9		5,888		4,402	−25.2
Vehicle stops[a]		4,826		4,731	−2.0		4,173		3,499	−16.2
Crime										
Disorder	77.8	2,795	79.5	2,758	−1.3	79.4	2,885	77.5	2,521	−12.6
Drugs	10.2	365	9.4	326	−10.7	8.4	304	7.9	258	−15.1
Violence	5.6	202	3.9	137	−32.2	4.8	174	5.0	162	−6.9
Vehicle crime	2.3	81	2.9	101	24.7	3.1	112	4.0	131	17.0
Theft	1.8	64	1.9	66	3.1	2.5	90	2.9	94	4.4
Burglary	1.6	58	1.6	56	−3.4	1.4	52	2.2	70	34.6
VUFA/firearm	0.8	29	0.7	26	−10.3	0.4	16	0.6	19	18.8
Total	100.0	3,594	100.0	3,470	−3.5	100.0	3,633	100.0	3,255	−10.4

Note: [a]Pedestrian stops and vehicle stops are not included in the total (see footnote 4)

Table II.
Activities of car patrol officers

by car patrol officers in treatment beats. For example, car patrol officers responded to 32 percent fewer violent incidents within treatment beats from pre-intervention through the intervention phases. During the pre-intervention period 5.6 percent of all activity was devoted to violent crime. That proportion declines to 3.9 percent during the intervention period.

For other crimes such as burglary and Violation of the Uniform Firearms Act (VUFA)/firearm, car patrol handled fewer reports within the treatment areas. Within treatment beats, car patrol dealt with fewer burglaries (−3 percent). Car patrol officers experienced a modest reduction in the number of firearm incidents they addressed over time within treatment beats (−10 percent). On the other hand, the frequency of other crime types to which car patrol officers responded in treatment beats such as vehicle crimes and theft increased 25 and 3 percent, respectively. The differences suggest that the addition of foot patrol had some effect on the activities of car patrol officers (i.e. they reduced the need for mobile officers to deal with more serious crimes but not less serious ones and slightly reduced the proactive work of car patrol).

6.2.1 Treatment vs control area changes in car patrol activities. Because the PFPE was a randomized-controlled experiment and we collected data describing police activity during the days and times foot patrol was on duty, we can use the control areas to identify any changes in car patrol activities not related to the presence of foot patrol. A dramatically different picture emerges when car patrol activities are examined pre-intervention vs intervention period in the control areas. Car patrol activity overall decreased 10.4 percent in the control areas as compared to pre-intervention levels. Pedestrian stops and vehicle stops by car patrol officers declined slightly in the treatment areas once the intervention began but fell dramatically in the control areas (25.2 and 16.2 percent, respectively). This translates into an average of almost 25 fewer per week (about one half a pedestrian stop per beat per week). Vehicle stops decreased by about 16 percent. Compared to part I and part II crimes, officers tend to have more discretion over these types of activities. In other words, car patrol seemed to be cutting back on self-initiated activities (i.e. those not assigned by a dispatcher) in the control areas to a greater extent than in the areas where foot patrol officers were working[7].

Change in reported crime types handled by car patrol from pre-intervention to intervention in the control areas was mixed. Disorder offenses had the largest magnitude decrease falling by 364 events (12.6 percent) but drug and violent offenses also decreased (by 15 and 7 percent). It is worth noting that the number of responses to violent crime handled by car patrol officers in control beats decreased by 12 events pre-intervention to intervention. This result suggests there was less violence to address in the control areas during the intervention period.

There were also significant contrasts between the activities of car patrol officers in treatment areas during the intervention period. In terms of proactive activity, car patrol officers made 34 percent more pedestrian stops (6,662 vs 4,402) and 26 percent more vehicle stops (4,731 vs 3,499) in the treatment areas than in the control areas. There were also large differences in the types of crime addressed. Car patrol reported 21 percent more drug-related incidents (326 vs 258), vehicle stops and 27 percent more firearm offenses (26 vs 19) in treatments than in control beats. This demonstrates more effort being expended by car patrol in treatment areas than in control areas. It may suggest that car patrol officers were targeting foot patrol areas – a possibility that will be explored in further detail in the discussion section.

When considering crime incident types pre-intervention vs intervention period in the treatment beats vs the control areas, differences begin to emerge. For some crimes

such as disorder, drugs, and violent crime, car patrol activity went down in both treatment and control areas. For example, car patrol officers responded to 32 percent fewer violent incidents within treatment beats from pre-intervention through the intervention phases, whereas the control beats experienced a much smaller decline of roughly 7 percent. This lends additional support to findings by Ratcliffe *et al.* (2011) that foot patrol had a significant crime reduction effect on violent crime during the intervention period. In the case of drugs and violence, the drop in car patrol activity in the treatment areas was higher than in the control areas. Before intervention, car patrol officers responded to 365 drug incidents within foot patrol areas; however, that figure declined by 11 percent during the intervention phase. Control areas experienced an even larger decrease in drug incidents addressed by car officers of 15 percent. In contrast, car patrol officers in both the treatment and control areas reported increases in both vehicle crimes and theft in the control beats vs the treatment beats during the intervention.

One of our original questions was whether foot patrol reduced car patrol effort in foot patrol areas. These findings reveal that was not the case; while the official activities of car patrol officers went down slightly, there was no evidence that instituting foot patrol in small areas caused car patrol officers to abandon those areas. In fact, there was an even larger reduction of car patrol activity in the control areas, about 10 percent, from pre-intervention through intervention. It may be inaccurate to attribute the slight decrease in the effort expended by car patrol to the efforts of foot patrol. It seems car patrol was involved in fewer official actions in both the treatment and control areas during the intervention period as compared to the pre-intervention period.

6.2.2 Foot patrol contribution relative to car patrol. To answer the question of how these changes in activities impacted the overall structure of police patrol activities, we present the proportions of activities addressed by car patrol officers and foot patrol officers within treatment and control beats during the intervention phase (Table III). In terms of total activity, car patrol officers addressed 57 percent of incidents that occurred within treatment beats during the intervention phase. Given the disparity between the number of foot patrol and car patrol officers and the natural

	Treatment			Control		
	Foot (%)	Car (%)	Total	Foot (%)	Car (%)	Total
Pedestrian stops	49.9	50.1	13,293	12.1	87.9	5,008
Vehicle stops	28.1	71.9	6,583	4.9	95.1	3,681
Burglary	17.6	82.4	68	6.7	93.3	75
Disorder	46.2	53.8	5,130	7.0	93.0	2,712
Drugs	32.4	67.6	482	6.2	93.8	275
Theft	21.4	78.6	84	1.1	98.9	95
Vehicle crime	7.3	92.7	109	0.8	99.2	132
Violence	12.2	87.8	156	6.4	93.6	173
VUFA/firearm	13.3	86.7	30	0.0	100.0	19
Total unique[a]	42.7	57.3	6,059	6.5	93.5	3,481

Notes: [a]Total unique column excludes counts of nature code activities (pedestrian stops and vehicle stops). Proactive police actions such as pedestrian stops and vehicle stops are not mutually exclusive from offense type totals. For example, when a Philadelphia police department officer conducts a pedestrian stop, it is recorded as a separate incident regardless of the outcome. This is done for managerial purposes. If the stop results in a narcotics arrest, a separate narcotics incident will be created, with a field that shows an arrest was made

Table III.
Proportions of incidents addressed by car and foot patrol officers

radio-response focus of car patrol, it is not surprising that across all categories of crime, disorder, and nature types, car patrol officers handled more incidents than their foot patrol counterparts[8].

Table III does suggest, however, that the above relationship varies by type of incident. Foot patrol made significant contributions, initiating 50 percent of pedestrian stops and handling 46 percent of disorder offenses and 32 percent of drug offenses. Car patrol officers continued to handle the lion's share of vehicle stops (72 percent) and other reported offenses. For example, car patrol officers handled around 90 percent of firearms, violent incidents, and vehicle crimes, as well as about 82 percent of burglaries, and 79 percent of thefts. This was expected since car patrol officers are officially called radio response officers and assigned the overwhelming majority of calls for service received through the computer-aided dispatch system.

Table III also displays the proportions of foot and car patrol activity occurring within control beats. In theory, control beats were supposed to be patrolled by car patrol officers, exclusively. Therefore, this section of the table provides some indication of contamination effects – that is, the extent to which foot patrol officers compromised the construct validity of the experiment by patrolling in control beats. This appears to be a minimal concern as only 8 percent of incidents were addressed by foot patrol officers within control beats[9].

The analysis of foot patrol's impact on car patrol discussed up to this point is descriptive. To investigate whether the observed differences are statistically significant, in the analyses below, we use a series of mixed model ANOVAs to model the direct effect of time (pre-intervention vs intervention) on changes in the mean number of car patrol responses to incidents, as well as the possibility of interaction effects with treatment status. In other words, the following results examine whether there are significant differences in the amount of incidents addressed by car patrol when comparing the pre-intervention period to when foot patrol took place. Furthermore, it considers whether the direct effect of such a relationship varies by whether an area is a foot patrol (treatment) area or control (business as usual/car patrol only) area.

We begin by analyzing the change in the total mean amount of crime addressed by car patrol officers from pre-intervention through the intervention period and then examine pedestrian stops, vehicle stops, and disorder crimes individually. Across foot patrol and control areas, car patrol officers addressed a mean of 60.2 incidents (SD = 34.4) during the pre-intervention period, and 56 incidents during the intervention period (SD = 34.0). The Greenhouse-Geisser adjustment for the direct effect of time is significant, $F(1, 118) = 6.56$, $p < 0.05$, partial $\eta^2 = 0.05$ which indicates that there was a significant change in the mean amount of incidents that car patrol officers addressed from pre-intervention through intervention[10]. However, as evidenced by Figure 1 interaction effects were non-significant, $F(1, 118) = 0.01$, $p > 0.05$, partial $\eta^2 = 0.00$ indicating that the decrease in the mean number of responses to incidents per violent crime area does not vary by treatment status. In other words, the changes in number of incidents addressed by car patrol officers did not differ significantly between treatment and control areas.

An analysis of pedestrian stops over time yielded a statistically significant effect, $F(1, 118) = 17.56$, $p < 0.05$, partial $\eta^2 = 0.13$. Additionally, the interaction variable (pedestrian stops × treatment status) was significant, $F(1, 118) = 6.48$, $p < 0.05$, partial $\eta^2 = 0.05$ indicating that the change in the mean amount of pedestrian stops changed over time, and that relationship varies between treatment and control groups. Marginal estimates indicate that across treatment and control groups the mean log values of

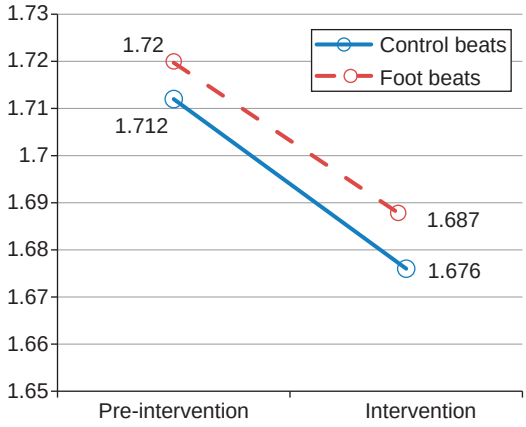

Figure 1.
Plot of interaction between all incidents and treatment status over time

pedestrian stops declined from 1.89 to 1.82. Additionally, when controlling for treatment status and contrary to expectations, one can see that the slope for the control group is steeper than that for the treatment group (see Figure 2). This tells us that foot patrol produced an unanticipated effect. The introduction of foot patrol was associated with greater declines in pedestrian stops in control groups over time than in treatment areas over time. This is in line with the descriptive findings indicating car patrol officers were conducting fewer activities in both the treatment and control areas, rather than drastically reducing their effort in the foot patrol areas. Based on these findings, it is likely that car patrol was working more in areas that were not part of the experiment. We comment on this finding further in a later section.

An analysis of vehicle stops over time yielded a statistically significant F-statistic, $F(1, 118) = 17.70$, $p < 0.05$, partial $\eta^2 = 0.13$. From pre-intervention to intervention periods the mean log value of vehicle stops conducted by car patrol officers within foot patrol and control beats significantly declined from 1.76 to 1.72. The interaction variable (vehicle stops × treatment status) was also significant, F-statistic, $F(1, 118) = 4.91$, $p < .05$, partial $\eta^2 = 0.04$ indicating that the change in the mean amount of vehicle stops varies by between treatment status and that the decrease in

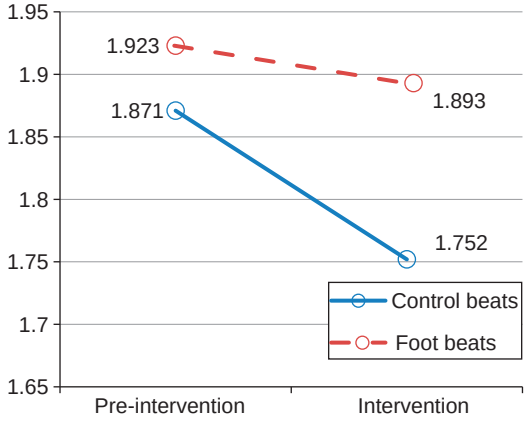

Figure 2.
Plot of interaction between pedestrian stops and treatment status over time

vehicle stops by car patrol officers is strongest for control areas. In other words, the presence of foot patrol beats was associated with more significant decreases in vehicle stops from the pre-intervention to intervention period for control beats than treatments. Again, it seems the car patrol officers began working more outside of control areas than inside them (Figure 3).

An analysis of disorder incidents addressed by car patrol officers indicated a significant decrease over time, $F(1, 118) = 6.26$, $p < 0.05$, partial $\eta^2 = 0.05$. At pre-intervention, the mean log value of disorder incidents addressed by car patrol officers was 1.60. This declined to 1.56 by the end of the intervention period. However, there is no evidence of an interaction effect between disorder over time and treatment status, $F(1, 118) = 0.30$, $p > 0.05$, partial $\eta^2 = 0.00$ (see Figure 4). Here the decline of activity by car patrol is in both type of areas and indicates car patrol was occupied elsewhere in the city.

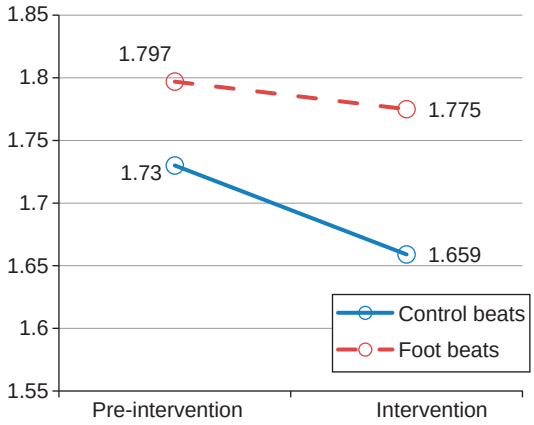

Figure 3.
Plot of interaction between vehicle stops and treatment status over time

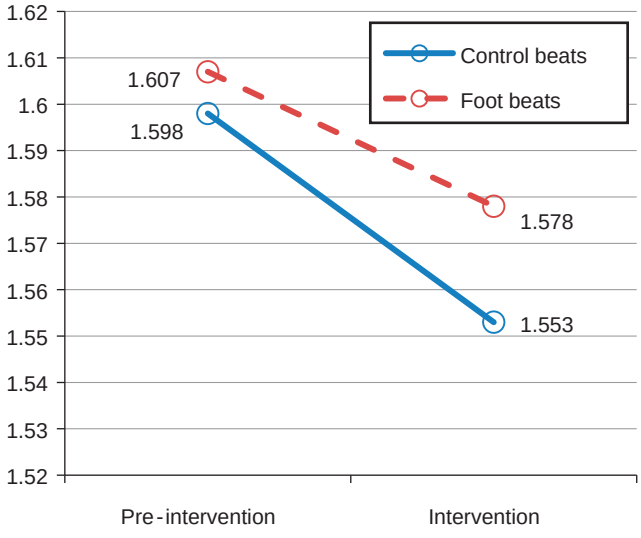

Figure 4.
Plot of interaction between disorder and treatment status over time

7. Discussion

The PFPE found that foot patrol achieved a 23 percent reduction in violent crime. The positive results raise additional questions about how the reduction in violent crime was achieved. Although the presence of foot patrol officers was the treatment in the experiment (i.e. the systematic difference between treatment and control areas) they were not working in isolation. Car patrol was still providing "business as usual" policing. The established literatures on deterrence, broken windows, and the co-production of community safety all point to the importance of investigating the kinds of activities undertaken by foot patrol and car patrol officers that may have contributed to this decline. We first identified and described how much and what type of policing activity can be attributed to the efforts of foot patrol and car patrol officers separately. Next, we examined whether the addition of foot patrol officers changed the types or volume of activity by car patrol officers. Using these findings we suggest an extension of the concept of co-producing community safety to include partnerships between different units within the police department as well as between the police and the community.

One possible outcome of adding foot patrol might have been to reduce the efforts of car patrol officers in target areas, translating into greater decreases in car patrol activity for the treatment areas. This finding would suggest foot patrol could replace car patrol in sort of a "zero sum game" of police deployment. The data in Philadelphia indicate a slight decline in car patrol activity in both treatment and control areas once foot patrol was deployed but there was no statistical difference between the decline in the treatment areas and in the control areas. In other words, car patrol officers remained active in areas where foot patrol was deployed. There was no wholesale abandonment of treatment areas for those assigned to the control condition (the other 60 highest crime areas in Philadelphia).

In fact, proactive actions such as pedestrian and vehicle stops declined less in treatment areas than control. This finding was especially surprising since foot patrol officer's activity was primarily devoted to pedestrian stops and to reporting disorder offenses. There are several possible explanations for the larger decline in proactive types of activities in the control areas. Although car patrol officers were not officially informed of the locations of the treatment beats, nor asked to concentrate their activities in those areas, they undoubtedly became aware of them over time. Therefore, it could be that car patrol officers targeted these because they had been labeled as high crime areas and worked in them more than they would have otherwise. Even more likely, car patrol officers could have focussed their patrols in treatment areas to provide additional protection for foot patrol officers. Recall that all foot patrol officers were recent graduates from the police academy and it is possible that the experienced officers wished to spend more time in and around the foot patrol areas as the rookie officers became acclimated to their new roles. Providing support for this hypothesis, field researchers indicated car patrol units would frequently ride by foot patrol officers to check on their well-being.

But what explains the decrease in car patrol activity in both treatment and control areas? It could be that natural short-term fluctuations in crime meant it had moved a few blocks in the months between identification of the areas and the deployment of foot patrol. Any change in the geographic distribution of crime incidents would impact car patrol officers more since their activities are largely driven by calls for service and they work where the calls take them. Summer is also a popular vacation time period and the decrease could stem from car patrol officers on the street.

The finding of no significant differences pre-intervention to intervention in car patrol activity between treatment and control areas is also important because it validates the assumption in the PFPE that car patrol activities would not bias the results of the experiment. This raises the question of whether it was foot patrol only or the joint presence of foot and car patrol that was behind the observed crime reductions? Broken windows theory and community policing principles support the explanation that foot patrol was primarily responsible. On the other hand, in line with deterrence theory, the finding that car patrol continued to actively police target areas leaves open the possibility that the combination of foot and car patrol may have been important too since both types of officers contribute to increased certainty of punishment within a deterrence framework. The emphasis on order maintenance activities by foot patrol officers in PFPE is consistent with broken windows theory's view of foot patrol as key to establishing order in a place (Wilson and Kelling, 1982). While we were not able to quantify the magnitude of their community liaison work, the activities of foot patrol seemed to be consistent both with community policing and with the order maintenance function in broken windows theory even though no specific instructions were given on which specific activities to perform and to what extent. For instance, car patrol officers were less likely to address disorder incidents and initiate pedestrian stops, but more likely to address more serious incidents such as violent crimes, gun offenses, and vehicle crimes. This corroborates earlier findings based on the Flint, MI foot patrol study, which revealed car patrol officers conducted six times the number of felony arrests as foot patrol officers (Trojanowicz, 1988). Other research found foot patrol officers are better at softer tasks such as removing vagrants and addressing merchant complaints (Esbensen, 1987). Although this research cannot gauge how well foot patrol officers addressed disorder offenses, it does suggest that they specialize in them, in large part because they develop fine-grained local knowledge about disorderly behaviors in the beats to which they are assigned. Disorder offenses constituted 92 percent of all foot patrol officers' activity.

The data indicate that the foot patrol officers reacted consistently to signs of social disorder in their foot beats, devoting a great deal of their time to "cleaning up" their foot beats. We would suggest that as rookies, foot patrol officers were ready to make a difference in the community and therefore naturally gravitated toward dealing with issues they observed. These issues were usually related to the types of fear producing social incivilities noted in broken windows theory (Wilson and Kelling, 1982). Broken windows theory postulates that the combination of a foot patrol officer's presence and his activities to decrease the social disorder at places serves to (re-)establish a normative order in a community, and may make the area ready for residents and business owners to implement informal control. Thus, it is possible that foot patrol and motor patrol officers worked in tandem to yield the observed 23 percent reduction in violent crime both instrumentally through the mechanism of deterrence and normatively by affirming, and representing, community order. The question our data do not answer is whether, and to what extent, community members, both residents and business owners, actually exercised greater informal control in their neighborhoods due to the presence of foot patrol and their effects on community order. Future research could also examine the issue of disorder policing by foot patrol to investigate the extent to which the number of disorder incidents addressed by foot patrol explains subsequent changes in the amount of serious crime experienced in high crime areas.

Our findings also support the proposition that the reduction in crime that occurred in treatment areas resulted from the additional activities of foot patrol officers over and

above the baseline activity by car patrol officers. In other words, the sum total of foot patrol activities might have had a leveraging effect on the efforts of car patrol officers, or vice-versa. The activities of foot and motor patrol officers differed significantly, offering evidence that the role played by the two types of officers is distinct. This is consistent with the observations of Payne and Trojanowicz (1985) who found the jobs of foot patrol and car patrol had some fundamental differences. An in-depth examination of the relative proportions of official police activity suggests that foot patrol and car patrol develop an informal division of labor based on the capacities and resources of each. During the treatment period, car patrol officers continued to account for most of the official policing activity addressing approximately 57 percent of all crime incidents occurring within foot patrol areas. This finding largely reflects the fact that car patrol officers were the primary responders to 911 calls for service even after foot patrol was instituted. Even with this constraint on their time, car patrol officers continued to work in the treatment areas at levels of effort greater than the call volume alone is able to explain. As previously mentioned, car patrol officers handled almost all serious incidents involving violent crimes, gun offenses, and vehicle crimes.

More generally, these findings suggest that the co-production of community safety could be fruitfully extended by including co-production dynamics within the police department. Currently, discussions occurring under the rubric of co-production of community safety focus exclusively on how police and communities working in partnership can reduce crime. Our study findings reveal another dimension at work within the police department; different officers with different roles complementing each other's activities to jointly produce the effect. The car patrol officers focussed on the "hard" pinches because they had the capacity and resources to do so, but in violent areas, it is not just the hard pinches that matter. Our data suggest that activities addressing visual signs of social disorder (the cleaning up) combined with the pinching (including hard proactive work like pedestrian stops which was done by both types of officers) help explain the outcome of the PFPE. Although our findings are consistent with the policing role as outlined by broken windows theory, they also indicate it's not just simply about order maintenance. Rather it is this broader combination of activities and styles that produces the specific outcome of violence reduction. Of course, future ethnographic work, perhaps combined with systematic observation of formal and informal policing activities, could address how foot patrol and car patrol may work symbiotically to address criminal behaviors through complementary combinations of policing styles and tactics.

In terms of practical implications, our results point to the value of distinguishing what police managers can expect to gain from each type of patrol. Foot patrol provides more community contact, more disorder policing, more proactive community contacts (both adversarial and non-adversarial), and a greater amount of community intelligence that can be leveraged within the police department. But foot patrol cannot respond efficiently to emergency calls for service. Car patrol excels at rapid response to calls for service but at a cost of community interaction and "boots on the ground" immediate presence. By taking into consideration the specific goal of the police deployment, managers can make better use of resources. Managers can take advantage of greater community collaboration with foot patrol as "intelligence collectors."

In addition, police managers should consider the impact of any deployment-related intervention they try (any treatment) specifically in terms of how one cog in the wheel affects the other parts of the machine – foot and motor patrol may work symbiotically to act on violent behaviors through different logics and mechanisms. The question for

managers is therefore how to combine these street-level resources optimally to get the best outcome – foot and motor patrol officers may produce, at least sometimes, an organic division of labor, but administrators can foster this division of labor as well, and provide for guidelines of co-production. Specifically, in terms of foot patrol, police managers should expect car patrol officers naturally and maybe even unconsciously try to work more in the areas where foot patrol officers are deployed. This is not surprising considering the dangerous nature of police work, especially in the most violent areas of a city like Philadelphia. Moskos (2008, pp. 1-2) describes the "Blue Brotherhood" not as a secret subculture but as one of the few organizational cultures where employees are willing to risk their lives to protect fellow employees. As a result, the bond between the foot patrol (rookie) and car patrol (veteran) officers – who likely knew very little about one another – is not due to membership in what the public may perceive as a secret culture but in the shared experience working in an extremely risky employment sector. In light of this, police managers of future foot patrol initiatives can expect more car patrol activity in foot patrol areas just as a function of looking out for fellow officers.

Our findings also suggest the typical activities of foot patrol officers are best thought of as the "hands-on" component of an overall patrol strategy that includes car patrol. When foot patrol officers are used in addition to, not instead of, regular car patrols, their presence on the street (rather than in a car) has immediate advantages in gathering information through conversations with street users and official pedestrian stops. They experience street-level disorder themselves and thus make it a priority. In the PFPE, although the types of activities overlapped, there were clear differences in emphasis. As we stated before, foot patrol primarily dealt with disorder crimes while car patrol handled almost all the rest. By taking on complementary responsibilities, foot patrol and car patrol can achieve a reduction in violent crime.

In summary, the quantitative data used here offer insight into the activities of foot and car patrol officers during the PFPE. The Philadelphia experience shows that when foot patrols are initiated, car patrols remain active in the foot patrol areas and maintain approximately the same level of proactive enforcement activity. Consistent with theory and previous research, car patrol officers concentrate on the serious crime incidents while foot patrol officers focus on order maintenance activities. The fact that these two different types of officers work dynamically to improve public safety suggests the co-production of community safety has an additional dimension within police departments that has yet to be used to its full advantage. Police managers need to carefully consider not only where to place foot patrol but also how to best leverage existing car patrol in overlapping areas.

Notes

1. For details on the methodology please see Ratcliffe *et al.* (2011). Following Sherman and Weisburd (1995) violent incidents included homicides, aggravated assaults, and robberies occurring outdoors.
2. Car patrol units and other PPD units were not excluded from patrolling or working in the target areas; thus the only formal intervention was the introduction of foot patrols in addition to business as usual. Car patrol officers were not officially informed as to the experimental areas. The 120 target areas were ranked by the weighted violent crime rate. Starting with the two highest violent crime areas and working down the list, one of each pair of places were assigned to treatment using the software version of a "flip of a coin" (see Ratcliffe *et al.*, 2011).
3. The specific dates are as follows: Phase 1 (pre-intervention: 1/6/2009-3/28/2009, intervention: 3/31/2009-6/20/2009), Phase 2 (pre-intervention: 4/14/2009-7/4/2009, intervention: 7/7/2009-9/26/2009).

4. It is possible that car patrol units responded to an incident first addressed by foot patrol officers. Field observations by the authors indicate that whenever a foot patrol officer indicated response to an incident, one or more car units would respond to provide back up. However, communication with police administration suggests that generally, call signs within the incident data are those of the first responder, and not of officers providing additional help.
5. Pedestrian stops and vehicle stops are nature codes that indicate the conditions under which an officer discovered an incident (e.g. a pedestrian stop that reveals drug possession). Consequently, the numbers are not independent of the additional offenses discovered. Nonetheless, the numbers alone suggest that foot patrol officers spent an inordinate amount of time conducting pedestrian and vehicle stops.
6. Of the 2,372 disorder incidents addressed by foot patrol officers within foot beats, 93 percent were for minor disturbances, and the remaining 7 percent were for disorderly conduct (3 percent), vandalism (2 percent), loitering (1 percent), and simple assault (1 percent). Of the 191 minor disturbance incidents addressed by foot patrol officers within control beats 92 percent were for disorder, 3 percent for disorderly conduct, 3 percent for vandalism, and the remaining 2 percent composed of loitering, public drunkenness, and simple assault.
7. The police department was not provided information on the control area boundaries so these changes likely reflect changes in the amount of criminal activity in the control areas.
8. Attempts to quantify the number of car patrol officers assigned to areas in which a treatment or control foot beat fell were uninformative because officers were assigned to districts and districts are too large to allow meaningful comparisons with areas as small as those used in the experiment.
9. Treatment and control areas were sometimes quite close to one another or situated between a foot patrol area and district headquarters. This meant foot patrol officers might legitimately come across an incident in a control area while walking to or from their beat.
10. Frequency distributions of total crime, pedestrian stops, vehicle stops, and disorder occurring during pre-intervention and intervention periods indicated a strong positive skew, violating the assumption of normality. All variables were log transformed, upon which visual examination of their histograms revealed that they closely approximated a normal distribution. We are unable to model the impact change in car patrol activity over time for burglary, drug, theft, vehicle crime, violence, or VUFA offenses. These variables failed to approximate a normal distribution, were not amenable to transformation. All analyses revealed a significant Mauchley's test of sphericity, suggesting that the assumption of homogeneity of variance has been violated. As a result the Greenhouse-Geisser adjustments are reported. The Greenhouse-Geisser adjustment serves as a correction for the assumption of homogeneity by reducing the degrees of freedom associated with the *F*-ratio.

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