Final Report

An Analysis of Race and Ethnicity Patterns in Boston Police Department Field Interrogation, Observation, Frisk, and/or Search Reports

Jeffrey Fagan
Anthony A. Braga
Rod K. Brunson
April Pattavina

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ABOUT THE AUTHORS

Jeffrey Fagan is the Isidor and Seville Sulzbacher Professor of Law at Columbia Law School and Professor of Epidemiology at the Mailman School of Public Health at Columbia University

Anthony Braga is the Don M. Gottfredson Professor of Evidence-Based Criminology at Rutgers University and Senior Research Fellow in the Program in Criminal Justice Policy and Management at Harvard University

Rod Brunson is a Professor of Criminal Justice at Rutgers University

April Pattavina is an Associate Professor of Criminal Justice and Criminology at University of Massachusetts, Lowell.

EXECUTIVE SUMMARY

The research findings presented in this report represent an independent inquiry into possible racial disparities in Boston Police Department Field Interrogation, Observation, Frisk, and/or Search practices (informally known as FIO reports). This inquiry was conducted at the request of the Boston Police Department and the American Civilian Liberties Union of Massachusetts and spans the years 2007-10. This report summarizes the methods and research findings of the independent research enterprise.

Key research findings include:

- The yearly number of FIO reports made by the BPD has steadily decreased in recent years. Between 2008 and 2013, the number of FIO reports made by the BPD decreased by almost 42% (from 55,684 to 32,463). This study focused on N=204,739 FIOs made by BPD officers between 2007 and 2010.

- Controlling for a variety of factors including race of residents, the logged number of crimes in Boston neighborhoods was the strongest predictor of the amount of FIO activity in Boston neighborhoods. However, the analyses revealed that the percentage of Black and Hispanic residents in Boston neighborhoods were also significant predictors of increased FIO activity after controlling for crime and other social factors. These racial disparities generate increased numbers of FIO reports in minority neighborhoods above the rate that would be predicted by crime alone. For instance, a neighborhood with 85 percent Black residents would experience approximately 53 additional FIO reports per month compared to an "average" Boston neighborhood.

- FIO activity was concentrated on repeated interactions with a relatively small number of people. Roughly 5 percent of the N=72,619 unique individuals subjected to FIO encounters accounted for more than 40 percent of the total number of FIO reports made during the study time period. 67.5 percent of the FIO subjects only experienced one FIO and, as a group, accounted for 24.6 percent of the total number of FIO reports made by BPD officers during the study time period.

- Gang membership and prior arrest histories were significant predictors of (a) repeated FIO reports of the same subject and (b) whether subjects were frisked / searched during an FIO encounter. These effects were present after controlling for age, sex, and race. In addition, Black subjects experienced 8 percent higher numbers of repeat FIOs and were roughly 12 percent more likely to be frisked / searched during an FIO encounter, controlling for prior criminal history, gang membership, and other factors.

- FIO reports were also concentrated among a small number of very active BPD officers. Roughly 4 percent of N=2,349 BPD officers made over 43 percent of the FIOs during the study time period. Youth Violence Strike Force officers (informally known as the "gang unit") were associated with the highest numbers of FIO reports. During the study period, nearly 26 percent of BPD officers did not file a single FIO report. These officers were primarily assigned to administrative positions or were on leave for significant portions of the study time period.

- White BPD officers made significantly higher numbers of FIO reports during the study time period relative to Black and Asian officers. White BPD officers also were more likely to frisk / search subjects during FIO encounters relative to minority officers. However, white officers did not seem to discriminate by subject race and ethnicity. Also, White officers made elevated numbers of FIO reports and were more likely to frisk and search during FIO encounters for subjects of all races and ethnicities. However, within suspect race categories, Black officers were less likely to FIO or frisk White or Black suspects than were White officers.

- These analyses revealed racially disparate treatment of minority persons in BPD FIO activity. However, we cannot determine whether the identified patterns were generated by bias or other sources of racial discrimination in BPD FIO practices. Further research is necessary to understand the factors and processes that influence the observed disparities.

I. INTRODUCTION

The use of proactive police tactics to disrupt criminal activities, such as *Terry* investigative (street)[1] stops and concentrated misdemeanor arrests, are common in contemporary urban policing. Although endorsed by many police executives, these tactics gave rise in the past decade to popular, legal, political and social science concerns about disparate treatment of minority groups in their everyday encounters with law enforcement. Litigation has resulted in court oversight in nearly two dozen cities since 1996, and political tensions have contributed to wide divides in trust of the police between minority and white citizens.

This report presents the results of an independent inquiry into possible racial disparities in Boston Police Department Field Interrogation, Observation, Frisk, and/or Search practices (informally known as FIO reports). FIO activity is the tactical expression of the *Terry* stop regime and proactive policing in Boston. This inquiry was conducted at the joint request of the Boston Police Department and the American Civilian Liberties Union of Massachusetts. It is intended to provide a factual basis to assess the implementation of proactive policing in Boston and how it affects Boston's diverse neighborhoods.

II. DATA AND METHODS

A. Data Sources

The Boston Police Department (BPD) Boston Regional Intelligence Center (BRIC) maintains an electronic database of Field Interrogation, Observation, Frisk, and/or Search reports (hereafter, FIO reports). FIO reports are used to document BPD officer interactions with individuals suspected of criminal activity, or associates of those individuals, including direct encounters and non-contact observations.[2] FIO reports represent a central activity in the BPD's intelligence efforts to collect and disseminate data on the activities and whereabouts of known and suspected criminals and their associates in Boston. These reports document the name, date-of-birth, sex, and race of FIO subjects as well as the date, time, and location of interaction.

FIOs also are conducted under constitutional authority set forth in *Terry v Ohio* (1968) and a series of subsequent state and federal cases.[3] Under *Terry*, officers are permitted

[1] *Terry v. Ohio*, 362 U.S. 1 (1968), stating that officers can conduct investigative stops and temporary detentions of citizens based on reasonable, individualized and articulable suspicion that "crime is afoot."

[2] Boston Police Department Rules and Procedures. Rule 323, Field Interrogation, Observation, Frisk, and/or Search Reports. May 25, 2005, Page 1.

[3] *Terry v. Ohio*, 392 U.S. 1 (1968). See, generally, David A. Harris, "Particularized Suspicion, Categorical Judgments: Supreme Court Rhetoric versus Lower Court Reality under *Terry v. Ohio*." *72 St. John's Law Review* 975 (1998); Tracey Meares and Bernard Harcourt, Randomization and the Fourth Amendment, 78 *University of Chicago Law Review* 809-877 (2011). For examples of state law, see, e.g., *People v DeBour*, 40 NY2d 210 (1976). In Massachusetts, the standard for *Terry* stops follows federal constitutional law, and was clarified in *Commonwealth v. Narcisse* (457 Mass. 1 (2010) ("police officers may not escalate a consensual encounter with an individual into a protective frisk absent a reasonable suspicion that the individual has committed, was committing, or was about to commit a criminal offense, and that the individual was armed and dangerous.")

to stop and detain citizens if they have reasonable suspicion to believe that "crime is afoot."[4] The BPD practice departs from the street detentions authorized by *Terry* in that FIOs record a broader spectrum of police practices than the street detentions imagined and endorsed under *Terry*. They include non-contact observations of and direct encounters with individuals as well as the types of face-to-face investigative stops that were the focus of the *Terry* decision and that are an commonly used in contemporary urban policing. Compliance with constitutional requirements has been an important focus of research and litigation on *Terry* encounters.

Our analysis focuses on the period from 2007 through 2010. During that time, BPD officers made N=204,739 FIO reports. Compared to the residential population, the targets of FIO reports were disproportionately male, young, and Black. For these 204,739 FIO reports, the subjects were 89.0 percent male, 54.7 percent ages 24 or younger, and 63.3 percent Black. According to the U.S. Census Bureau, in 2010, Boston had some 617,594 residents that were 47.9 percent male, 36.2 percent ages 24 or younger, and 25.1 percent black.[5]

At first glance, these differences suggest racially disparate treatment in BPD FIO activity. However, these differences could also reflect crime risk differences in Boston's neighborhoods and population groups. Criminological research has long documented that criminal offenders are more likely to be young and male.[6] Violent crime problems also tend to concentrate in highly disadvantaged urban neighborhoods that are disproportionately populated by black residents.[7]

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4 In *Terry v. Ohio*, supra note 1 at 27, the U.S. Supreme Court ruled that a person can be stopped and briefly detained by a police officer based on a reasonable suspicion of involvement in a punishable crime. If the officer has reasonable suspicion, the officer may perform a search of the person's outer garments for weapons. Such a detention does not violate the Fourth Amendment prohibition on unreasonable searches and seizure, though it must be brief. "Reasonable suspicion" requires more than an "inchoate and unparticularized suspicion or 'hunch'" (*Ybarra v. Illinois*, 444 U.S. 85, 91 (1979)). Reasonable suspicion must be based on specific and articulable facts, taken together with rational inferences from those facts, (*Terry*, id at 21) and the suspicion must be associated with the specific individual (*Ybarra* at 85, 91).

5 http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk (Accessed March 14, 2015).

6 David Farrington, Age and Crime 7 *Crime & Justice* 189 (1986). Jeffery T. Ulmer, and John H. Kramer, The Interaction of Race, Gender, and Age in Criminal Sentencing: The Punishment Costs of Being Young, Black, and Male, 36 *Criminology* 763-797 (1998).

7 Lauren J. Krivo, Ruth D. Peterson, and Danielle C. Kuhl, Segregation, Racial Structure, and Neighborhood Violent Crime, 114 *American Journal of Sociology* 1765-1802 (2009). Unfortunately, due to a long history of exclusion from economic and social opportunities, residents of disadvantaged urban neighborhoods are primarily minorities and often black. Research has documented that most violence occurs within racial groups and that black Americans, often victimized by black offenders, experience disproportionately high levels of violent crime. Empirical evidence suggests that the capacity of neighborhood residents to achieve a common set of goals and exert control over youth and public spaces, termed "collective efficacy," is a protective factor against serious violence. See, Robert J. Sampson and William Julius Wilson, *Toward a Theory of Race, Crime, and Urban Inequality* in Crime and Inequality (John Hagan and Ruth Peterson, eds.) 37-56 (1995); Robert J. Sampson, Steven Raudenbush and Felton Earls, Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy*,* 277 *Science* 918 (1997); Jeffrey D. Morenoff, Robert J. Sampson and Steven Raudenbush, Neighborhood Inequality, Collective Efficacy, and the Spatial Dynamics of Urban Violence, 39 *Criminology* 517-59 (2001).

BPD officers are required to document the reason for the FIO encounter in a FIO report and also to note whether they conducted *Terry* frisks for officer safety purposes and/or searches for the purposes of seizing evidence. Four in ten (40.5 percent) FIO reports led to a frisk and/or search of the subject (82,919).[8] Officers have limited space on the form to record their reasons for the FIO and, unfortunately, 75.0 percent (153,554) of the FIO reports simply state "investigation person" as the justification. This absence of evidence of stop rationales prevents a Fourth Amendment analysis of the constitutionality of discretionary stops and searches of FIO subjects. Also, the FIO reports contain no information as to whether the frisks and searches led to arrests, summons, or seizure of weapons or contraband. FIO events that did lead to either of those outcomes are not recorded on the FIO report, but instead officers default to the completion of an arrest report in those circumstances. In turn, the type of outcome analysis that has been widely applied to resolve Fourth and Fourteenth Amendment claims in policing litigation was not possible in this analysis.

B. Analytic Strategy

We combined two distinct approaches to estimate racial disparities. The first strategy is a disparate treatment strategy that examines stops in alternate empirical specifications looking at first aggregates – neighborhoods or police districts – and then individuals nested within those districts. We drew upon statistical models developed by Fagan and colleagues[9] to investigate alleged violations of the Fourteenth Amendment of the U.S. Constitution by the New York City Police Department (NYPD) in their stop, question, and frisk (SQF) practices.[10] The analyses in that litigation estimated whether the racial composition of NYPD precinct residents predicted stop patterns after controlling for the influences of crime, social conditions, and the allocation of police resources. Here, we adapted that analytical framework to examine whether the racial composition of Boston neighborhoods, defined as census tracts, predicts BPD FIO patterns, adjusting for crime, social and economic predictors, and police resources.

We apply a general test for evidence of disparate treatment using a regression equation that takes the form:

$$\text{Outcome} = \alpha + \beta_1 * \text{Minority} + \Sigma_i \beta_i * (\text{Plausible Non-Race Influences}) + \varepsilon_i$$

[8] 38.6% of the FIO reports indicated that the subjects were frisked and 11.6% of the FIO reports indicated that the subjects were searched. All but 1.8% of the searches were reported in conjunction with a frisk of the subject. Moreover, descriptive statistical analyses revealed that the biggest differences between FIO type and subject race arose when the FIO involved a frisk and/or search relative to a more simple observation and/or interrogation. Some 29.5% percent of White subjects were frisked / searched during an FIO relative to the 45.4% percent of Black subjects, 40.5% of Hispanic subjects, and 35.6% of Asian /other race subjects. As such, FIO type was collapsed into two categories: 0 = No Search (Observed and/or Interrogated only) and 1 = Frisk and/or Search Conducted.

[9] Report of Jeffrey Fagan, Ph.D. (2010) for *David Floyd et al. v. City of New York et al.*, U.S. District Court for the Southern District of New York, 08 Civ. 01034 (SAS), October 28; Andrew Gelman, Jeffrey Fagan, and Alex Kiss, "An Analysis of the NYPD's Stop-and-Frisk Policy in the Context of Claims of Racial Bias," 102 *Journal of the American Statistical Association* 813-823 (2007).

[10] Second Amended Complaint, *David Floyd et al. v. City of New York et al.*, U.S. District Court for the Southern District of New York, 08 Civ. 01034 (SAS), October 28.

where *Outcome* is the event or status of interest, *Minority* is an indicator for the racial composition or status of the unit observed (i.e., neighborhood or person, depending on the outcome), *Plausible Non-Race Influences* are a set of variables representing non-race factors that also might influence the outcome, and an error term e that captures the variation in the outcome that cannot be explained by either Minority status or the Non-Race Influences. These models may include non-race influences that are correlated with race, so as to better identify the unique effects of race that are present once the influence of proxies for race are removed.[11]

The goal in specifying these models is to identify the effects of race on outcomes after simultaneously considering factors that may be relevant to race.[12] Under a disparate treatment theory, the critical question is whether a person's race was the "but for" *cause* of being selected for different treatment than similarly situated persons of other races. Failure to consider these other race-correlated factors raises the risk of "omitted variable bias," which could lead to erroneous conclusions about the effects of variables that do appear in a regression test.[13]

The second strategy exploits the availability of data on officer race to determine whether the observed differences in stop rates for White and non-white youths are a function of preference-based discrimination, or statistical discrimination.[14] Statistical discrimination would reflect a tendency to stop one group at a higher rate than another based on observable characteristics such as known crime rates. But preference-based discrimination would reflect a tendency to prefer one group for stops over others based on factors unrelated to their observable differences in the targeted behavior.[15] Similar to prior studies, we use comparisons of officer race and suspect race to distinguish between these two potential sources of disparity.

[11] For a general discussion of the specification of regression models to test for disparate treatment, see generally D. James Greiner, Causal Inference in Civil Rights Litigation, 122 *Harvard L. Rev.* 533 (2008). For a general discussion of how regressions sort out the influences of predictors of an outcome, see Thomas J. Campbell, Regression Analysis in Title VII Cases: Minimum Standards, Comparable Worth, and Other Issues Where Law and Statistics Meet, 36 *Stanford L. Rev.* 1299 (1984).

[12] See, e.g., *Griggs v. Duke Power Co.*, 401 U.S. 424 (1971). In a disparate treatment claim, we would ask if the use of a high school diploma requirement biases the hiring process since African American job applicants may be less likely to have obtained a high school diploma. Once this race-correlated control is introduced, it would likely reduce the racial disparity in the hiring rates and provide a different test than would a simple disparate impact test.

[13] See, e.g., Ian Ayres, Testing for Discrimination and the Problem of 'Included Variable Bias', Yale Law School Working Paper (2010), available at http://islandia.law.yale.edu/ayres/ayresincludedvariablebias.pdf; Ian Ayres, Three Tests for Measuring Unjustified Disparate Impacts in Organ Transplantation: The Problem of 'Included Variable' Bias, 48 *Perspectives in Biology and Medicine* 68 (2005).

[14] Kate Antonovics and Brian G. Knight, "A New Look at Racial Profiling: Evidence from the Boston Police Department," 91 *The Review of Economics and Statistics*, 163–177 (2009).

[15] See, for example, Billy R. Close and Patrick Leon Mason, "Searching for Efficient Enforcement: Officer Characteristics and Racially Biased Policing," 3 *Review of Law & Economics* 263 (2007);

III. RESULTS

A. Suspects and Officers

Table 1 shows the characteristics of both suspects and officers. Suspect identifiers were available for 199,331 (97.4% of 204,739) FIO encounters between 2007 and 2010. From these, we were able to identify N = 72,619 unique subjects. Using gang intelligence databases maintained by BPD, we estimated that 5.5 percent (3,967 of 72,619) of the suspects in FIO encounters were classified as gang members.[16] The number of FIO's per suspect ranged from 1 to 249, with an average of 2.74 FIO events per suspect, during the study period. About half (48.5 percent) had been arrested, with the number of arrests ranged from 1 to 63, with a mean of 5 arrests.

Most suspects were young: nearly half were younger than 25 years of age. One in three (33.7%) were between 18 and 24 years of age. Most were male (81.8%), consistent with known gender differences in crime rates by gender.[17] Most suspects were Black (42.5%) or Hispanic (13.3%), each above their respective share of population in Boston in the 2010 census. Whites were under-represented in the FIO subject pool relative to population share. As we discussed earlier, population is a weak benchmark, and we control for local crime rates in subsequent analyses.

About half of the FIO suspects (48.5%) had one or more prior arrests, and in turn, more than half had none. To the extent that stops in general carry risks of social and psychological harms,[18] the reach of FIOs to persons with no prior record extends an umbrella of suspicion to a group of primarily young people with no known criminal involvement.

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[16] See, Anthony A. Braga, David M. Hureau, and Leigh Grossman, *Managing the Group Violence Intervention: Using Shooting Scorecards to Track Group Violence*, 15 (2014). The Boston Regional Intelligence Center (BRIC) created a classification system using several parameters to identify individuals as gang members. To be classified as a gang member by BRIC, a person has to accumulate 10 points based upon the following criteria: prior validation by a BRIC-affiliated criminal justice agency that uses the same selection criteria (9 points), prior validation by a non-BRIC-affiliated criminal justice agency that uses similar selection criteria (8 points), self-admitted gang membership (8 points), use and/or possession of gang paraphernalia or identifiers (4 points), gang-related photograph (2 points), known gang tattoo or marking (8 points), information from reliable confidential informant (5 points), information from anonymous source or tipster (1 point), crime victim associated with rival gang (3 or 8 points depending on incarceration status), possession of gang documents such as by-laws (3 or 8 points depending on incarceration status), possession of gang publications (2 points), participation in gang publication (8 points), possession of court and/or investigative documents involving an identified gang member (9 points), possession of printed or electronic media indicating membership (1 point), contact with known gang members via Field Interrogation Observation reports (2 points per report), named in police incident report involving known gang member (4 points per report), possession of gang membership material (9 points), information developed during surveillance and/or surveillance (5 points), and other information (1 point).

[17] Janet L. Lauritsen, Karen Heimer, and James P. Lynch, "Trends in the gender gap in violent offending: new evidence from the national crime victimization survey," 47 *Criminology* 361 (2009).

[18] See, William J. Stuntz, "Terry's Impossibility," 72 *St. John's Law Review* 1213 (1998). See, also, Ekow Yankah, "Policing Ourselves: A Republican Theory of Citizenship, Dignity and Policing" (2013), available at SSRN: http://ssrn.com/abstract=2258048; Amanda Geller, Jeffrey Fagan, Tom R. Tyler, and Bruce G. Link, Aggressive Policing and the Mental Health of Young Men, 104 *American Journal of Public Health* 2321 (2014).

Table 1. Age, Gender, and Race of Unique BPD FIO Subjects and Officers

	FIO Subjects, N=72,619		*FIO Officers, N=1750*[a]	
	N	Percent	N	Percent
Gender				
Male	59,438	81.8	1,558	89
Female	13,181	18.2	192	11
Age				
Below 18	9,201	12.7	0	0
18 – 24	24,471	33.7	10	0.6
25 – 30	12,375	17	208	11.9
31 – 35	6,417	8.8	286	16.3
36 – 40	5,636	7.8	356	20.3
41 – 50	9,650	13.3	609	34.8
51 and older	4,869	6.7	281	16.1
Mean	29.2		41.3	
Median	26		41	
Range	12 to 71 years		23 to 64 years	
Race				
Black	30,849	42.5	418	23.9
White	25,758	35.5	1,139	65.1
Hispanic	9,693	13.3	150	8.6
Asian / Other	1,321	1.8	43	2.5
Unknown	4,998	6.9	0	0
Selected Characteristics				
Subjects				
Gang member	3,967	5.5		
Prior arrest (1+)	35,256	48.5		
Officers				
Gang Unit (YVSF)	65	3.7		
Detective (any rank)	212	12.1		
Patrol Officer	1,379	78.8		
Patrol Sergeant	130	7.4		
Patrol Lieutenant / Captain	23	1.3		
Dep. Supt. / Superintendent	6	0.3		

a. These are the officers who have had one or more FIO encounter over the study interval.

Gangs are a focus of Boston police tactics. Yet few of the FIO suspects (5.5%) were known to the police as gang members. The department's gang unit was proportionately small, with 3.7% of the population of officers whose shields were in the FIO database.

BPD Officers were older, and in turn, experienced. More than half were over 40 years of age (50.9%), with a median age of 41.3 years. Nearly two officers in three were White (65.1%), and about one in four were Black (23.9%). Most were assigned to patrol commands, with about one in eight (12.1%) holding a detective's shield.

The number of repeat FIO reports per subject is concentrated among a small number of individuals who experience large numbers of FIO encounters. Table 2 shows that about two FIO subjects in three (67.5 percent) experienced just one FIO. As a group, they accounted for 24.6 percent of the total number of FIO reports from 2007 – 2010. About one in 20 (5.2 percent) experienced 10 or more FIOs and, as a group, accounted for 40.2 percent of the total number of FIO reports made by BPD officers during this time.

Table 2. FIO Report Distribution by Unique Subjects

N of FIOs	N Subjects	% Subjects	Cum. % Subjects	Sum FIOs	% FIOs	Cum. % FIOs
51+	211	0.3	0.3	14,886	7.5	7.5
25 – 50	671	0.9	1.2	22,314	11.2	18.7
10 – 24	2,933	4	5.2	42,787	21.5	40.2
5 – 9	4,926	6.8	12	31,798	15.9	56.1
2 – 4	14,860	20.5	32.5	38,528	19.3	75.4
1 only	49,018	67.5	100	49,018	24.6	100
Total	72,619	100	100	199,331	100	100

Table 3. FIO Report Distribution by Unique BPD Officers

N of FIOs	N Officers	% Officers	Cum % Officers	Sum FIOs	% FIO	Cum % FIO
1,000+	28	1.2	1.2	42,399	21.2	21.2
500 - 999	65	2.8	4	44,153	22.1	43.3
250 - 499	128	5.4	9.4	44,809	22.4	65.7
100 - 249	253	10.7	20.1	39,693	19.8	85.5
50 - 99	214	9.1	29.2	15,179	7.6	93.1
1 - 49	1,062	45	74.2	13,870	6.9	100
Zero	609	25.8	100	0	0	100
Total	2,359	100	100	200,103	100	100

Table 3 shows that, similar to the distribution of repeat FIOs among subjects, the number of repeat FIO reports per officer is also highly concentrated among a small number of individuals. FIO forms also report the badge numbers of the BPD officers who filled out the reports. Officer badge numbers were available for N=200,103 FIO reports (97.7% of 204,739). BPD personnel records identified 2,359 unique officers in its workforce between 2007 and 2010, including new hires and retirements during that time period. Personnel records were used to determine officer demographic information, years on the job, rank, assignment, and detective status for all sworn BPD officers. Badge numbers on FIO reports were used to identify the N=1,750 unique BPD officers.

About three officers in four (74.2% of 2,359) made one or more FIO reports between 2007 and 2010. The counts ranged from 1 to 2,315 FIOs. Officers averaged 84.3 FIOs over the four years, or 21 per year. Nearly half (45.0 percent) generated fewer than 50 FIO reports and, as a group, accounted for 6.9 percent of the total number of FIO reports during the study time period. A small group (4.0 percent, or approximately 70 officers) generated 500 or more FIOs; they accounted for 43.3 percent of the total number of FIO reports made by BPD officers from 2007 - 2010.

B. Race, Crime and FIOs

1. FIOs by Neighborhood Crime and Social Conditions

Table 4 shows the results of the estimates of FIO activity using alternate benchmarks for racial composition of the population of potential suspects. The monthly number of total Index crimes (logged, lagged) in a tract was a consistently significant positive predictor of the monthly count of FIO reports in a tract across models with varying benchmarks. This suggests that the intensity of BPD FIO activity in a tract is associated with the amount of serious crime experienced in a tract controlling for other conditions. An increase of 1 percent more total index crime incidents in the previous month leads to an increase of 10.6 percent (IRR=1.106) FIO reports in the following month. This is a large effect, considering that the average Boston census tract experiences 12.2 index crimes per month. Each of the models in Table 4 show that the Boston police prioritized crime problems in the allocation of FIO activity by tract and police district during this period.

After controlling for crime, Table 4 also shows that the racial composition variables for Percent Black and Percent Hispanic are positive and significant for all three models. The pattern of race effects suggests evidence of disparate treatment in FIO activity based on neighborhood racial composition. After controlling for local crime rates, we observe higher rates of FIO activity for census tracts based on their Black or Hispanic racial composition, whether in residents, arrestees, or the race of known crime suspects. In each of these specifications, the percentage of Foreign Born Residents in a tract was also a statistically-significant predictor of increased FIO activity. Since foreign born residents of Boston are primarily persons of color, the focus of FIO activity in those neighborhoods reinforces the notion of disparate treatment by race and ethnicity.

The consistent size and direction of the race and ethnicity coefficients suggests a consistent race effect after controlling for crime, police activity, and other relevant factors, even if the effects were modest in size. Still, even modest effects can have practical significance. The disparity in the monthly count of FIO reports can be meaningful in census tracts with larger shares of minority residents, arrestees, and reported suspects. Using the residential racial composition variable as an example, the incidence rate ratio on Percent Black suggests that a one-unit increase in the black percentage of residents relative to the white percentage of residents in a Census tract is associated with a 2.2 percent increase (IRR=1.022) in the monthly count of FIO reports made by the BPD controlling for crime and other factors. The effects of race (and foreign born residents) in Table 4 were observed after controlling for the number of officers deployed in each police district, a measure of the exposure of local residents to police and their availability for FIO contacts.

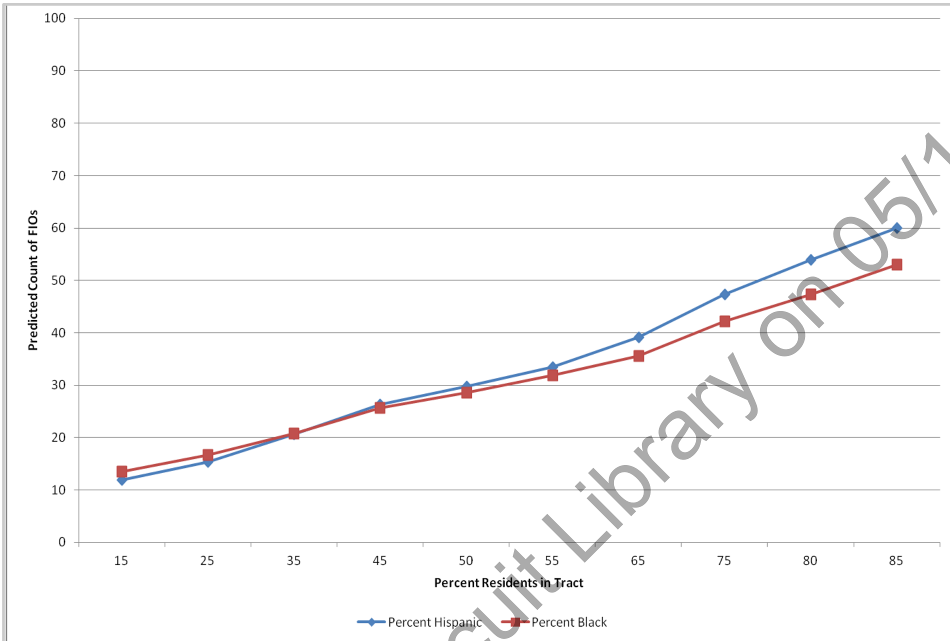
Table 4. Negative Binomial Regressions of Monthly FIO Report Counts Controlling for Census Tract Characteristics, Crime, Police Activity, and Other Conditions for Three Racial Benchmarks (IRR's, SE, p)

	Residents	Arrestees	Crime Victims
Percent Black	1.022 (.006) **	1.025 (.005) **	1.029 (.009) **
Percent Hispanic	1.041 (.008) **	1.016 (.008) *	1.040 (.011) **
Percent Asian / other	1.020 (.012)	0.917 (.052)	0.967 (.063)
Percent Unknown Race	----	----	0.922 (.015) **
Total Crime (logged, lagged)	1.106 (.026) **	1.125 (.036) **	1.091 (.027) **
Disadvantage Index	0.894 (.157)	0.911 (.178)	0.924 (.143)
Percent Foreign Born	1.016 (.009) +	1.017 (.007) *	1.019 (.009) *
Patrol Strength	1.006 (.006)	1.002 (.005)	1.006 (.006)
Moran's I (lagged)	1.285 (.369)	1.124 (.280)	1.054 (.282)
Constant	0.063 (.052) **	0.168 (.131) *	0.916 (.035) **
District Fixed Effects?	Yes	Yes	Yes
Year Fixed Effects?	Yes	Yes	Yes
Season Fixed Effects?	Yes	Yes	Yes
Standard Errors Clustered by Tract?	Yes	Yes	Yes
Observations	8,303	8,303	8,303
Groups	173	173	173
Wald Chi-Square	460.36	492.63	582.82
Wald degrees of freedom	25	25	26
Wald Chi-Square *p*	.000	.000	.000

Notes: Estimates reported as Incident Rate Ratios. Robust standard errors were clustered by census tract. Percent White is the reference category for the resident, arrestee, and suspect race dummy variables. The natural log of the total number of residents, total number of arrestees, and total number of suspects for each tract-month were used as exposure offsets in the respective regression models. Significance: $^{+}$ p<=.10, * p<=.05, ** p<=.01.

Figure 2 shows the marginal increase in the predicted count of monthly FIO reports in a census tract as the percentages of Black and Hispanic residents in a tract increase. The figure shows the nearly linear and monotonic increase in the adjusted (for predictors) monthly count of FIO reports increases as the percentages of minority residents increases in a tract. To illustrate, Figure 2 shows that a tract with 85 percent black residents would experience an additional 53 FIO reports per month compared to a tract with 15 percent black residents. Over the course of one year, residents in that tract would be subjected to an additional 636 FIO reports and, over the four-year study time period, this difference would represent an additional 2,544 FIO reports in that tract.

Figure 2. Predicted Count of FIO's per Month by Percent Black and Hispanic Residents in Tract, Boston, 2007-10, Controlling for Crime, Policing and Social Conditions



Because crime and racial composition are unevenly distributed across tracts and neighborhoods in Boston, similar to other cities, we tested for the possible leverage of outliers in the estimates in Table 4.[19] That is, both of the central findings in Table 4 on crime and race could reflect the undue leverage and influence of neighborhood outliers in each of these distributions.[20] For example, Figure 2 shows the concentration of crimes and race in particular corners of the city. To test for the effects of outliers, we conducted a sensitivity test by trimming 20 percent of tracts at the extremes of the FIO activity distributions. The results were largely unchanged. Using a population benchmark (Model 1 in Table 4), the IRR for percent Black population declines slightly from 1.022 to 1.018 in the narrower model. For crime, the IRR of crime on FIO counts dropped from 1.106 to 1.088. In other words, the FIO / race / crime relationship is robust to the removal of the extremes.

[19] Krivo and Peterson, supra note 7.

[20] For an example of an estimation of leverage effects of outliers, see Richard A. Berk, "New Claims about Executions and General Deterrence: Déja Vu All Over Again?" 2 *Journal of Empirical Legal Studies* 303 (2005) (showing the undue influence of Texas in state-year fixed effects estimates of the deterrent effects of executions on homicides).

2. FIO Activity by Suspect Characteristics

FIOs are a first-stage intrusion by police on individual liberty and privacy. But in Boston, the use of non-contact FIOs carries a lower level of intrusion but also an unarticulated basis of suspicion. While privacy may be violated in the sense that one's movements in these contacts are recorded by a police officer acting on behalf of the state, a non-contact incident does not have the same physical intrusion nor temporary detention and liberty implications of a full contact stop. Yet the accumulation of official records of surveillance of one's movements and associations carries its own unique privacy effects. The fact that these incidents – which are not concretely tied to a crime incident – create an archival record outside of any constitutional regulatory mechanism raises concerns about the security and privacy of such personal information.

To compare race effects on contact versus non-contact encounters, we estimated negative binomial regressions of subject race and other individual characteristics on FIO counts. The models were estimated with and without gang membership status and arrest history to examine how individual criminality might mediate any observed race effects.

Table 5. Negative Binomial Regression of the Number of FIO Reports by Individual Suspect Characteristics Controlling for Gang Membership (IRR, SE, *p*)

	All FIO Reports		*Non-Contact FIO Reports*
	Model 1	*Model 2*	*Model 3*
Black Suspect	1.725 (.026) **	1.088 (.011) **	1.047 (.010) **
Hispanic Suspect	1.136 (.026) **	0.969 (.013) *	0.972 (.012) *
Asian / Other Suspect	0.725 (.024) **	0.791 (.021) **	0.757 (.021) **
Unknown Race	0.501 (.007) **	0.681 (.007) **	0.483 (.007) **
Age	0.990 (.001) **	0.988 (.001) **	0.979 (.001) **
Female Suspect	0.670 (.011) **	0.830 (.009) **	0.811 (.008) **
Gang Member	----	3.339 (.076) **	4.171 (.075) **
Arrest History	----	1.108 (.001) **	1.151 (.001) **
Constant	2.788 (.058) **	2.103 (.029) **	2.091 (.029) **
District Fixed Effects?	Yes	Yes	Yes
Year Fixed Effects?	Yes	Yes	Yes
Season Fixed Effects?	Yes	Yes	Yes
SE's Clustered by Tract?	Yes	Yes	Yes
Observations	72,619	72,619	72,619
Log Pseudo-likelihood	-153,503.52	-133,092.42	-117,323.91
Wald Chi-Square	9,269.43	22,813.61	19,112.43
Wald Chi-Square *p*	0.000	0.000	0.000

Notes: Models estimated with robust standard errors clustered by tract. Race variables contrasted with White. Significance: + *p*<=.10, * *p*<=.05, ** p<=.01

Model 1 in Table 5 shows the results for all FIO encounters. Model 2 controls for arrest history and gang membership, an adjustment that acknowledges the more intense surveillance and contact rates with suspected gang members or persons suspected by the police to be involved in criminal activity. Model 3 re-estimates Model 2 for only non-contact FIO encounters.

In Model 1, Black and Hispanic suspects have significantly higher FIO activity compared to Whites. The effect size for Blacks is especially large and more modest for Hispanic suspects. For Asian and Other Race suspects, they are less likely to be the subject of an FIO encounter compared to Whites, and the results also are significant. Older suspects and females are less likely to be subjects of FIO encounters.

Comparing Models 1 and 2, prior arrest history and gang membership each mediate the influence of race on the number of FIO encounters experienced by subjects, reducing the size of the race estimates but they remain statistically significant. Model 1 shows that compared to White subjects, Black subjects experienced 72.5 percent more FIO encounters per month across the city and Hispanic subjects experienced 13.6 percent more FIO encounters. When the prior arrest and gang status covariates are included, in Model 2, Black subjects experienced only 8.8 percent more FIO encounters per month and Hispanic subjects experienced 3.1 percent fewer FIO encounters compared to their White counterparts. The results for Asians and Other / Unknown race suspects remain unchanged. Gangs evidently are a priority in using FIO authority, and account for at least some of the racial disparity in FIO encounters. The reduction in effect size for race once gang status is introduced hints that race and gang status are serving as proxies for one another in FIO activity.

The pattern for non-contact FIO activity in Model 3 is similar to the pattern shown in Model 2. The effects of gang membership increase from Model 2 to Model 3, suggesting even greater attention to gang members, albeit without contact or interpersonal interaction. This makes sense, since gang members or reputed gang members are well known to the specialized Youth Violence Strike Force (YVSF, informally known as the gang unit), and their observations can be recorded for surveillance and intelligence purposes. Perhaps observing gang member movements and associations has intelligence payoffs, which might explain and rationalize the use of police powers in this way. But massing data on persons – many of whom have no prior record – carries the risk of an administrative stigma that may influence later police or court actions.

The importance of Table 5 is its portrayal of intense police attention to gang members by Boston police, including reputed gang members who may have had no criminal history. Gangs are thought to be an important source of the city's gun violence problem, which leads to this attention. We also see that like the general population of those with FIO encounters, gang membership also is skewed by both individual and neighborhood racial composition.[21]

[21] Anthony A. Braga, David M. Hureau, and Andrew V. Papachristos, Deterring Gang-Involved Gun Violence: Measuring the Impact of Boston's Operation Ceasefire on Street Gang Behavior, 30 *Journal of Quantitative Criminology* 113 – 139 (2014); Andrew V. Papachristos, David M. Hureau, and Anthony A. Braga, The Corner and the Crew: The Influence of Geography and Social Networks on Gang Violence, 78 *American Sociological*

3. Frisks and Searches by Suspect Race

Table 6 shows that Black and Hispanic suspects were more likely to be frisked or searched during an FIO encounter, after controlling for non-racial suspect characteristics. Compared to White suspects, Black suspects were 12.4 percent more likely to be frisked / searched, and Hispanic subjects were 4.5 percent more likely to be frisked / searched during FIO encounters with arrest and gang status covariates included in the model. Gang members were 11.7 percent more likely to be frisked / searched during FIO encounters relative to their non-gang counterparts, controlling for other factors. For every additional arrest in their history, suspects were 1.8 percent more likely to be frisked or searched during FIO encounters. Asian and other race subjects were significantly less likely to be frisked / searched during FIO encounters when compared to White subjects. Here, the gang effect that explained FIO activity in Table 5 seems to have comparable and independent influence on the decision to frisk as does the suspect's race.

Table 6. Hierarchical Logistic Regression Estimating Impact of Suspect Race on Probability of a Frisk and/or Search (OR, SE, p)

Characteristic	*OR*	*SE*	*p*
Age	0.977	-0.001	**
Female	0.347	-0.007	**
Suspect Race – Black	1.124	-0.018	**
Suspect Race – Hispanic	1.045	-0.018	**
Suspect Race – Asian/Other	0.837	-0.021	**
Suspect Race – Unknown	0.588	-0.018	**
Gang Member	1.117	-0.017	**
Arrest History	1.018	-0.001	**
Constant	0.459	-0.082	***
Observations	199,331		
Log Likelihood	-121413.72		
Wald Chi-square	2603.82		
p(Wald Chi-square)	0.000		

Notes: Robust standard errors clustered by tract. Fixed effects for police districts, year and season. Random effects for tract characteristics (not shown) include tract population (logged), total violent crime in tract (logged, lagged), disadvantage index, and Moran's I. Race variables contrasted with White suspects. Significance: + p<=.10, * p<=.05, ** p<=.01

Taken together, Tables 5 and 6 show racial disparities in the number of repeated FIO contacts and the probability of being frisked / searches experienced by Black and Hispanic suspects. The effects in these tables are adjusted for the influences of age, gang membership, neighborhood and other relevant non-race influences.

Review 417 (2013); Anthony A. Braga, David Hureau, and Christopher Winship, "Losing Faith? Police, Black Churches and the Resurgence of Youth Violence in Boston, 6 *Ohio St. J. Crim. L.* 141 (2008).

In fact, we see the frisk estimates in Table 6 as conservative and expected to see even greater effects by suspect race considering the attention to gangs in this setting. This might be due to the BPD's use of FIOs for intelligence gathering purposes, especially among gang members. Other *Terry* stop "programs" do not document non-contact observations, in line with the Supreme Court dicta limiting constitutional regulation to the physical aspect of investigative stops.[22]

The large FIO differences in counts of encounters – both observational and face-to-face – compared to the incidence of frisks or searches suggests more extensive use of FIO reports to monitor gang members at a distance rather than repeatedly initiating physical contact to search them for weapons, drugs, or other contraband. Perhaps this is a safety consideration, or it may be that there are information yields from non-contact encounters, such as understanding gang membership and associations, that can address tactical and policy goals. Whatever the purpose and rational, more research is needed on the reasons and circumstances for this component of the FIO strategy, as well as its informational payoff.

4. FIO Activity by Unit and Officer Race

Table 7 shows the effects of officer characteristics on FIO patterns. There were large differences in FIO activity by officer race or ethnicity. Black officers made 42.5 percent fewer FIO reports per month compared to White officers, controlling for age, sex, rank, detective status, and assignment. Asian officers also made significantly fewer FIO reports. Relative to White officers, Asian officers made 44.8 percent fewer FIO reports controlling for officer demographic, rank, and assignment covariates. Hispanic officers made slightly smaller numbers of FIO reports than their White officers but the observed differences were not statistically significant. Controlling for assignment, rank, and other factors, older officers and female officers made significantly fewer FIO reports relative to their younger and male counterparts, respectively.

Unit assignment also was a significant predictor of officers' FIO activity. BPD officers assigned to the YVSF make almost 12 times as many FIO reports per month compared to officers assigned to other specialized units or policing districts, controlling for other factors. Their mission explains in part this emphasis: YVSF officers are charged with preventing outbreaks of gang violence. Completing FIO reports on gang member whereabouts, their associations and routine activities represent a central activity in pursuing that mission by massing information on the routine activities of gang members.

Compared to line level patrol officers, Captains, Deputy Superintendents, and Superintendents make significantly fewer FIO reports holding other officer characteristics constant. These high-ranking officers have extensive managerial responsibilities and, while they maintain a presence in the community, they are much less likely to be engaging in street-level law enforcement work.[23]

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[22] See, *Terry v Ohio*, 362 U.S. 1 (1968)

[23] The model used for the estimates in Table 7 is a zero-inflated negative binomial regression, which is employed in situations where there are large numbers of observations of zero events in the data and there are separate functions to determine any participation and then frequency of participation. See, for example, Kelvin KW Yau, Kui Wang, and Andy H. Lee, "Zero-Inflated Negative Binomial Mixed Regression Modeling- of Over-Dispersed Count Data with Extra Zeros," 45 *Biometrical Journal* 437 (2003). This regression first estimates factors that explain when there are one or more events, and then explains the count of those events given one or more. The first stage analyzes the inflation factors associated with *any* participation. The medical leave and administrative position variables were statistically significant predictors of zero FIO activity during the study

Table 7. Zero Inflated Negative Binomial Regressions of FIO Counts on Officer Characteristics (IRR, SE, p)

Characteristic	*OR*	*SE*	*p*
Years on Job	0.902	-0.007	**
Female	0.377	-0.069	**
Officer Race			
Black	0.575	-0.066	**
Hispanic	0.901	-0.156	
Asian	0.552	-0.121	**
Officer Rank			
Detective	0.885	-0.187	
Sergeant or Lt.	0.893	-0.151	
Captain or Command	0.778	-0.133	*
Officer Unit			
Mobile Operations	1.021	-0.583	
Drug Control	1.131	-0.263	
YVSF	11.953	-2.655	**
Other Patrol	0.358	-0.112	**
Other Investigation	0.215	-0.069	**
Constant	206.322	-49.72	**
Zero Inflation Parameters			
Administrative Assignment	4.946	-0.404	**
On Leave	4.592	-0.389	**
Constant	-4.734	-0.301	**
Observations	2,359		
Log Likelihood	-9,833.14		
Wald Chi-square	1059.06		
p (Chi-square)	0		

Notes: Models estimated with robust standard errors, not clustered due to mobility of officers. Fixed effects for police district, year, season, and police district. Significance: + *p*<=.10, * *p*<=.05, ** p<=.01

The strong influence of the YVSF officers on FIO activity, coupled with the race-specific patterns shown in Table 7, leads to a further question: whether FIO activity within the YVSF command also varies by officer race. Table 8 shows the results of regressions with

time period, controlling for other factors. BPD officers who were not able to perform their duties or were assigned to administrative positions generally do not complete FIO reports.

only officers having one of more FIO encounters, and disaggregating officers by race and YVSF assignment. The six groups shown in Model 2 in Table 8 are compared to Asian and Other Race officers, a move that exploits the fact that there are so few Asian officers in the YVSF. This permits direct comparisons of the regression estimates in Model 2.

Table 8. Negative Binomial Regression of the Number of FIO Reports by Officer Race and YVSF Status (IRR, SE, p)

	Model 1	*Model 2*
Age	.916 (.006) **	.922 (.006) **
Female	.307 (.059) **	.383 (.074) **
White Officer	1.752 (.335) **	----
Black Officer	1.171 (.243)	----
Hispanic Officer	1.613 (.338) *	----
White YVSF	----	9.022 (2.136) **
White Other	----	1.488 (.287) *
Black YVSF	----	8.358 (2.081) **
Black Other	----	.826 (.170)
Hispanic YVSF	----	10.788 (3.706) **
Hispanic Other	----	1.112 (.265)
Constant	191.969 (37.743) **	175.144 (34.663) **
Observations	1,750	1,750
Log Pseudo-likelihood	-9,245.30	-9,116.84
Wald Chi-Square	312.99	652.49
Wald Chi-Square *p*	0	0

Notes: Models estimated with robust standard errors, not clustered due to mobility of officers. Officers included in this analysis made at least one FIO report between 2007 and 2010. Asian is the contrast category for the FIO officer race tests.

Significance: + p<=.10, * p<=.05, ** p<=.01

Model 1 in Table 8 shows that White and Hispanic officers had substantially more FIO encounters than Black officers. Without controlling for assignment, the effect sizes for White and Hispanic officers are considerably larger than for Black officers. Model 2 shows that this effect is an artifact of YVSF assignment. Within officer race, YVSF officers have far more frequent FIO activity than their non-YVSF counterparts. The differences again are very large. White YVSF officers have about 6.5 times more FIO encounters per month than White officers in other units. The differences for Black and Hispanic officers in the YVSF units are even greater.

Here again, we see the importance of the YVSF unit in explaining racial disparities in FIO encounters between citizens and police. This is not to say that there is no evidence of racially disparate treatment by officers in other commands; the data show that in fact, regardless of command, White officers and Hispanic officers are more active in FIO work.

Rather, Table 8 shows that within this focus of police efforts, the race disparities within officer racial categories are quite large, and officers from all racial and ethnic groups are more active once assigned to this command. The results suggest an institutional dimension to explain officer FIO activity that is separate from an individual officer's taste or preference for discrimination.

5. Frisks and Searches by Officer Race and Assignment

Table 9 shows differences in frisk/search probability by officer race and assignment. Black officers were 15.0 percent less likely to frisk / search subjects during FIO encounters when compared to White officers, controlling for age, sex, rank, detective status, and assignment. Asian officers were also less likely to frisk / search FIO subjects. Relative to White officers, Asian officers were 32.6 percent less likely to frisk / search subjects during FIO encounters controlling for officer demographic, rank, and assignment covariates. Hispanic officers were only 4.4 percent less likely to frisk / search subjects during FIO encounters holding the other variables constant; that result was not statistically significant. More experienced officers and female officers were significantly less likely to frisk / search subjects during FIO encounters relative to their younger and male counterparts, respectively, controlling for assignment, rank, and other factors.

Two assignments show extremely elevated rates of frisk / search activity. Detectives were 49.5 percent more likely to frisk / search subjects during FIO encounters relative to non-detectives, controlling for assignment, rank, and other factors. Given their responsibility for investigating unsolved crimes, detectives were presumably more likely to frisk / search FIO subjects for evidence of criminal activity during the course of an investigation. YVSF officers were 24.3 percent more likely to frisk / search subjects during FIO encounters relative to non-YVSF officers, controlling for assignment, rank, detective status, and other factors. YVSF officers focus FIO encounters on gang members who pose a higher risk of carrying weapons relative to other FIO subjects, which explains in part their preferences for search relative to other BPD officers. Compared to line level patrol officers, Sergeants, Lieutenants Captains, Deputy Superintendents, and Superintendents were significantly less likely to frisk / search subjects during FIO encounters holding other officer characteristics constant.

Despite the frequent FIO activity by YVSF officers, these results suggest that they exercise caution in proceeding from an encounter to a frisk or search. YVSF officers were far more active in FIO activity, by orders of magnitude, than their non-YVSF counterparts, yet only a fraction of their encounters proceeded to a frisk or search.

Table 9. Hierarchical Logistic Regression Estimating Impact of Officer Race on Probability of a Frisk or Search (OR, SE, p)

Characteristic	*OR*	*SE*	*p*
Years on Job	0.973	(.007)	**
Female	0.618	(.069)	**
Officer Race			
Black	0.850	(.066)	**
Hispanic	0.956	(.156)	
Asian	0.674	(.121)	**
Officer Rank			
Detective	1.495	(.187)	
Sergeant or Lt.	0.847	(.151)	
Captain or Command	0.5	(.133)	*
Officer Unit			
YVSF	1.243	(2.655)	**
Constant	315.322	(49.720)	**
Observations	200,103		
Log Likelihood	-123,410.23		
Wald Chi-square	1,618.47		
p (Chi-square)	0.000		

Notes: Robust standard errors clustered by police district. Random effects (not shown) included census tract population (logged), total crime in tract (logged, lagged), disadvantage index, and Moran's I. Fixed effects for year, season, and police district. Significance: + p<=.10, * p<=.05, ** p<=.01

6. Officer-Suspect Racial Asymmetries

Table 10a shows the results of analyses that disaggregate patterns of FIO encounters by both officer race and suspect race. We estimated models of the count of FIO encounters using negative binomial regressions, following the functional form used in the previous models of FIO activity. Controls included age and gender of the suspect and age, gender, rank and assignment for officers. Separate models were conducted for each officer race group. Fixed effects for police districts controlled for differential exposure of officers to crime and to different local racial concentrations. The first three columns compare FIO reports of each suspect racial group by officers of each race to FIO reports done by White officers. The fourth column compares FIO reports by White officers to FIO reports of Black Officers. The cells in Table 10a show the incidence rate ratio for each comparison. To test for different patterns in frisks and searches, we use multilevel logistic regression models as the functional form to estimate the probability of a frisk or search across racial groups. The results in Table 10b show the odds ratio for each comparison.

Table 10a. Negative Binomial Regression Analyses of the Joint Distribution of Officer Race and Subject Race on FIO Counts (IRR, SE)

	Officer Race			
Subject Race	*Black*	*Hispanic*	*Asian*	*White*
Black	.645**	.865	.504**	1.548*
	(.071)	(.139)	(.112)	(.169)
Hispanic	.581**	.128	.664	1.722**
	(.063)	(.170)	(.171)	(.188)
Asian / Other	.616**	1.219	1.113	1.623**
	(.089)	(.334)	(.281)	(.235)
White	.426**	.731*	.702*	2.345**
	(.041)	(.103)	(.200)	(.227)

Table 10b. Hierarchical Logistic Regression Analyses of the Joint Distribution of Officer Race and Subject Race on the Likelihood of a Frisk / Search (OR, SE)

	Officer Race			
Subject Race	*Black*	*Hispanic*	*Asian*	*White*
Black	.813**	.922**	.649**	1.229**
	(.014)	(.020)	(.038)	(.021)
Hispanic	.991	.968	.605**	1.008
	(.041)	(.040)	(.068)	(.041)
Asian / Other	.949	1.031	.724*	1.052
	(.060)	(.071)	(.112)	(.066)
White	.874**	.926*	.811**	1.143**
	(.032)	(.035)	(.057)	(.042)

Note: Models estimated with robust standard errors clustered by police district. Estimates control for suspect and officer age and gender. Fixed effects include year, season, police district, and officer rank and assignment. White is the contrast category for officer race variables in the regressions in the first three columns of coefficients. Black is the contrast category for the White officer race dummy variable in the regressions in the fourth column. Significance: $^{+}$ *p*<=.10, * *p*<=.05, ** p<=.01

Table 10a shows higher FIO activity for White officers for suspects of all races, including White suspects, compared to Black officers. White officers have significantly more encounters with White suspects than they have with suspects of other races. Column 1 shows that Black officers, compared to White officers, are significantly less active across all suspect race groups, again suggesting discrimination other than preference-based. The pattern for frisks and searches in Table 10b is similar. White officers are more likely to frisk or search both Black and White suspects compared to cross-racial frisks or searches by Black officers. Black officers again show lower rates of frisks and searches compared to White officers, and are equally likely to frisk or search both White and Black suspects. Hispanic officers are less likely compared to White officers to frisk Black and White suspects, while White officers are more likely than Hispanic officers to frisk or search both Black and White suspects. Both tables show that when we compare within suspect race, black officers are less likely to FIO black suspects than white officers are to FIO black suspects.

One way to understand Tables 10a and 10b is that while White officers may not discriminate between suspects of different races, they do have stronger preferences for stops between races than do Black officers. This is evident for suspects of all races. This presents a more complex picture of the preference-statistical discrimination distinction than previous studies have reported. White officers are more active than are Black or Hispanic officers in FIO activity overall, but they also prefer within each race to conduct FIOs relative to Black officers. There may not be preferences by race, but there does appear to be stronger preferences for FIO activity overall. Put another way, white officers are biased toward everyone compared to Black, Hispanic or Asian officers.

While this type of cross-racial comparison helps establish differences in preferences by officer race, we still cannot assume that this is a sign of bias in officers' perceptions and actions. That conclusion requires a different research model.

IV. Conclusion

We show that BPD FIO activity is concentrated in high-crime neighborhoods and largely focused on gang-involved and criminally-active individuals. Theses analyses also revealed racially disparate treatment of minority persons in BPD FIO activity. Controlling for a wide range of covariates and using three different benchmarks, the analyses demonstrated that neighborhoods with higher percentages of Black and Hispanic residents experienced higher numbers of FIOs relative to "average" Boston neighborhoods. Moreover, controlling for gang membership and prior criminal history, Black and Hispanic FIO subjects are more likely to experience repeated FIO encounters and are more likely to be searched during FIO encounters relative to white subjects.

Officer race explains part of the racial and ethnic disparaties in FIO activity. During the time period of the study, we find higher FIO activity for White officers for suspects of all races, including White suspects, compared to Black, Hispanic or Asian officers. Comparing within-suspect-race results, we see signs of preference-based discrimination by White officers. White officers have about 55 percent more FIO encounters with Black suspects compared to Black officers. Black officers have 35 percent fewer FIO encounters of Black suspects compared to White officers. This between-officer within-suspect comparison suggests preferences by White officers compared to Black officers in FIO activity for Black suspects. However, White officers also have about 135 percent more FIO encounters with White suspects compared to Black officers and Black officers have about 67 percent fewer FIO encounters with White suspects compared to White officers.

Unfortunately, this research cannot determine whether the identified patterns were generated by bias or other processes of racial discrimination in BPD FIO practices. The data do not unravel the individual decision-making process of BPD officers who are engaged in FIO encounters; we can only observe differences that require more extensive and different types of study. Further research is necessary to understand the factors and processes that influence the observed disparities.

Technical Appendix

We analyze differences in stop rates by neighborhood to determine whether FIO activity is explained by local crime rates, or if there is additional variance that is explained by race. A race-neutral practice would predict a positive effect for local crime rates and non-significant effects for race once we control for crime. Significant positive or negative effects for other characteristics, including the racial and ethnic composition of the census tracts, would indicate the presence of additional explanatory effects net of the influences of local crime rates. The outcome variable of interest was the monthly count of FIOs made in each Census tract between 2007 and 2010 (N=8,304; 173 Census tracts with 48 observations each).

1. Data and Measures

The neighborhood analyses were conducted using 2010 U.S. Census tracts as the principal unit of analysis. Census tracts were used instead of BPD geographic units (e.g. districts, reporting areas) or smaller areal units (e.g. Census block groups, street segments). Tracts are areas roughly equivalent to neighborhoods developed by the U.S. Census Bureau for the purposes of analyzing populations.[24] According to the 2010 U.S. Census, Boston was comprised of N=181 tracts. Data on the social and economic conditions in these tracts were obtained from the 2007-2010 American Community Survey (ACS).[25]

Eight tracts were excluded from the analysis because there were no residents in these areas for a total N=173 tracts: the Stony Brook reservation, Belle Isle Marsh reservation, the Harbor Islands, the Esplanade recreational area, the Franklin Park recreational area, and three commercial property waterfront areas.

The FIO data included date and geographical location (x-y coordinates) information that permitted aggregation of FIO counts to Census tracts and by differing time periods. Coverage was good: 95.2% (194,858 of 204,739) of the FIO reports were geocoded to 2010 Census Tracts in Boston.

2. Estimation Methods

The specific estimation technique for this analysis, or the functional form of the regression equation, was responsive to the specific measure of FIO activity (monthly counts in Census tract units). Accordingly, models were estimated using negative binomial regressions. This class of regression models is appropriate for counts of events, such as FIO reports in a specific area, where assumptions about the independence of events cannot be reliably made. Negative binomial regressions also are especially useful for discrete data such as event counts when the variance exceeds the mean across areas.[26] We used a specific form of negative binomial regression known

[24] https://www.census.gov/geo/reference/gtc/gtc_ct.html; Nancy Krieger, A Century of Census Tracts: Health and the Body Politic (1906–2006), 83 *Journal of Urban Health* 83 (3): 355 (2006).

[25] http://www.census.gov/acs/

[26] Joseph M. Hilbe, Negative Binomial Regression (2007). See, also, Richard Berk and John M. MacDonald, Overdispersion and Poisson Regression, 24 *J. Quant. Criminology* 269 (2008); D. Wayne Osgood, Poisson-Based Regression Analysis of Aggregate Crime Rates, 16 *J. Quant. Criminology* 21 (2000); David A. Freedman, Statistical Models: Theory and Practice (2005); William Greene, Econometric Analysis (5th ED.) (2003).

as General Estimating Equations (GEEs).[27] GEEs are beneficial for nested or hierarchically organized data, such as years within Census tracts, as they allow for the specification of within-subject correlations of observations. These nesting variables are treated as random effects in the estimating models. Random effects here include census tract correlations. To adjust for difference in population densities in the census tracts, we estimated population-averaged models.

Since the analyses include a sequence of time periods (calendar months), the models include an AR(1) variance estimation function that adjusts for the serial autocorrelation (or autoregression) of the counts of events within sampling units over long periods of time.[28] AR(1) adjustments reflect the reality that the best predictor of what the crime rate will be in the next month is what it was in last month. This is an empirical constraint in identifying the relationship between crime and policing. Failure to correct for this temporal dependence will bias the standard errors in estimates of crime effects on policing, and this distortion remains even when fixed effects are used to control for temporal trends.

There is a long tradition of studies of the seasonality of crime and the theoretical explanations for why crime varies by season.[29] Accordingly, we also controlled for yearly and seasonal variations in the monthly counts of FIO reports by including fixed-effects for calendar quarter and year.[30]

In each of the regressions, the parameter estimates were expressed as incidence rate ratios (i.e., exponentiated coefficients). Incidence rate ratios are interpreted as the rate at which things occur; for example, an incidence rate ratio of 1.10 would suggest that, controlling for other independent variables, a one unit increase in the selected independent variable was associated with a 10% increase in the rate at which the dependent variable occurs.[31] Robust standard errors clustered by tracts were used where appropriate.[32]

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[27] James W. Hardin and Joseph M. Hilbe, Generalized Estimating Equations (2003); Gary A. Ballinger, Using Generalized Estimating Equations for Longitudinal Data Analysis, 7 *Organizational Research Methods* 127 (2004).

[28] See, Badi Baltagi, Econometric Analysis of Panel Data (2001); Badi Baltagi and Qi Li, Testing AR(1) Against MA(1) Disturbances in an Error Component Model, 68 *Journal of Econometrics* 133 (1995).

[29] See, e.g., John R. Hipp, et al., Crime of Opportunity or Crimes of Emotion? Testing Two Explanations of Seasonal Change in Crime, 82 *Social Forces* 1333 (2004).

[30] We created indicator variables to account for seasonal variations by calendar quarter. Quarter 1 represented January, February, and March monthly FIO counts (1 = Yes, 0 = No). Quarter 2 represented April, May, and June monthly FIO counts (1 = Yes, 0 = No). Quarter 3 represented July, August, and September monthly FIO counts (1 = Yes, 0 = No). Quarter 4 represented October, November, and December monthly FIO counts (1 = Yes, 0 = No). Quarter 1 served as the reference category for the seasonal polychotomous dummy variable. We also created indicator variables for year to account for annual variations in the data.

[31] See, Sophie Rabe-Hesketh and Anders Skrondal. Multilevel and Longitudinal Modeling Using Stata, Volume II: Categorical Responses, Counts and Survival, 3rd ed. (2012). See, also, Kenneth Rothman and S. Greenland, Modern Epidemiology, 3rd ed. (2008).

[32] Greg Ridgeway and John MacDonald, Doubly Robust Internal Benchmarking and False Discovery Rates for Detecting Racial Bias in Police Stops, 104 *Journal of the American Statistical Association* 661 (2009). See, also Gary King and Margaret E. Roberts, How Robust Standard Errors Expose Methodological Problems they Do Not Fix, and What to Do About It, *Political Analysis* (2014).

3. Measures

Police activity in Boston is closely linked to crime.[33] As such, we test whether crime rates in a neighborhood are linked to the intensity of BPD FIO activity in that area. We use crime incident data generated by the BPD on 113,419 "index" crime incidents in Boston between 2007 and 2010.[34] These crime incident data were geocoded, and then aggregated by Census tract and month of occurrence to create a covariate measuring lagged and logged monthly counts of serious crime in Boston census tracts. All models control for the one-month-lag of logged total crime incidents. The natural log transformation of the actual number of crimes was used. Log transformation is necessary to adjust when the distributions are highly skewed and non-linear. The lag reflects the police planning process whereby FIO reports and other enforcement activity are adjusted to reflect actual crime conditions.

As Figure A-1 reveals, FIO reports made by BPD officers in 2010 tended to concentrate in census tracts with higher rates of total crime incidents and higher percentages of black resident populations. Figure A-1 also shows a high degree of spatial autocorrelation in the concentration of FIO reports across Census tracts. To account for spatial dependence, we included measure of spatial dependence in the estimates. Spatial dependence, or autocorrelation, violates the assumption of independence among observations used in most statistical models. Spatial regression analyses of the variation of crime, etc. across neighborhood units account for spatial autocorrelation through the addition of a spatial effects covariate such as Moran's I . The argument is that analyses that do not compensate for spatial dependency can have unstable parameter estimates and yield unreliable significance tests.[35]

We also control for police deployment patterns. The allocation of police and targeting of police activity frequently involved "saturation" deployment of police patrols in higher crime areas. Since these areas in Boston and elsewhere often had higher concentrations of non-white residents, asymmetrical deployments of police increased exposure of citizens to police and thus the increased probability of encounters with minority citizens as compared to whites,[36] in turn producing racial or ethnic differences in contact patterns. Accordingly, an analysis of FIO patterns by neighborhood required an understanding of the allocation of police patrol resources in each unit of analysis. Patrol

[33] Anthony A. Braga, et al., An Ex-Post-Facto Evaluation Framework for Place-Based Police Interventions, 35 *Evaluation Review* 592 (2011).

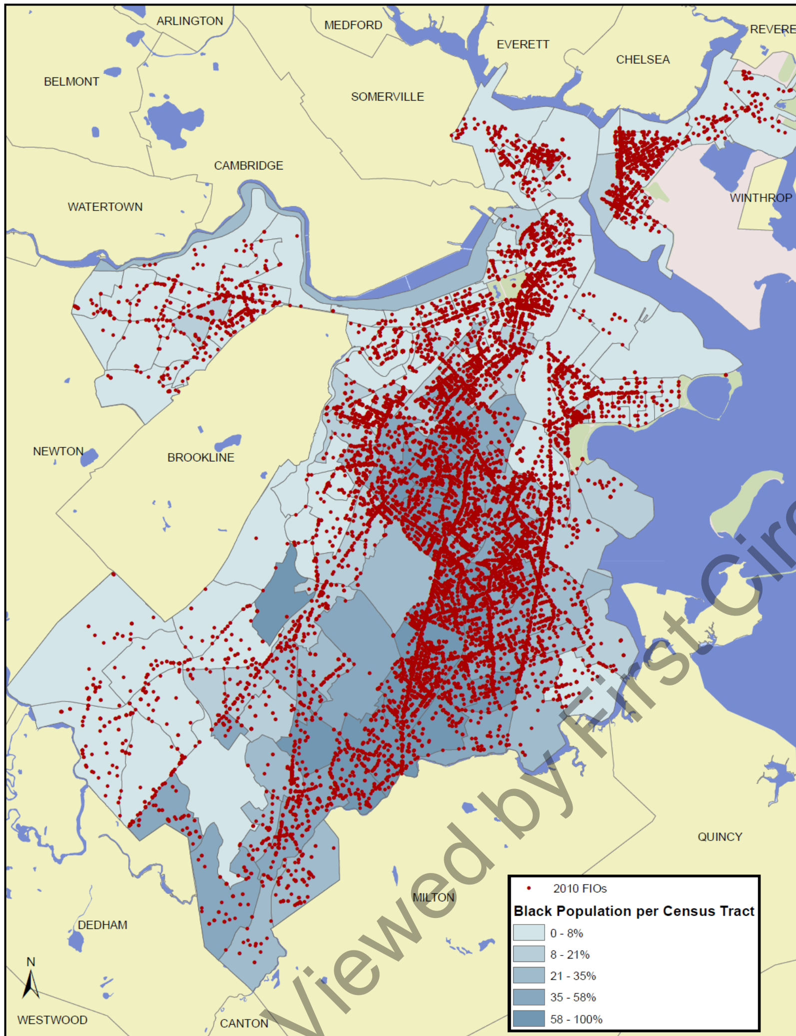
[34] Index crimes, as defined by the FBI, included murder, rape, robbery, aggravated assault, burglary, auto theft, and larceny. See http://www.fbi.gov/about-us/cjis/ucr (accessed August 1, 2014). Using ArcGIS 10.2 mapping software, the BRIC was able to geocode 113,152 of these incidents to their respective Census tracts (99.8 % of 113419 total crime incidents).

[35] See, Michael D. Ward and Kristian Skrede Gleditsch, *Spatial Regression Models*, Quantitative Applications in the Social Sciences series, No. 155, 8 – 10 (2008). ArcGIS 10.2 was used to export a shapefile containing the total number of FIOs made per U.S. Census Tract during the study time period to GeoDa 1.4.6 spatial analysis software. Using queen's contiguity, a Moran's I = 0.674689 was estimated (199 permutations, z = 14.73, p<.005; 99 permutations, z = 15.18, p<.01). The Moran's I spatial autocorrelation lag for each Census Tract was exported to Stata 13.1 and included in the neighborhood analysis.

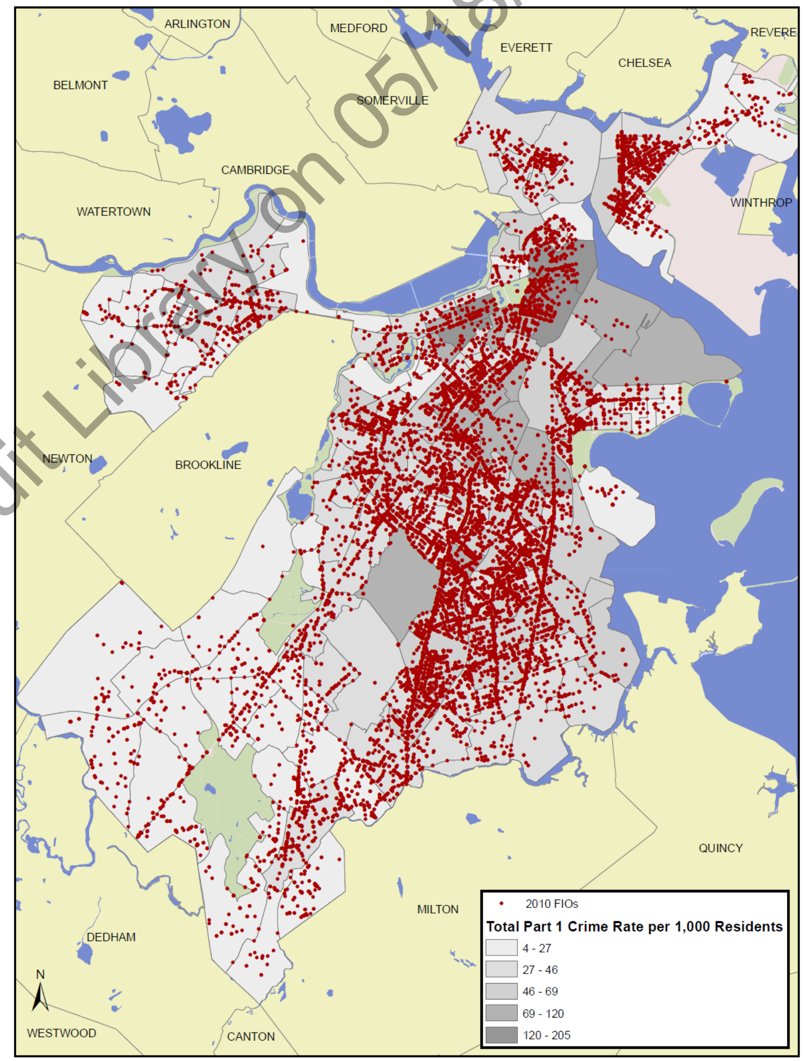
[36] See, e.g., Donald Tomaskovic-Devey, Marcinda Mason, and Mattew Zingraff, Looking for the Driving While Black Phenomena: Conceptualizing Racial Bias Processes and their Associated Distributions, 7 *Police Quarterly* 3 (2004).

Figure A-1. Crime Rate and Population Demography, 2010

2010 Percent Black Population in Census Tracts



2010 Total Part 1 Crime Rate per 1,000 Census Tract Residents



strength data were provided by the BPD for each of their eleven policing districts between 2007 and 2010. These patrol data were then allocated to the each Boston census tract. Because BPD districts do not, as a rule, share boundaries with Census tracts, we allocated patrol strength to tracts based on the percent of each district's area that falls into each tract. Because BPD districts do not, as a rule, share boundaries with Census tracts, we allocated patrol strength to tracts based on the percent of each district's area that falls into each tract.[37]

It is also important to note that the regulation and oversight of FIO policy and activities takes place at the police district level. There are 12 police districts in Boston, each commanded by a police captain who reports directly to the Superintendent of the Bureau of Field Services. BPD Captains are accountable for district-level crime trends and have discretion to allocate officers tactically within districts. Since tracts are nested within Boston's policing districts, we included fixed effects for police districts to account for any unobserved effects of conditions in the districts that might influence police activity, such as district-level variations in the use of FIOs to gather intelligence and maintain contact with potential offenders.[38]

Several studies show that neighborhood crime rates, including violent crime,[39] are strongly associated with concentrated social disadvantage, especially violent crime. The concentrated disadvantage index is a standardized index composed of the percentage of residents who are black, the percentage of residents receiving public assistance, the percentage of families living below the poverty line, the percentage of female-headed households with children under the age of 18, and the percentage of unemployed residents (as measured by the percentage of men over the age 16 who did not work in the previous year).[40] Since we are explicitly interested the independent impact of race on the number of FIO reports in a neighborhood controlling for other factors, we excluded the percentage of black residents from the construction of the Boston concentrated disadvantage used in this analysis. Because of the high correlation among these variables, we conducted principal components factor analysis to identify the underlying dimensions among the variables.[41] This

[37] For example, if Census tract A shares area with three police districts (A1, A2, and A3), the Census tract patrol strength was estimated as [(% of A1 falling into tract A * patrol strength of A1) + (% of A2 falling into tract A * patrol strength of A2) + (% of A3 falling into tract A * patrol strength of A3)].

[38] The BPD has 12 districts that provide policing services across Boston's neighborhoods: A-1 serving Downtown, Beacon Hill, and Chinatown neighborhoods; A-15 serving Charlestown; A-7 serving East Boston; B-2 serving Roxbury and Mission Hill neighborhoods; B-3 serving Mattapan and parts of North Dorchester; C-6 serving South Boston; C-11 serving most of Dorchester; D-4 serving Back Bay, Fenway, and South End neighborhoods; D-14 serving Allston and Brighton neighborhoods; E-5 serving West Roxbury and Roslindale neighborhoods; E-13 serving Jamaica Plain; and E-18 serving Hyde Park. The reference category for the BPD district dummy variable was E-13. For a basic review of the use of dummy variables in regression models, see: Melissa A. Hardy, *Regression with Dummy Variables*, No. 93 in Quantitative Applications in the Social Sciences series, 7 – 16 (1993).

[39] Robert J. Sampson and William Julius Wilson, "Toward a theory of race, crime, and urban inequality, in (John Hagan and Ruth Peterson, eds.), *Crime and Inequality*, 37 – 56 (1995); Robert J. Sampson, Steven Raudenbush and Felton Earls, Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy, 277 *Science* 918 (1997); Jeffrey D. Morenoff, Robert J. Sampson and Steven Raudenbush, Neighborhood Inequality, Collective Efficacy, and the Spatial Dynamics of Urban Violence, 39 *Criminology* 517-59 (2001).

[40] Robert J. Sampson, Steven Raudenbush and Felton Earls, Neighborhoods and Violent Crime, id. Jeffrey D. Morenoff, Robert J. Sampson and Steven Raudenbush, *Neighborhood Inequality, Collective Efficacy, and the Spatial Dynamics of Urban Violence*, id.

[41]Factor analysis is a statistical technique that captures consistency among observed variables to generate a composite measure using a lower number of unobserved variables. The method produces factors that represent the correlations

procedure revealed that variables load on a single factor (which was retained as a standardized disadvantage index variable).[42] The presence of concentrations of recent immigrants is a protective factor that reduces the risk of crime in a neighborhood.[43] As such, we created a variable that measured the percentage of foreign-born residents in each Census tract.

4. Benchmarks

The selection of a benchmark against which to assess police enforcement activity is a basic question in reliably measuring the extent of racial disparities in police-citizen interactions.[44] A benchmark allows us to determine if Boston Police are selectively, on the basis of race or another prohibited factor, singling out persons for FIO reports. As such, we compare the police decision to complete an FIO report on someone to their availability and eligibility for such reports, and compare that calculation across racial and ethnic groups. It is not hard to see that the reliability of an estimate of the extent of racial disproportionality or fairness is likely to depend on – and be particularly sensitive to – the benchmark used to measure criminal behavior.

To the extent that observed or reported crimes are leading indicators of those behaviors that are correlated with crime, crimes known to the police are important part of a valid benchmark. So too is population, as an index of the overall exposure of citizen as available targets for surveillance and interdiction. Accordingly, these analyses use both population and reported crime as benchmarks for understanding the racial distribution of FIO reports. Sensitivity tests applied alternate benchmarks including lagged race-specific arrest rates[45] and lagged race-specific suspect rates.[46]

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among the observed measures. See Jae-On Kim et al., *Factor Analysis: Statistical Methods and Practical Issues* (1978). The principal components factor analysis was completed using STATA 13.1.

42 For example, a Boston Census tract featuring a disadvantage index score of 1.5 would be 1.5 standard deviations more disadvantaged than the mean Boston Census tract. As such, the disadvantage index is adjusted specifically for the city of Boston using 2010 ACS variables, even while the components used to construct the index remain constant across much neighborhood research and remain robust predictors of crime across a variety of city types and spatial aggregations. See Sampson et al., Collective Efficacy, supra note 32; Morenoff et al., Neighborhood Inequality and Collective Efficacy, supra note 32.

43 See, e.g., Robert J. Sampson, Rethinking Crime and Immigration, Contexts, Winter 2008. Available at http://contexts.org/articles/winter-2008/sampson/

44 The issues in benchmarking for pedestrian stops can be different from those that influence decisions on how to benchmark for traffic stops. See, generally, Lori A. Fridell, *By the Numbers: A Guide for Analyzing Data from Vehicle Stops*, 7 (2004); Jeffrey Fagan, "Law, Social Science and Racial Profiling," 4 *Justice Research and Policy* 104 (2002); Ian Ayres, "Outcome Tests of Racial Disparities in Police Practices," 4 *Justice Research and Policy* 133 (2002); Greg Ridgeway and John MacDonald, Methods for Assessing Racially Biased Policing, in *Race, Ethnicity and Policing: Essential Readings* (S.K. Rice and M.D. White, eds.) 180 (2010). See, also, Samuel Walker, "Searching for the Denominator: Problems with Police Traffic Stop Data and an Early Warning Solution," 4 *Justice Research and Policy* 133 (2002). The Fagan and Walker articles respectively wrestle with the unique demands of benchmarking for pedestrian stops.

45 See Jerry H. Ratcliffe, Geocoding Crime and a First Estimate of a Minimum Acceptable Hit Rate, 18 *International Journal of Geographical Information Science,* 61-72 (2004).

46 As described earlier, between 2007 and 2010, there were 113,419 Part I UCR crime incidents in Boston. Victims in these incidents reported information on 340,585 suspects. The racial distribution of these suspects was as follows: 41.2% Black, 21.8% White, 17.3% Hispanic, 2.0% Asian or other race category, and 17.7% unknown race.

Between 2007 and 2010, the BPD arrested 28,427 suspects. The racial distribution of arrested suspects was as follows: 50.4% Black, 26.8% White, 20.6% Hispanic, and 2.2% Asian or other race category. Using ArcGIS 10.2 mapping software, the BRIC was able to geocode 24,590 of these arrests to their respective Census tracts (86.5% of 28,427 total arrests). While a 100% geocoding rate is always desired, the geocode rate in the current study exceeds the minimum acceptable threshold of 85%. Natural log of the Census tract population, total number of arrested individuals in Census tract, and total number of suspects reported in Census tract were used as the offsets in the regression models.

These analyses were designed to test whether monthly counts of FIO reports in Census tracts were disproportionate to the racial composition of tract residents, racial composition of arrested suspects in the tract, and the racial composition of crime suspects as reported by victims in crime incident reports, after controlling for the known crime rate in the previous month and other characteristics that are correlated with crime. For each racial composition benchmark, three race categories (percent Black, percent Hispanic, and Percent Asian / other) are included and the category of percent White is omitted. This was done to avoid collinearity in the model estimation. As such, the coefficients for each racial group are based on comparison with the percent White of the benchmark in the tract. When a racial composition variable is significant, this means that its relationship to FIO activity is significantly different from that of the White racial composition of that benchmark in the Census tract.