Measuring Police Presence in US Cities using Smartphone Data

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Abstract

While extensive, research on policing in America has focused on documented actions such as stops and arrests—less is known about patrolling and presence. We map the movements of over ten thousand police officers across twenty-three of America’s largest cities by combining anonymized smartphone data with station and precinct boundaries. Police spend considerably more time in Black neighborhoods, a disparity which persists after controlling for density, socioeconomics, and crime-driven demand for policing. Our results suggest that roughly half of observed racial disparities in arrests derive from disparities in exposure, and that supervisor (but not officer) diversity reduces this.

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Where police spend time matters to the communities they serve. By deciding where officers are present, police departments and individual officers wield considerable discretion in determining where law enforcement is provided. Detailed information on where officers work during their shifts can both identify disparities and guide policy aimed at improving the provision of public safety in the United States. Currently, very few departments track this information or release it to researchers in a standardized way. We map local policing environments using anonymized, individual-level smartphone location data that allows us to track the movement of individual officers. These data identify where police spend their time and offer government agencies, policymakers, and researchers a new way to evaluate spatial patterns of policing at scale while maintaining officer privacy.

Generally, geographic analysis of policing at the sub-city level has measured local policing in two ways: “down-funnel” data on observed police enforcement actions made public by a department—use of force, arrests, or stops, or “up-funnel” information on where commanders direct their officers to patrol—officers’ assigned beats (Ba et al. 2021, Vomfell and Stewart 2021, Mastrobuoni 2019). Comparisons of assigned officer beats with actual patrol car locations suggest that while beats are highly correlated with actual officer presence, officers spend a nontrivial amount of time outside of their officially assigned geographic locations (Weisburd 2021). Down-funnel interactions between the police and the public matter (Geller et al. 2014). However, down-funnel, enforcement-based measures of policing fail to capture the increasingly diverse set of tasks that officers perform within a community (Brooks 2021; Lum 2021; Lum, Koper and Wu 2021). Further, down-funnel measures do not fully measure officer presence in a neighborhood in the absence of enforcement actions - the most fundamental element of what it means for an area to be “policed”.

In this study, we use smartphone location data to identify and track the location of individual police officers. Using these data, we quantify how patterns of socioeconomic status, crime, social capital, and race relate to local police presence within and across twenty-three of America’s largest cities. Different definitions of “presence” are possible; we conceptualize
police presence as the total number of officer hours spent in a census block group (a “neighborhood” with roughly 1,000 residents) over a ten-month period (Feb 2017 - Nov 2017), when the officer was moving through a neighborhood at 50 mph or less.

Smartphone location data confirm many hypotheses posed by qualitative and historical research on policing across America (Hinton 2016; Rios 2011; Sharkey 2018), and patterns observed at the city level (Carmichael and Kent 2014). We show that police officers spend more time in places with larger Black, Hispanic, or Asian populations relative to the city overall. Some, but not all, of this variation can be explained by neighborhood differences in socioeconomic status, social disorganization, and violent crime, suggesting that social interventions targeted at the “root causes” of crime will not necessarily eliminate the observed racial disparity in who is policed in America.

Our measure of officer presence complements existing spatial analyses of down-funnel measures of policing by allowing analysis of pre-enforcement exposure to police at a highly granular level. Many studies have found that police engage in more enforcement actions in Black neighborhoods, with more mixed evidence in Hispanic neighborhoods (Geller et al. 2014; Ba et al. 2021; Pierson et al. 2020). Our estimates suggest that, in the cities in our sample, differences in where officers spend time can explain roughly half of the Black-White disparities in number of arrests, meaning officers’ higher propensity to make an arrest, conditional on being in a Black neighborhood, explain the remainder of these disparities. In contrast, officers do not make more arrests in Hispanic neighborhoods than White neighborhoods on average due to a decreased amount of time spent in more Hispanic places; when present, officers make arrests at a rate comparable to neighborhoods with more Black residents.

Closest to our work are single-city studies of police presence based on Automatic Vehicle Location (AVL) systems or assigned officer beats (Ba et al. 2021; Vomfell and Stewart 2021; Wu, Koper and Lum 2021). However, AVL and beat assignments may not fully capture exposure to police presence (e.g., time officers spent away from a squad car, outside their
assigned beats, or exposure variation within the coverage of a beat). In addition, these analyses are contingent on a department’s decision to collect and release the underlying administrative data.

Studies have found smartphone data to be broadly representative in the United States (Long, Chen and Rohla 2020), allowing us to extend single-city studies to a much broader set of US cities, without relying on the decision of a particular local government. While still descriptive, our data allow us to differentiate between the racial composition of police presence and the racial composition of frontline officers versus police supervisors. Consistent with existing single-department studies (e.g. Hoekstra and Sloan 2020; Ba et al. 2021), our results suggest that there is less police presence in Black neighborhoods where more police officers are Black. However, this is driven not by the racial composition of officers walking the beat, but the racial composition of the supervisors that direct police officer activity. This highlights the role of retention and promotion in police reform aimed at reducing racial disparities in the criminal justice system.

2 Methods

2.1 Data

Smartphone location data used in this study comes from Veraset, a company that aggregates anonymized GPS data from a suite of smartphone applications. The smartphone data records “pings” denoting where a specific smartphone is located at a particular point in time. Pings are logged at irregular time intervals, whenever a participating smartphone application requests location information. The modal time between consecutive pings is roughly 10 minutes. Our smartphone data covers more than 50 million smartphones, spanning the continental US, in a 10-month period from February 2017 to November 2017. While the dataset contains geolocation information from only a subset of all smartphones, previous studies have found it highly representative of the United States on numerous demographic
dimensions (Long, Chen and Rohla 2020).

We link the smartphone data to two other data sources: 1) police station location data published by the Department of Homeland Security, verified with the city’s open data portal and google maps data, and 2) building rooftop geofence data provided by Microsoft, enabling us to associate each police station’s latitude-longitude location to a geofence that delineates the convex hull of a building’s rooftop boundary. To identify patrol officers in local city neighborhoods, we include police stations categorized as patrol stations, as headquarters, or as unspecified police stations, resulting in a total of 341 stations across 23 of America’s largest cities. A description of other data sources and data cleaning process can be found in Appendix A1. It is important to note the selection of the cities in our sample was based on jurisdictional population and the physical construction of police stations. Our sample was not determined by the investment the department chose to make in electronically monitoring officers or a department’s decision to release the data publicly or enter into a research agreements with external parties (see Goel et al. (2017) for a discussion of these issues in the context of measuring police bias).

### 2.2 Measuring Police Presence

We infer whether a smartphone belongs to an officer by linking smartphone data to police stations’ geofences in several steps. First, if a specific smartphone is observed in a police station geofence at least five times in a month, we identify it as belonging to a police employee in that month. We next infer each smartphone user’s “home” as the smartphone’s modal Geohash-7 (a 152m × 152m grid) during a five month period when the device is not at any police stations. We identify two home locations separately for the early and the latter half of the year to account for a potential summer move. Then, we identify patrol officers by looking for a specific pattern: leaving home, traveling to a police station, moving around the

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1Among the 25 largest US cities, we excluded police stations in San Jose and Jacksonville from our analysis, as a majority of police stations in these cities share a building with non-police offices, preventing us from cleanly identifying police officers’ phones.
city (without returning home), returning to the police station, and then going home. The movements of that smartphone between the first and the last station visits are assumed to be the actual locations of a patrol officer while working a “shift”. We require that shifts are bracketed by home visits that are no more than 12 hours apart. Under this definition, our officer smartphone sample consists of 10,971 officers that have at least one shift.\(^2\) The modal shift we observe is 8 hours long, with a mean of 5.24 hours. In Appendix A3, we show that our results are highly robust to limiting our sample to 8 to 12 hour shifts, loosening the time between two home visits to 18 and 24 hours, and excluding shifts with long hours spent within the police stations.

To measure police presence in all census block groups (“neighborhoods”) within the city’s jurisdiction, we look at officers’ smartphone pings outside of the police stations when officers are “on shift” in the month where the device has at least 5 days’ presence. We conceptualize police presence in a city neighborhood as the number of officer-hours spent in the neighborhood.\(^3\) Specifically, we match police officers’ ping locations to block groups, exclude pings moving faster than 50 mph, and assign the duration of each ping as half of the time between its previous and next ping.\(^4\) We then compute the sum of officer-hours from all officers’ pings observed in the block group as police hours across the 10-month period. Figure 1 illustrates the spatial distribution of exposure to police in neighborhoods across the four largest cities in the United States. Where police spend time on patrol is highly non-uniform, and as our later regressions analysis will confirm, is strongly correlated with demographics in ways that produce large racial disparities.

2.3 Validity Check

Our study focuses on America’s largest cities. While our data do not capture the universe of police officers in a city, our estimates of the number of officers in a city satisfy many tests

\(^2\)The spatial pattern of pings for one representative LAPD officer is displayed in appendix Figure A.1. 
\(^3\)In Appendix A2 we look at other constructs of police presence—for example the number of shifts observed in a neighborhood—and find qualitatively and quantitatively similar results. 
\(^4\)Our results are also robust to no or other speed threshold, see Appendix A3 for more details.
of face validity. Figure A.2 in the Appendix shows that the number of officer smartphones that we observe across US cities is highly correlated with FBI estimates of police force size ($\rho = 0.98$). Further, we probabilistically impute each smartphone’s race using its home census block’s racial composition to estimate each police department’s racial composition. Figure A.3 to Figure A.5 in the Appendix show that the smartphone estimates of percent Black (White, Hispanic) align closely with survey measures of the share of sworn officers that are identified as Black (White, Hispanic) from the Law Enforcement Management and Administrative Statistics (LEMAS), where these two measures do not differ significantly on these measures of race.\(^5\) Table A.1 in the Appendix further shows that this significant correlation is not simply driven by cross-city variation in racial composition.

We can conduct an additional residence-based check in New York City, where we compare the NYPD’s official records on the number of officers who live in a zip code with the number of smartphones that we estimate to “live” in that zip code. Figure A.6 in the appendix reveals a strong and positive correlation ($\rho = 0.71$) between official NYPD records and our smartphone-based measures.

There is a well-established positive correlation between the fraction of a city population that is Black and the number of sworn police officers per capita (Carmichael and Kent 2014, Stults and Baumer 2007). A basic test of construct validity is therefore to test if we observe a similar pattern in our data. Figure A.7 plots per capita patrol officers (i.e. smartphones that have at least one shift) against the share of Black population in the 23 cities, replicating the positive correlation between the fraction of city residents who are Black and our measure of total officers per capita. We also show that our smartphone-based measure of police presence has significant predictive power on down-funnel measures of police actions, e.g. stops, arrests, frisks, and searches. Figure 2 shows that, after adjusting for nonlinearity, the correlation between our measure of police presence and the number of arrests—which we

\(^5\)The p-value testing whether the slope between the smartphone measures and LEMAS measure of racial composition is equal to 1 is 0.911 for Black, 0.891 for White, and 0.296 for Hispanic. The slopes between the two estimates for the share of Asian is significantly different from 1, though Asians account for only 2.5% of the police force across the cities in LEMAS.
observe in six cities—ranges from 0.27 (Columbus, OH) to 0.57 (Nashville). Similar positive and significant correlations for other police actions including stops, frisks, and searches, in the subset of the cities which make these records public, are illustrated in Appendix Figure A.8 to Figure A.10.

3 Results

3.1 Neighborhood Correlates of Police Presence

Understanding how police provide services to people from different groups is important, from both a constitutional and efficiency perspective, and our data are uniquely suited to provide new evidence on this issue. Within each neighborhood, we measure the concentration of different racial/ethnic groups as the ratio of the percent of neighborhood residents who report being in a particular category divided by the percent of city residents who report the same. This reflects the observation that exactly what constitutes a “more” Asian, Black, or Hispanic neighborhood is likely different in Baltimore than in Salt Lake City. One feature of our relative share measure is that one unit increase relative to the mean roughly corresponds to a neighborhood with twice as many Asian, Black, or Hispanic residents as in the city as a whole.

Table 1 presents our estimates of where police patrol in America’s largest cities. Our smartphone data reveal a strong relationship between the racial and ethnic composition of a neighborhood and police presence. Relative to the average city neighborhood, our coefficient of 0.072 (0.0393 for Hispanic, 0.012 for Asian) in Table 1 suggests police spend 7.3% more time in a place with where the fraction of residents who are Black is twice the city’s share, 3.7% more time in a place with twice the share of Hispanic residents, and 1% more time in a place where twice as many neighborhood residents are Asian as in the city as a whole.

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6 Additional analyses when looking at race in absolute terms are discussed in Appendix A2 and similar results are observed.

7 Complete summary statistics for measures used in this paper are in Appendix Table A.2.
Why do these disparities exist? Differences in where police spend their time can reflect decisions made by individual officers and department-level directives, both of which involve assessing the “need” for police presence in an area. Such Department policies, officer decisions, and residential demand for police presence can all be influenced by the racial composition of the neighborhood. We use a multivariate regression framework to provide insight into why police tend to spend more time in places with relatively more Asian, Black, and Hispanic residents.\(^8\)

We begin by introducing proxies for residential demand. If officers spend more time in places where there are more people, variation in population density that is correlated with race may contribute to spatial differences in policing. Location decisions can also indicate residential demand for police presence. Residents may request that officers respond to crimes, and in particularly disadvantaged neighborhoods, police officers may be one of the few remaining providers of any social service (Lum 2021). Racial disparities in police presence may therefore stem from racial inequity in the quality of non-policing institutions.

A lack of educational opportunity and well-paying jobs are established root causes of crime (Messner and Rosenfeld 1997). Of course, neighborhoods where residents have low incomes but high social capital (e.g. high degrees of social cohesion and community engagement) are places where police rarely need to respond to acts of violence or property destruction (Sampson and Raudenbush 1999). Following Martin and Newman (2015), we measure social capital using the fraction of 2010 census forms returned by residents (Martin and Newman 2015). Finally, police officers go where violent crime exists. We estimate the crime-driven demand for police based on the location of homicides known to the police. While imperfect, police records of homicides are generally thought to be the most accurate, in the sense that reporting is unlikely to be as influenced by police presence as it may be for other types of crime (Levitt 1998). We calculate the log distance from the neighborhood center to the closest homicide in 2016, treating these rare events as an extreme expression of

\(^8\)For robustness check, we present results on other regression specifications in Appendix A3.
underlying social issues, implicitly assuming that this distance is negatively correlated with exposure to other types of crime. Additionally, we control for the number of homicides in 2016, by neighborhood, to account for potential high-end variation in crime.

In column 2 of Table 1, we condition our estimates of local police presence in different types of U.S. neighborhoods on measures of density, socioeconomic, demographics, social cohesion, and violence. Differential residential demand for police presence, some of which is created by decisions made in other policy domains, explains approximately 32% of the disparate exposure of people living in relatively Black neighborhoods, and can explain all of the additional exposure of people living in relatively Hispanic or Asian neighborhoods—even suggesting that more Asian neighborhoods have less police presence than one might expect based on social conditions. The residual correlation between racial composition and police presence in column 2 reflects independent decisions at the city, police command, and officer level.

In column 3, we include city-specific fixed effects, differencing out any preference of officials in cities with more concentrated non-White populations for a particular type of policing, that may cause the observed disparity. Focusing on variation in neighborhoods within cities, reduces the estimated extra time officers spend in more relatively Black neighborhoods by an additional 62%, and reduces the lighter policing of more Asian neighborhoods by 42%. Even though, on average, officers spend more time in neighborhoods with more Hispanic people, once we compare neighborhoods with different levels of residential demand for police in the same city, officers spend less time than expected in these places.

Finally, we compare how policing varies with the racial composition of a city’s police force. We include mean centered interactions between the relative share of Black residents and the share of patrol officers that are Black in column 4, and both the share of police supervisors and patrol officers that are Black in column 5. Both departmental measures are divided by the share of the city that is Black. Column 4 suggests the additional exposure to police in Black neighborhoods is smaller in cities with a larger share of Black officers. Column
5 implies that, conditional on the composition of patrol officers, increasing the share of command staff that is Black reduces the additional police presence in Black neighborhoods. In contrast to previous studies, conditional on the share of command that is Black, we find that employing more Black officers increases the exposure of people in Black neighborhoods to police. While correlational in nature, our findings suggest that efforts to hire more Black police officers without parallel efforts to retain and promote those officers may not reduce disparities in how the public is policed.

### 3.2 Disparity Heterogeneity

#### 3.2.1 Disparities over the course of a shift

Officers begin each shift at a station and, after receiving specific instructions about their daily tasks, leave to patrol their beat with relatively little oversight. Chalfin and Goncalves (2021) find that enforcement activity generally peaks midway through an officer’s shift, suggesting that the way officer spend their patrol time may vary over the course of a day. Figure A.11 and A.12 plot how much more time officers spend in more Black and more Hispanic places as their shift rolls out. In the first hour of an officer’s shift, the racial and ethnic composition of a neighborhood is not associated with where police actually patrol. The difference between how much time officers spend in Whiter versus more Hispanic places increases through the third hour. In places where more Black people live, the disparities in police time are most pronounced midshift, and then decline. This pattern is strikingly similar to the inverted u-shaped relationship between shift time and arrest activity observed in Chalfin and Goncalves (2021).\(^9\)

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\(^9\)Also similar to Chalfin and Goncalves (2021), we do not find strong differences in disparities associated with time of day (see Appendix Figure A.13 and A.14).
3.2.2 Cross-city variation in correlates of police presence

The percentage of spatial variation in police presence that can be explained by our socioeconomic measures of demand for policing in each city in our sample, and how much can be explained once we incorporate the neighborhood’s racial composition, is presented in Figure 3. Just as US policing is administratively decentralized, there is substantial variation in how policing is contextualized. In New York City, neither variation in socioeconomic status nor racial composition explain much of the spatial differences in police presence. Policing in El Paso is more closely tied to differences in predicted demand for police and, when divorced from its relationship to socioeconomic status, race plays little additional role. In contrast, race appears to be independently influential in both Austin and Detroit, where spatial variation in estimated demand for police both is highly (Austin) and not at all (Detroit) explanatory on its own.

4 Using Police Presence to Understand Enforcement

The empirical observation that police are more ambiently present in Non-White neighborhoods provides support for the construct validity of our data, as this correlation has been repeatedly demonstrated at the city level (Carmichael and Kent 2014). It does not, on its own, lead to strong normative conclusions. However, when taken in the context of existing qualitative and legal scholarship on modern policing, it raises equity concerns.

Past research highlights how the increased use of surveillance (either remotely or in person) by law enforcement and algorithmic policing can reinforce existing racial disparities, even in the absence of differential criminal behavior by residents (Ba et al. 2021; Brayne 2020). Our measure of police presence can quantify the extent to which variation in ambient police presence, rather than differences in the enforcement behavior of officers in different neighborhood contexts, can explain disparities in police enforcement contact.

Consistent with studies of down-funnel measures of policing, Table 2 confirms that in
the six cities for which we have both police presence and arrest data, officers spend more
time, and make more arrests in places with higher relative Black shares.\textsuperscript{10} In addition,
officers appear to make almost 24\% more arrests per hour present in neighborhoods were the
share of residents who are Black is twice the city’s share.\textsuperscript{11} This could be due to Becker-style
discrimination, where police use different standards to determine if people in different groups
are suspicious enough to warrant an arrest, or differences in when police officers choose or
are directed to spend time in these neighborhoods.\textsuperscript{12} Whatever the source, this disparity
in the propensity of an officer to make an arrest explains less than 1/2 of the disparity in
the total number of arrests made. This implies that the added time that police spend in
Black neighborhoods is a central source of Black-White disparities in arrests, in addition
to an officer’s specific decision in a particular encounter. Consistent with Meares (2015),
our results suggest that, in terms of police reforms aimed at reducing disparities in criminal
justice contact, attention to reducing the scope for racial bias at both the incident and
programmatic level is warranted.

5 Conclusion

We conclude by noting that a positive correlation in the provision of policing and the concen-
tration of Black residents contrasts with documented spatial patterns of other institutional
investment in neighborhoods with concentrated Black populations. Census tracts where
more of the residential population is Black are less, not more, likely to have a large grocery
store, nearby hospital, or local banking services (Walker, Keane and Burke 2010, DeYoung
et al. 2008, Lieberman-Cribbin et al. 2020, Yearby 2018). During the 2016 election, Chen

\textsuperscript{10}The six cities are: Chicago, Philadelphia, San Antonio, Columbus, Seattle and Nashville.
\textsuperscript{11}In contrast to our findings regarding the source of Black-White arrest disparities, smart phone data do
not suggest that differences in police presence are an important source of Hispanic-White arrest disparities.
Appendix Table A.8 also reveals a highly similar pattern regarding stop disparities.
\textsuperscript{12}This type of Becker-style discrimination is not necessarily illegal; Illinois v Wardlow, 528 U. S. 119 (2000)
established that officers can use the predetermined designation of an area as “high crime” in determining
how likely it is someone has (or is) engaged in crime, creating a legal basis for a stop. If places with more
Black or Hispanic residents are more likely to be known as “high crime” places to police, then this would
lower the standard of individualized suspicion needed to make a constitutionally permissible stop.
et al. (2019) found that voting lines moved more slowly in places with larger Black popu-
lations, suggesting underinvestment in polling services in places where we observe more
investment in ambient policing.

Our data are well suited to further research on policing in the United States. First,
smartphone location data provide insight into officer presence in communities that traditional
measures of policing cannot fully capture. Measuring officer presence informs estimates of
which communities are at risk of more serious police encounters, like arrest or the use of
lethal force. Second, our smartphone location data do not depend on software purchased
by or developed for a particular policing agency, allowing us to map officer locations in
cities across the United States using a consistent methodology. This is an advantage over
technologies like AVL and body cameras, because it provides enhanced visibility into the
unreported and highly discretionary activities of police officers at work. Finally, data on
where officers actually spend their time grants researchers and practitioners new abilities
to understand patterns in police presence and track the implementation of departmental
policies that shape the provision of public safety.
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Figure 1: The Spatial Distribution of Police Exposure

Notes: Each panel shows block-group level values of our police exposure measure, for Chicago (A), New York (B), Los Angeles (C), and Houston (D). Colors run from light to dark as police exposure increases, and are shaded by city-specific quantiles.
Figure 2: The Number of Arrests vs. Police Hours Across Block Groups

Notes: Each panel presents a binned scatter plot of the number of arrests vs. the police hours observed in the block groups, with both variables measured in arsinh values. Block groups are grouped into 20 equal size bins. Correlation coefficient between the two measures (in arsinh values) is reported in each panel.
Figure 3: Variance of Police Hours Explained by Socioeconomics, Crime, and Race

Notes: Socioeconomic characteristics variables include Log Population, % College Graduates, Median Household Income, Census Form Return Rate, Crime variables include Log Distance to Nearest Homicide and Homicide Count in 2016. Relative racial share variables include relative Black share, relative Hispanic share, and relative Asian share, defined as the ratio of percent Black (Hispanic, Asian) in BG to percent Black (Hispanic, Asian) in the city.
Table 1: Disparities in Neighborhood Police Exposure

| VARIABLES | (1) | (2) | (3) | (4) | (5) |
|-----------|-----|-----|-----|-----|-----|
| Police Exposure in a Census Block Group: arsinh(Hours) | | | | | |
| Relative Black Share | 0.0718*** | 0.0401*** | 0.0184* | 0.0505*** | 0.0666*** |
| | (0.00726) | (0.00796) | (0.00737) | (0.00811) | (0.00839) |
| Police: Relative Black | -0.400*** | -0.272*** | | | |
| | (0.0337) | (0.0629) | | | |
| Relative Black Share X Police: Relative Black | -0.0653*** | 0.0847+ | | | |
| | (0.0250) | (0.0442) | | | |
| Supervisor: Relative Black | -0.0737* | | | | |
| | (0.0318) | | | | |
| Relative Black Share X Supervisor: Relative Black | -0.0899*** | | | | |
| | (0.0203) | | | | |
| Relative Hispanic Share | 0.0393*** | 0.0157 | -0.0149 | 0.0166 | 0.0283* |
| | (0.00905) | (0.0105) | (0.00989) | (0.0109) | (0.0111) |
| Relative Asian Share | 0.0120+ | -0.0198*** | -0.0124* | -0.0186** | -0.00841 |
| | (0.00648) | (0.00563) | (0.00552) | (0.00593) | (0.00637) |
| Log Population | 0.376*** | 0.363*** | 0.416*** | 0.424*** | |
| | (0.0197) | (0.0198) | (0.0205) | (0.0210) | |
| % College Graduates | 0.947*** | 0.813*** | 0.976*** | 1.053*** | |
| | (0.0579) | (0.0570) | (0.0593) | (0.0611) | |
| Median Household Income (1K) | -0.00620*** | -0.00459*** | -0.00601*** | -0.00569*** | |
| | (0.000369) | (0.000362) | (0.000378) | (0.000380) | |
| Census Form Return Rate | -0.814*** | -1.313*** | -0.511*** | -0.613*** | |
| | (0.119) | (0.121) | (0.124) | (0.128) | |
| Log distance to nearest homicide (km) | 0.00469 | -0.138*** | 0.0191*** | 0.0268*** | |
| | (0.00564) | (0.0116) | (0.00571) | (0.00667) | |
| Homicide Count 2016 | 0.286*** | 0.143*** | 0.308*** | 0.308*** | |
| | (0.0210) | (0.0220) | (0.0218) | (0.0223) | |

Observations | 24,571 | 23,381 | 23,381 | 21,821 | 20,972 |
R-squared | 0.005 | 0.051 | 0.167 | 0.059 | 0.063 |
Fixed effects | NA | NA | City | NA | NA |

Notes: This table presents OLS estimates of exposure disparities among census block groups (BGs) across (Column 1,2,4,5) and within 23 large cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares are defined as the ratio of % Black (Hispanic, Asian) in a BG to the % in that city, Police (Supervisor) Relative Black defined as the ratio of % Black of a department’s sworn officers (supervisors) to the % in that city. The dependent variable is police hours observed in a BG (excluding pings moving faster than 50 mph), transformed into arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses, and standard errors clustered at the tract level are reported in the Appendix. Results are qualitatively and quantitatively similar to running all regressions with log independent values and dropping zero-valued observations.
Table 2: Disparities in Neighborhood Police Exposure and Downstream Disparities

| VARIABLES                     | (1) arsinh(Hours) | (2) arsinh(Arrests) | (3) arsinh(Arrests/Hour) | (4) arsinh(Hours) | (5) arsinh(Arrests) | (6) arsinh(Arrests/Hour) |
|-------------------------------|-------------------|---------------------|--------------------------|------------------|-------------------|--------------------------|
| Relative Black Share          | 0.160***          | 0.439***            | 0.219***                 | 0.0465*          | 0.212***          | 0.109***                 |
|                               | (0.0154)          | (0.0252)            | (0.0175)                 | (0.0184)         | (0.0231)          | (0.0187)                 |
| Relative Hispanic Share       | 0.0361*           | 0.226***            | 0.161***                 | -0.0541**        | 0.104***          | 0.109***                 |
|                               | (0.0154)          | (0.0198)            | (0.0169)                 | (0.0176)         | (0.0202)          | (0.0188)                 |
| Relative Asian Share          | 0.0626***         | -0.00349            | -0.0619***               | 0.0140           | -0.0178           | -0.0401***               |
|                               | (0.0128)          | (0.0139)            | (0.00907)                | (0.0131)         | (0.0133)          | (0.00938)                |
| Log Population                | 0.469***          | -0.0307             | -0.259***                | 0.557***         | 0.278**           | -0.320***                |
|                               | (0.0401)          | (0.0381)            | (0.0318)                 | (0.110)          | (0.101)           | (0.0972)                 |
| % College Graduates           | -0.06765***       | -0.000448           | 0.00327***               | (0.0008355)      | (0.000762)        | (0.000719)               |
| Median Household Income (1K)  | -1.173***         | -4.717***           | -2.276***                | (0.265)          | (0.276)           | (0.243)                  |
| Census Form Return Rate       | -0.0621***        | -0.156***           | -0.0695***               | (0.00920)        | (0.00818)         | (0.00846)                |
| Homicide Count 2016           | 0.140***          | 0.299***            | 0.122***                 | (0.0299)         | (0.0292)          | (0.0277)                 |
| Observations                  | 5,940             | 5,940               | 5,876                    | 5,604            | 5,604             | 5,542                    |
| R-squared                     | 0.020             | 0.127               | 0.065                    | 0.092            | 0.306             | 0.131                    |

Notes: The sample of six cities with arrest data include: Chicago, Philadelphia, San Antonio, Columbus, Seattle and Nashville. All race variables are mean-centered, relative Black (Hispanic, Asian) shares are defined as the ratio of % Black (Hispanic, Asian) in a BG to the % in that city, Police (Supervisor) Relative Black defined as the ratio of % Black of a department’s sworn officers (supervisors) to the % in that city. The dependent variables are: police hours observed in a BGs (excluding pings moving faster than 50 mph, mean 15.6), number of arrests in that BG (mean 9.2), and the ratio of those two measures (mean 5.1), all transformed into arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses, and standard errors clustered at the tract level are reported in the Appendix. Results are qualitatively and quantitatively similar to running all regressions with log independent values and dropping zero-valued observations.
Online Appendix
Measuring Police Presence in US Cities using Smartphone Data

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1 Other Data Sources: Description

Census demographics data. Census block group, and city characteristics data come from American Community Survey (ACS) 2013-2017 5-year estimates. We collect data on block group’s racial composition (percent Black, Hispanic, and Asian), population, median household income, percent college graduates, and census form mail return rate. At the city level, we collect data on the 23 cities’ racial composition (percent Black, White, Hispanic, and Asian).

Homicide data. Homicide data is collected by Washington Post covering homicide information (including latitude-longitude location, arrest decision, victim demographics) from 2007 to 2017 in the 50 largest U.S. cities (?). The definition of homicides follows the FBI’s Uniform Crime Reporting Program, including murder and nonnegligent manslaughter while excluding suicides, accidents, justifiable homicides, and deaths caused by negligence. We use records of homicide to measure crime-driven demand for policing given the high accuracy of homicide reporting.

The Law Enforcement Management and Administrative Statistics (LEMAS) data. The LEMAS data contains information on police officers’ demographics, salaries, and functions, as well as on agencies’ duties, structures, and policies for 3499 local law enforcement agencies in 2016 (?). We obtain the racial composition of full time sworn officers and supervisors for 23 cities’ police departments to compare with the imputed race for smartphone users. Among the 23 cities, the Indianapolis Metropolitan police department is not included in the LEMAS data, while the Phoenix Police Department and the San Antonio Police Department have missing data on officers’ and supervisors’ race respectively.

FBI Uniform Crime Report (UCR) - Law Enforcement Officers Killed or Assaulted (LEOKA) data. UCR-LEOKA data contains measures of officers that are killed or assaulted and total officer employment each year at the city departmental level (?). We compare the police employee counts (with and without arrest powers) in the 2017 UCR-LEOKA data with our counts of qualified smartphones that visit the police stations.
at least five times a month.

**NYPD Officer Home Zip Code data.** Data on NYPD police officers’ home zip code comes from ? that submits a Freedom of Information Law (FOIL) request to the NYPD. The data reports the number of police officers that live in a specific zip code and patrol in a specific precinct. We calculate the total number of police officers that live in a zip code across all precincts to compare with the police officer counts that we infer to “live” in that zipcode from the smartphone location data.

**Police Action data.** We collect geocoded data on recorded police action (e.g. stops, arrests, frisks, and searches) for eight cities from multiple sources. Chicago police department stop and arrest data comes from ?, and Philadelphia police stop, arrest, frisk and search data comes from its open data portal.¹ For the rest of the six cities’ police departments (Columbus, Houston, Nashville, Oklahoma City, San Antonio, and Seattle), we obtain stop data (along with arrest, search, and frisk records for some of these cities) from the Stanford Open Policing Project (?). For each city, we match the latitude-longitude location of police action to a census block group and calculate the number of stops (or arrests, frisks, searches) across the year for each block group to compare with the smartphone data’s measure of police presence. We use the year that is closest to 2017: for Houston, Nashville, Philadelphia, and San Antonio, we use data in 2017; for Columbus and Oklahoma City, we use data in 2016; for Seattle and Chicago, we use data in 2015. One caveat is that some records of police action are missing location information. While the missing records usually account for less than 5% of the observations for most cities, 13.49% of the stop records have missing location information for the Chicago Police Department.

¹https://www.opendataphilly.org/dataset/vehicle-pedestrian-investigations/
2 More Results

2.1 Summary Statistics

We begin by reporting the summary statistics for the policing measures and control variables, all measured at the census block group level in Table A.2. Police hours are positively and highly skewed but become more normally distributed after an inverse hyperbolic sine transformation. On average, block groups in the 23 cities are 23% Black (non-Hispanic), 29.2% Hispanic, and 8.4% Asian, and the racial composition for the average block group is roughly representative of the city’s racial composition.

2.2 Detailed Regression Results

This section reports more detailed regression results to complement Table 1 in the main paper. In Table A.3, we sequentially condition our estimates of police presence in U.S. neighborhoods on measures of population (column 2), socioeconomic status (column 3), social capital (column 4) and crime-driven demand for policing (column 5). In Column 6, we include city fixed effects to decompose the variation of police presence within versus between cities. The fact that police spend more time in places where there are more people can essentially explain all of the difference in exposure of Asian people to police presence, and 60% of the increased exposure of Hispanic people to police, but not the increased exposure of Black people. Income-related inequality explains 12% of the differential exposure of Black people to police, and conditional on household income, police spend less time in Asian neighborhoods. Our measure of social capital correlates highly with police presence and reduces the residual correlation between relative Black share and policing by 20%. Conditional on our measures of crime-driven demand for policing further explains a small amount of the additional police presence in Black neighborhoods.

In Table A.4, we include mean centered interactions between the relative share of Black residents and the share of patrol officers that are Black (column 1, 4), the share of police
supervisors that are Black (column 2, 5), and both the share of police supervisors and patrol officers that are Black (column 3, 6), all variables divided by the share of the city population that is Black. We observe that additional exposure to police for Black neighborhoods is less seen in cities with a larger share of Black patrol officers, as well as in cities with a larger share of Black supervisors, a stable pattern regardless of conditioning on local demand for policing. When including both interaction with fraction of officers and supervisors that are Black, we find additional Black supervisors play a major role in reducing the exposure of people in Black neighborhoods to police, conditional on the fraction of officers that are Black.

2.3 Number of “Shifts” as the Dependent Variable

Our measure of police presence in the main paper is the number of officer-hours spent in the neighborhood. In this section, we re-estimate the regressions in Table 1, replacing the dependent variable using another measure of police presence, the number of “shifts” observed in the block groups. Rather than measuring the “dosage” of police presence as officer hours, this measure captures the frequency of police visits to neighborhoods (?).

Column 1 in Table A.5 reveals that a neighborhood that is more Black or more Hispanic than the city average has more frequent visits from police officers, but this pattern is not observed in relatively more Asian neighborhoods. Column 2 shows that local demand for policing variables explain to a large extent, the higher frequencies of police visits in more Black and Hispanic neighborhoods. Unlike the pattern of police hours, Column 3 shows that restricting the comparison among neighborhoods within the same city eliminates most disparities in the number of “shifts” for Black and Hispanic neighborhoods, with fewer “shifts” observed in relatively more Asian neighborhoods. This indicates that, though police in the same city visit neighborhoods of different races at similar frequencies conditional on neighborhood characteristics, police officers still tend to spend more time in neighborhoods that have relatively more Black residents. One potential explanation is that while police officers’ “shift” location is mostly determined by neighborhood characteristics and crime
that could factor into the police department’s deployment decision, police officers still have
discretion in choosing how much time to spend in different neighborhoods. Finally, consistent
with Table 1, a cross-city comparison of supervisors’ and patrol officers’ race in column 4
and 5 reveals a relatively greater role of supervisor’s race in dictating police officer’s shift
locations.

2.4 Race in Absolute Shares

In this section, we examine the relationship between officer hours observed and neighborhood
race in absolute shares of race to complement the main analysis. Table A.6 re-estimates the
specification in the main paper, replacing races in relative shares with races in absolute
shares. Similarly, Table A.7 estimates the exposure disparity in neighborhoods that are
majority Black, White, Hispanic and Asian, where mixed-race neighborhood is the base
group.

The results from Table A.6 and Table A.7 reflect a very similar pattern as using relative
racial shares with some subtle differences. We find more police presence in neighborhoods
that have a higher fraction of Black or Hispanic residents in absolute terms. Importantly,
this increased police presence only decreases by a small fraction when conditional on other
socioeconomic characteristics reflecting demand for policing, and city-specific fixed effects
(Column 6, Table A.6). However, we do not find a robust pattern of more officer-hours in
neighborhoods with a higher fraction of Asian residents, potentially as most neighborhoods
have a low share of Asian residents. Additionally, Table A.7 shows that relative to mixed
race neighborhoods, police presence is significantly and consistently lower in predominantly
White and Asian neighborhoods, and a robust and persistent Black-White gap in police
presence is observed under all specifications.
3 Robustness

3.1 Alternative Police Presence Measure

In the main analysis, we make several restrictions and assumptions to define what consists of police “shifts” for police presence measurement. Here, we perform several analyses to show that our results are also robust to various definitions of “shifts”. First, we exclude “shifts” fewer than eight hours to calculate the police hours measure. Table A.9 shows that the estimates are largely consistent with our central estimates under this definition of police presence.

To capture potential overtime shifts that are longer than 12 hours, we also relax the constraint on the duration of the home visits that bracket the “shifts”. In Table A.10 and Table A.11, we use all “shifts” bracketed by home visits that are no more than 18 and 24 hours apart when computing the police presence measure respectively, and find a slight increase in the estimates of presence disparity. Additionally, to remove potential “shifts” by administrative staffs instead of patrol officers, we drop “shifts” when the duration of pings that are inside police stations is over 3 hours. Table A.12 reveals that the regression estimates barely change under this definition of police hours.

We present additional results where we recalculate the police presence measure using all pings of any speed or using pings moving no faster than 25 mphs. Replicating the same regressions, Table A.13 and Table A.14 find that the estimates in both tables are substantively similar to the results in Table 1 in the main paper.

3.2 Alternative Regression Specifications

In this section, we re-estimate our models using alternative specifications. In Table A.15 and A.16, we replace the dependent variables by taking a log transformation, rather than the inverse hyperbolic sine transformation in the main paper and find that the estimates are fundamentally unchanged. To account for potential spatial correlation, we cluster the
standard errors at the census tract level in Table A.17 and Table A.18.

3.3 Sensitivity to Visitors’ Foot Traffic

We also perform sensitivity checks to show that our results are robust to removing foot traffic from non-residents. First, we examine police presence during non-working hours between 9 am to 5pm on weekdays. Table A.19 replicates the same regressions with the non-working hours police presence and reveals a strikingly similar pattern. Figure A.13 and Figure A.14 also plot the disparities in police presence at different hours of day, and similar to ?, we do not find strong differences in disparities associated with time of day.

We complement the above analysis by examining police presence in New York City that accounts for the largest number of block groups (N = 6,226). We test the sensitivity of the NYC police presence to visitor foot traffic by running regressions where we exclude block groups in Precinct 1 (Wall Street), 6 (the West Village), 8 (Penn Station, Grand Central), 14 (Midtown South) and 18 (Midtown North). Comparing the estimates of exposure disparities for NYC where we include every block group in NYPD precincts (column 1-2) or exclude block groups in five NYPD precincts (column 3-4) in Table A.20, we obtain similar estimates in both models, suggesting that our results are insensitive to the exclusion of precincts with non-residential foot traffic.
Notes: The spatial pattern of smartphone pings is categorized as either Home, Other, or Work. Smartphone is “at home” if the ping location is at the Home Geohash-7 (a 150 x 150 m grid); “at Work” if the ping location is in any police stations’ building boundaries. Pings observed at locations other than “Home” and “Work” are classified as “Other”.

Figure A.1: Spatial Pattern of Pings of a Smartphone Observed in LAPD
Figure A.2: Police Officer Validation at the City Level

Notes: Total Employee Counts on the y-axis reports the number of officers (with or without arrest power) in each city’s police department in 2017. Smartphones Counts reports the number of smartphones visiting the city’s local police stations for at least 5 days in any one month during Feb 2017 to Nov 2017. Correlation coefficient between the two measures is reported.
Figure A.3: LEMAS % Black of Police Force vs. Smartphone % Black

Intercept: .017, Slope: 1.019
Figure A.4: LEMAS % White of Police Force vs. Smartphone % White

Police Actual % White vs. Smartphone Imputed % White

 Intercept: .026, Slope: 1.009
Figure A.5: LEMAS % Hispanic of Police Force vs. Smartphone % Hispanic

Police Actual % Hispanic vs. Smartphone Imputed % Hispanic

Intercept: -0.016, Slope: 1.04
Figure A.6: Police officer validation: residence-based check for NYPD officers at the zip code level.

Notes: This figure presents a binned scatter plot of the number of smartphones from NYPD that we infer to live in a zip code vs. the actual number of NYPD police officers living in a zip code from (24) who submits a FOIL request to NYPD, both transformed in arsinh values. We include all zip codes in the FOIL request data, with zip codes grouped into 20 equal-sized bins. Correlation coefficient between the two measures (in arsinh values) is reported.
Figure A.7: Correlation Between % Black and Officers per capita in a City

Per Capita Officers vs. % Black in Cities

Notes: Per capita officers is defined as the number of likely patrol officers on “shift” divided by the city population. We identify patrol officers on “shift” by looking for a specific pattern for smartphones that visits at least 5 days in a month: Leaving “home”, traveling to a police station, moving around the city (without returning home), returning to the police station, and then going home. The correlation coefficient between the two measures is reported.
Notes: Each panel presents a binned scatter plot of number of stops vs. the police hours observed in the block groups, with both variables transformed in arsinh values. Block groups are grouped into 20 equal-sized bins. Correlation coefficient between the two measures (in arsinh values) is reported in each panel. See supplemental material S3 for more details on the construction of both measures.
Figure A.9: The Number of Searches vs. Police Hours Across Block Groups

Notes: Each panel presents a binned scatter plot of the number of searches vs. the police hours observed in the block groups, with both variables transformed in arsinh values. Block groups are grouped into 20 equal-sized bins. Correlation coefficient between the two measures (in arsinh values) is reported in each panel. See supplemental material S3 for more details on the construction of both measures.
Figure A.10: The Number of Frisks vs. Police Hours Across Block Groups

Notes: Each panel presents a binned scatter plot of number of frisks vs. the police hours observed in the block groups, with both variables transformed in arsinh values. Block groups are grouped into 20 equal-sized bins. Correlation coefficient between the two measures (in arsinh values) is reported in each panel. See supplemental material S3 for more details on the construction of both measures.
Figure A.11: Black Disparity in Police Presence by Hour of the Shift

Notes: Figure plots coefficients of relative Black share from a regression where police presence in each hour of shifts is regressed against the relative share of Black, Hispanic and Asian population.
Figure A.12: Hispanic Disparity in Police Presence by Hour of the Shift

Notes: Figure plots coefficients of relative Black share from a regression where police presence in each hour of shifts is regressed against the relative share of Black, Hispanic and Asian population.
Notes: Figure plots coefficients of relative Black share from a regression where police presence in each hour of shifts is regressed against the relative share of Black, Hispanic and Asian population.
Figure A.14: Hispanic Disparity in Police Presence by Hour of Day

Notes: Figure plots coefficients of relative Black share from a regression where police presence in each hour of shifts is regressed against the relative share of Black, Hispanic and Asian population.
Table A.1: Racial Composition: Smartphone Measure vs. LEMAS

| VARIABLES               | (1)               | (2)               | (3)               | (4)               |
|-------------------------|-------------------|-------------------|-------------------|-------------------|
| Police: % White         | 0.618***          |                   |                   |                   |
|                         | (0.102)           |                   |                   |                   |
| Smartphone: % White     |                   | 0.646***          |                   |                   |
|                         |                   | (0.156)           |                   |                   |
| City % White            |                   |                   | 0.522***          |                   |
|                         |                   |                   | (0.134)           |                   |
| Smartphone: % Black     |                   |                   |                   | 0.465***          |
|                         |                   |                   |                   | (0.144)           |
| City % Black            |                   |                   |                   | 0.186**           |
|                         |                   |                   |                   | (0.0797)          |
| Smartphone: % Hispanic  |                   |                   |                   | 0.849***          |
|                         |                   |                   |                   | (0.0838)          |
| City % Hispanic         |                   |                   |                   | 0.186**           |
|                         |                   |                   |                   | (0.0797)          |
| Smartphone: % Asian     |                   |                   |                   | 0.608***          |
|                         |                   |                   |                   | (0.170)           |
| City % Asian            |                   |                   |                   | -0.0135           |
|                         |                   |                   |                   | (0.148)           |
| Constant                | -0.0122           | -0.00776          | -0.0287***        | -0.00262          |
|                         | (0.0309)          | (0.0148)          | (0.00966)         | (0.00288)         |
| Observations            | 21                | 21                | 21                | 21                |
| R-squared               | 0.919             | 0.905             | 0.969             | 0.934             |

Notes: Police % White (Black, Hispanic, Asian) represents measures of racial composition from LEMAS data. Smartphone: % White (Black, Hispanic, Asian) denotes the smartphone-imputed racial composition based on home blocks. City % White (Black, Hispanic, Asian) denotes the share of population that is identified as White (Black, Hispanic, Asian) in the city. Robust standard errors are reported in parentheses.
Table A.2: Summary Statistics

| Variable                          | Obs  | Mean  | Std. Dev. | Min   | Max   |
|-----------------------------------|------|-------|-----------|-------|-------|
| **Police Presence:**              |      |       |           |       |       |
| Hour                             | 24688| 15.605| 128.244   | 0     | 11404.66 |
| arsinh(Hours)                    | 24688| 1.939 | 1.369     | 0     | 10.035 |
| Number of Shifts                 | 24688| 44.907| 102.444   | 0     | 5413  |
| arsinh( Number of Shifts)       | 24688| 3.706 | 1.317     | 0     | 9.29  |
| **Neighborhood Characteristics:**|      |       |           |       |       |
| % Black                          | 24571| .23   | .307      | 0     | 1     |
| % Hispanic                       | 24571| .292  | .29       | 0     | 1     |
| % Asian                          | 24571| .084  | .137      | 0     | .983  |
| Relative Black Share             | 24571| .003  | 1.29      | -1.014| 11.682|
| Relative Hispanic Share          | 24571| 0     | .974      | -.946 | 11.945|
| Relative Asian Share             | 24571| 0     | 1.532     | -.895 | 63.569|
| Black Majority                   | 24571| .192  | .394      | 0     | 1     |
| White Majority                   | 24571| .363  | .481      | 0     | 1     |
| Hispanic Majority                | 24571| .243  | .429      | 0     | 1     |
| Asian Majority                   | 24571| .026  | .161      | 0     | 1     |
| Population                       | 24688| 1427.356| 818.29    | 0    | 18369 |
| % College Graduates              | 24568| .341  | .252      | 0     | 1     |
| Median Household Income (1K)     | 23386| 62.816| 38.248    | 2.499 | 250.001|
| Census Form Return Rate          | 24559| .738  | .088      | 0     | 1     |
| Distance to nearest homicide (km)| 24688| 27.974| 144.061   | .001  | 1008.614|
| Homicide Count 2016              | 24688| .146  | .463      | 0     | 7     |
Table A.3: Disparities in Neighborhood Police Exposure

| VARIABLES                              | (1)      | (2)      | (3)      | (4)      | (5)      | (6)      |
|----------------------------------------|----------|----------|----------|----------|----------|----------|
|                                        | Police Exposure in a Census Block Group: arsinh(Hours) | Police Exposure in a Census Block Group: arsinh(Hours) | Police Exposure in a Census Block Group: arsinh(Hours) | Police Exposure in a Census Block Group: arsinh(Hours) | Police Exposure in a Census Block Group: arsinh(Hours) | Police Exposure in a Census Block Group: arsinh(Hours) |
| Relative Black Share                   | 0.0718***| 0.0714***| 0.0628***| 0.0504***| 0.0401***| 0.0184*  |
|                                        | (0.00726)| (0.00717)| (0.00789)| (0.00802)| (0.00796)| (0.00737) |
| Relative Hispanic Share                | 0.0393***| 0.0158+   | 0.0193+   | 0.0125   | 0.0157   | -0.0149  |
|                                        | (0.00888)| (0.0104) | (0.0104) | (0.0105) | (0.0105) | (0.00989) |
| Relative Asian Share                   | 0.0120+   | -0.00296 | -0.0195***| -0.0237***| -0.0198***| -0.0124*  |
|                                        | (0.00648)| (0.00596)| (0.00563)| (0.00560)| (0.00563)| (0.00552) |
| Log Population                         | 0.288***  | 0.379***  | 0.382***  | 0.376***  | 0.363***  | 0.363***  |
|                                        | (0.0193) | (0.0198) | (0.0197) | (0.0197) | (0.0197) | (0.0198) |
| % College Graduates                    | 0.869***  | 0.894***  | 0.947***  | 0.813***  | 0.813***  | 0.813***  |
|                                        | (0.0576) | (0.0576) | (0.0579) | (0.0579) | (0.0579) | (0.0579) |
| Median Household Income (1K)           | -0.00694***| -0.00640***| -0.00620***| -0.00459***| -0.00459***| -0.00459*** |
|                                        | (0.000361)| (0.000370)| (0.000369)| (0.000362)| (0.000362)| (0.000362) |
| Census Form Return Rate                | -0.861***| -0.814***| -1.313*** |          |          |          |
|                                        | (0.117)  | (0.119)  | (0.121)  |          |          |          |
| Log distance to nearest homicide (km)  | 0.00469   | -0.138***|          |          |          |          |
|                                        | (0.00564)| (0.0116) |          |          |          |          |
| Homicide Count 2016                    | 0.286***  | 0.143***  |          |          |          |          |
|                                        | (0.0210) | (0.0220) |          |          |          |          |
| Observations                           | 24,571    | 24,571    | 23,386    | 23,381    | 23,381    | 23,381    |
| R-squared                              | 0.005     | 0.017     | 0.040     | 0.042     | 0.051     | 0.167     |
| Fixed effects                          | NA        | NA        | NA        | NA        | NA        | City      |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1-5) and within cities (Column 6). Relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city. The dependent variable is police hours observed in BGs (excluding pings moving faster than 50 mph), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.4: The Role of Police Officers’ and Supervisors’ Race in Neighborhood Police Exposure

| VARIABLES                          | (1)          | (2)          | (3)          | (4)          | (5)          | (6)          |
|------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Police Exposure in a Census Block Group; arsinh(Hours) |              |              |              |              |              |              |
| Relative Black Share               | 0.0677***    | 0.0804***    | 0.0716***    | 0.0565***    | 0.0710***    | 0.0666***    |
|                                    | (0.00734)    | (0.00734)    | (0.00749)    | (0.00811)    | (0.00822)    | (0.00839)    |
| Relative Hispanic Share            | 0.0272**     | 0.0433***    | 0.0260**     | 0.0166       | 0.0424***    | 0.0283*      |
|                                    | (0.00935)    | (0.00939)    | (0.00938)    | (0.0109)     | (0.0112)     | (0.0111)     |
| Relative Asian Share               | 0.0135+      | 0.0208**     | 0.0224**     | -0.0186**    | -0.00985     | -0.00841     |
|                                    | (0.00706)    | (0.00741)    | (0.00790)    | (0.00693)    | (0.00611)    | (0.00637)    |
| Log Population                     | 0.416***     | 0.403***     | 0.424***     |              |              |              |
|                                    | (0.0205)     | (0.0206)     | (0.0210)     |              |              |              |
| % College Graduates                | 0.976***     | 1.047***     | 1.053***     |              |              |              |
|                                    | (0.0593)     | (0.0595)     | (0.0641)     |              |              |              |
| Median Household Income (1K)       | -0.00601***  | -0.00590***  | -0.00569***  |              |              |              |
|                                    | (0.000378)   | (0.000374)   | (0.000380)   |              |              |              |
| Census Form Return Rate            | -0.511***    | -0.652***    | -0.613***    |              |              |              |
|                                    | (0.124)      | (0.125)      | (0.128)      |              |              |              |
| Log distance to nearest homicide (km) | 0.0191***  | 0.0312***    | 0.0263***    |              |              |              |
|                                    | (0.00571)    | (0.00619)    | (0.00667)    |              |              |              |
| Homicide Count 2016                | 0.308***     | 0.311***     | 0.308***     |              |              |              |
|                                    | (0.0218)     | (0.0220)     | (0.0223)     |              |              |              |
| Police: Relative Black             | -0.341***    | -0.171**     | -0.400***    | -0.272***    |              |              |
|                                    | (0.0326)     | (0.0592)     | (0.0337)     | (0.0629)     |              |              |
| Relative Black Share X Police: Relative Black | -0.0686** | 0.107*       | -0.0653**    | 0.0847+      |              |              |
|                                    | (0.0246)     | (0.0453)     | (0.0250)     | (0.0442)     |              |              |
| Supervisor: Relative Black         | -0.150***    | -0.0838**    | -0.182***    | -0.0737*     |              |              |
|                                    | (0.0155)     | (0.0280)     | (0.0170)     | (0.0318)     |              |              |
| Relative Black Share X Supervisor: Relative Black | -0.0597*** | -0.0990***   | -0.0581***   | -0.0890***   |              |              |
|                                    | (0.0114)     | (0.0213)     | (0.0114)     | (0.0203)     |              |              |
| Observations                       | 22,988       | 23,058       | 22,107       | 21,821       | 21,909       | 20,972       |
| R-squared                          | 0.009        | 0.010        | 0.010        | 0.059        | 0.060        | 0.063        |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities and how is moderated by the fraction of police officers and supervisors that are Black. All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is police hours observed in BGs (excluding pings moving faster than 50 mph), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.5: Disparities in Neighborhood Police Exposure, Measured by Number of Shifts Observed

| VARIABLES                          | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  |
|------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Police Exposure in a Census Block Group: arsinh(Number of Shifts) |                      |                      |                      |                      |                      |
| Relative Black Share               | 0.0651***            | 0.0103               | -0.0115              | 0.0197*              | 0.0339***            |
|                                    | (0.00720)            | (0.00788)            | (0.00728)            | (0.00785)            | (0.00820)            |
| Relative Hispanic Share            | 0.0530***            | 0.0216*              | -0.0138              | 0.0165               | 0.0263*              |
|                                    | (0.00930)            | (0.0107)             | (0.0104)             | (0.0109)             | (0.0112)             |
| Relative Asian Share               | -0.000483            | -0.0258***           | -0.0193**            | -0.0212**            | -0.0126+             |
|                                    | (0.00663)            | (0.00646)            | (0.00628)            | (0.00676)            | (0.00718)            |
| Log Population                     | 0.201***             | 0.238***             | 0.234***             | 0.245***             |                      |
|                                    | (0.0182)             | (0.0179)             | (0.0187)             | (0.0192)             |                      |
| % College Graduates                | 0.917***             | 0.772***             | 0.932***             | 0.985***             |                      |
|                                    | (0.0562)             | (0.0543)             | (0.0565)             | (0.0582)             |                      |
| Median Household Income (1K)       | -0.00600***          | -0.00476***          | -0.00588***          | -0.00561***          |                      |
|                                    | (0.000375)           | (0.000353)           | (0.000377)           | (0.000381)           |                      |
| Census Form Return Rate            | -1.435***            | -1.311***            | -1.030***            | -1.058***            |                      |
|                                    | (0.112)              | (0.112)              | (0.114)              | (0.118)              |                      |
| Log distance to nearest homicide (km) | -0.0489***           | -0.233***            | -0.0314***           | -0.0235***           |                      |
|                                    | (0.00552)            | (0.0115)             | (0.00549)            | (0.00642)            |                      |
| Homicide Count 2016                | 0.202***             | 0.0387*              | 0.224***             | 0.222***             |                      |
|                                    | (0.0179)             | (0.0191)             | (0.0181)             | (0.0184)             |                      |
| Police: Relative Black             |                      | -0.377***            | -0.264***            |                      |                      |
|                                    |                      | (0.0318)             | (0.0661)             |                      |                      |
| Relative Black Share X Police: Relative Black | -0.0750**            |                      |                      |                      |                      |
|                                    |                      | (0.0238)             | (0.0452)             |                      |                      |
| Supervisor: Relative Black         |                      | -0.0750*             |                      |                      |                      |
|                                    |                      | (0.0238)             | (0.0452)             |                      |                      |
| Relative Relative Black Share X Supervisor: Relative Black | -0.109***            |                      |                      |                      |                      |
|                                    |                      | (0.0219)             |                      |                      |                      |

Observations | 24,571 | 23,381 | 23,381 | 21,821 | 20,972 |
R-squared | 0.005 | 0.050 | 0.193 | 0.055 | 0.057 |
Fixed effects | NA | NA | City | NA | NA |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is the number of “shifts” observed in BGs (excluding pings moving faster than 50 mph), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.6: Disparities in Neighborhood Police Exposure by Race in Absolute Share

| VARIABLES                        | (1)   | (2)   | (3)   | (4)   | (5)   | (6)   |
|----------------------------------|-------|-------|-------|-------|-------|-------|
| % Black                          | 0.432*** | 0.490*** | 0.730*** | 0.674*** | 0.618*** | 0.345*** |
|                                  | (0.0313) | (0.0314) | (0.0420) | (0.0428) | (0.0437) | (0.0468) |
| % Hispanic                       | 0.276*** | 0.177*** | 0.504*** | 0.483*** | 0.489*** | 0.287*** |
|                                  | (0.0322) | (0.0328) | (0.0461) | (0.0461) | (0.0460) | (0.0543) |
| % Asian                          | 0.0163 | -0.132+ | -0.0959 | -0.170* | -0.123+ | 0.106  |
|                                  | (0.0680) | (0.0684) | (0.0700) | (0.0711) | (0.0711) | (0.0768) |
| Log Population                   | 0.321*** | 0.396*** | 0.395*** | 0.382*** | 0.348*** |
|                                  | (0.0202) | (0.0203) | (0.0202) | (0.0202) | (0.0198) |
| % College Graduates              | 1.255*** | 1.271*** | 1.302*** | 1.032*** |       |
|                                  | (0.0641) | (0.0641) | (0.0640) | (0.0646) |       |
| Median Household Income (1K)     | -0.00626*** | -0.0058*** | -0.00567*** | -0.00437*** |
|                                  | (0.000358) | (0.000368) | (0.000367) | (0.000363) |       |
| Census Form Return Rate          |       | -0.740*** | -0.755*** | -1.249*** |       |
|                                  |       | (0.117) | (0.118) | (0.120) |       |
| Log distance to nearest homicide (km) |       | 0.0161** | -0.116*** |       |       |
|                                  |       | (0.00566) | (0.0119) |       |       |
| Homicide Count 2016              |       | 0.266*** | 0.152*** |       |       |
|                                  |       | (0.0212) | (0.0221) |       |       |
| Observations                     | 24,571 | 24,571 | 23,386 | 23,381 | 23,381 | 23,381 |
| R-squared                        | 0.009 | 0.025 | 0.051 | 0.053 | 0.060 | 0.168 |
| Fixed effects                    | NA    | NA    | NA    | NA    | NA    | City  |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1-5) and within cities (Column 6). The dependent variable is police hours observed in BGs (excluding pings moving faster than 50 mph), transformed in arsinh values. % Black, % Hispanic and % Asian in census block groups range from 0-1. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.7: Disparities in Neighborhood Police Exposure by Majority Race

| VARIABLES | (1)      | (2)      | (3)      | (4)      | (5)      | (6)      |
|-----------|----------|----------|----------|----------|----------|----------|
| Black Majority | 0.0326   | 0.137*** | 0.223*** | 0.214*** | 0.163*** | 0.0687*  |
|           | (0.0290) | (0.0295) | (0.0309) | (0.0309) | (0.0312) | (0.0307) |
| White Majority | -0.257*** | -0.210***| -0.239***| -0.211***| -0.216***| -0.118***|
|           | (0.0262) | (0.0261) | (0.0286) | (0.0289) | (0.0287) | (0.0279) |
| Hispanic Majority | -0.0525+ | 0.0580*  | 0.0757** | 0.0724*  | 0.0426   |
|           | (0.0273) | (0.0271) | (0.0291) | (0.0293) | (0.0291) | (0.0291) |
| Asian Majority | -0.277*** | -0.265***| -0.244***| -0.241***| -0.221***| -0.136*  |
|           | (0.0550) | (0.0551) | (0.0550) | (0.0550) | (0.0549) | (0.0566) |
| Log Population | 0.300*** | 0.383*** | 0.382*** | 0.371*** | 0.347*** |
|           | (0.0200) | (0.0202) | (0.0201) | (0.0201) | (0.0198) |
| % College Graduates | 1.110*** | 1.129*** | 1.170*** | 0.962*** |
|           | (0.0623) | (0.0623) | (0.0624) | (0.0611) |
| Median Household Income (1K) | -0.00653*** | -0.00609***| -0.00591***| -0.00447***|
|           | (0.000360) | (0.000369) | (0.000368) | (0.000362) |
| Census Form Return Rate | -0.710*** | -0.703*** | -1.255*** |
|           | (0.117) | (0.118) | (0.121) |
| Log distance to nearest homicide (km) | 0.116* | -0.124*** |
|           | (0.00564) | (0.0116) |
| Homicide Count 2016 | 0.282*** | 0.153*** |
|           | (0.0212) | (0.0220) |
| Observations | 24,571   | 24,571   | 23,386   | 23,381   | 23,381   | 23,381   |
| R-squared | 0.008    | 0.022    | 0.046    | 0.048    | 0.056    | 0.168    |
| Fixed effects | NA      | NA      | NA      | NA      | NA      | City     |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1-5) and within cities (Column 6). The dependent variable is police hours observed in BGs (excluding pings moving faster than 50 mph), transformed in arsinh values. Majority Black (White, Hispanic, Asian) is a dummy indicating the % Black (White, Hispanic, Asian) is larger than 50%. The base group is mixed-race block groups (i.e., no racial or ethnic group in the block comprises more than 50% of the population). Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.8: Disparities in Neighborhood Police Exposure and Downstream (Stop) Disparities

| VARIABLES                           | (1)              | (2)              | (3)              | (4)              | (5)              | (6)              |
|-------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                                     | arsinh(Hours)    | arsinh(Stops)    | arsinh(Stops/Hours) | arsinh(Hours)    | arsinh(Stops)    | arsinh(Stops/Hours) |
| Relative Black Share                | 0.128***         | 0.321***         | 0.143***          | 0.0371*          | 0.122***         | 0.0670***         |
|                                     | (0.0132)         | (0.0168)         | (0.0163)          | (0.0157)         | (0.0178)         | (0.0201)          |
| Relative Hispanic Share             | 0.0198           | 0.198***         | 0.144***          | -0.0594***       | 0.0168           | 0.0714***         |
|                                     | (0.0141)         | (0.0186)         | (0.0189)          | (0.0165)         | (0.0217)         | (0.0235)          |
| Relative Asian Share                | 0.0662***        | 0.00776          | -0.0629***        | 0.0147           | -0.00874         | -0.0192           |
|                                     | (0.0112)         | (0.0128)         | (0.0127)          | (0.0116)         | (0.0129)         | (0.0138)          |
| Log Population                      | 0.421***         | 0.332***         | -0.142***         | 0.095***         | -0.201+          | -0.985***         |
|                                     | (0.0330)         | (0.0364)         | (0.0396)          | (0.0998)         | (0.114)          | (0.124)           |
| % College Graduates                 | 0.695***         | -2.01+           | -0.985***         | 0.00694***       | -0.0495***       | 0.00251***        |
|                                     | (0.000750)       | (0.00850)        | (0.00850)         | (0.000870)       | (0.000870)       | (0.000870)        |
| Median Household Income (1K)        | -1.901***        | 0.288            | 0.288             | 0.226            | (0.253)          | (0.271)           |
|                                     | (0.000864)       | (0.00882)        | (0.0112)          | (0.0260)         | (0.0260)         | (0.0315)          |
| Census Form Return Rate             | -1.687***        | -0.0678***       | -0.0257*          | 0.129***         | 0.215***         | 0.0807***         |
|                                     | (0.000750)       | (0.000870)       | (0.00112)         | (0.0270)         | (0.0260)         | (0.0315)          |
| Log distance to nearest homicide (km)| -0.0678***       | -0.115***        | -0.0257*          | 0.129***         | 0.215***         | 0.0807***         |
|                                     | (0.000864)       | (0.00882)        | (0.0112)          | (0.0270)         | (0.0260)         | (0.0315)          |
| Homicide Count 2016                 | 1.882***         | 4.290***         | 3.329***          | 0.453            | 3.967***         | 4.390***          |
|                                     | (0.0313)         | (0.0399)         | (0.0392)          | (0.295)          | (0.319)          | (0.342)           |
| Constant                            | 7.741            | 7.741            | 7.662             | 7.353            | 7.353            | 7.276             |
| Observations                        | 0.015            | 0.063            | 0.022             | 0.082            | 0.155            | 0.038             |
| R-squared                           | 0.015            | 0.063            | 0.022             | 0.082            | 0.155            | 0.038             |

Notes: All race variables are mean-centered, relative Black (Hispanic, Asian) shares are defined as the ratio of % Black (Hispanic, Asian) in a BG to the % in that city, Police (Supervisor) Relative Black defined as the ratio of % Black of a department’s sworn officers (supervisors) to the % in that city. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.9: Disparities in Neighborhood Police Exposure (Excluding “Shifts” Fewer Than 8 Hours)

| VARIABLES                                    | (1)                      | (2)                      | (3)                      | (4)                      | (5)                      |
|----------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Police Exposure in a Census Block Group: arsinh(Hours) |                          |                          |                          |                          |                          |
| Relative Black Share                         | 0.0648***                | 0.0638***                | 0.0285***                | 0.0747***                | 0.0895***                |
|                                              | (0.00638)                | (0.00718)                | (0.00670)                | (0.00737)                | (0.00763)                |
| Relative Hispanic Share                      | 0.0446***                | 0.0391***                | -0.00596                 | 0.0413***                | 0.0541***                |
|                                              | (0.00840)                | (0.00974)                | (0.00843)                | (0.0102)                 | (0.0104)                 |
| Relative Asian Share                         | 0.0103+                  | -0.0193***               | -0.0118*                 | -0.0175***               | -0.00758                 |
|                                              | (0.00559)                | (0.00502)                | (0.00478)                | (0.00526)                | (0.00556)                |
| log(Population)                              | 0.375***                 | 0.311***                 | 0.390***                 | 0.406***                 |                          |
|                                              | (0.0182)                 | (0.0179)                 | (0.0190)                 | (0.0194)                 |                          |
| % College Graduates                         | 0.810***                 | 0.691***                 | 0.863***                 | 1.035***                 |                          |
|                                              | (0.0537)                 | (0.0503)                 | (0.0543)                 | (0.0558)                 |                          |
| Median Household Income (1K)                 | -0.00473***              | -0.00421***              | -0.00486***              | -0.00446***              | -0.00446***              |
|                                              | (0.000328)               | (0.000321)               | (0.000340)               | (0.000342)               |                          |
| Census Form Return Rate                      | -0.601***                | -0.923***                | -0.333**                 | -0.559***                |                          |
|                                              | (0.108)                  | (0.108)                  | (0.114)                  | (0.117)                  |                          |
| Log distance to nearest homicide (km)        | 0.0453***                | -0.118***                | 0.0533***                | 0.0253***                |                          |
|                                              | (0.00548)                | (0.0103)                 | (0.00556)                | (0.00649)                |                          |
| Homicide Count 2016                          | 0.163***                 | 0.0806***                | 0.170***                 | 0.151***                 |                          |
|                                              | (0.0201)                 | (0.0203)                 | (0.0210)                 | (0.0212)                 |                          |
| Police: Relative Black                       | -0.196***                | -0.695***                |                          |                          |                          |
|                                              | (0.0319)                 | (0.0591)                 |                          |                          |                          |
| Relative Black Share X Police: Relative Black| -0.0835***               | 0.0332                   |                          |                          |                          |
|                                              | (0.0242)                 | (0.0419)                 |                          |                          |                          |
| Supervisor: Relative Black                   |                          |                          | 0.314***                 |                          |                          |
|                                              |                          |                          | (0.0287)                 |                          |                          |
| Relative Black Share X Supervisor: Relative Black |                      |                          | -0.0726***               |                          |                          |
|                                              |                          |                          | (0.0182)                 |                          |                          |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is police hours observed in BGs (excluding “shifts” fewer than 8 hours), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.10: Disparities in Neighborhood Police Exposure (Extending Home Visits Brackets to 18 Hours)

| VARIABLES                        | (1)     | (2)     | (3)     | (4)     | (5)     |
|----------------------------------|---------|---------|---------|---------|---------|
|                                  | Police Exposure in a Census Block Group: arsinh(Hours) |         |         |         |         |
| Relative Black Share             | 0.0822*** | 0.0598*** | 0.0224**  | 0.0504*** | 0.0633*** |
|                                  | (0.00708) | (0.00781) | (0.00770) | (0.00817) | (0.00856) |
| Relative Hispanic Share          | 0.0524*** | 0.0316**  | -0.0101  | 0.00672  | 0.0193+  |
|                                  | (0.00981) | (0.0113)  | (0.0103) | (0.0114) | (0.0117) |
| Relative Asian Share             | 0.0165*   | -0.0214*** | -0.0167** | -0.0226*** | -0.0131* |
|                                  | (0.00719) | (0.00595) | (0.00574) | (0.00624) | (0.00666) |
| log(Population)                  | 0.492***  | 0.408***  | 0.517***  | 0.541***  |         |
|                                  | (0.0204)  | (0.0206)  | (0.0211)  | (0.0216)  |         |
| % College Graduates              | 1.013***  | 0.936***  | 0.937***  | 1.143***  |         |
|                                  | (0.0599)  | (0.0592)  | (0.0612)  | (0.0626)  |         |
| Median Household Income (1K)     | -0.00553*** | -0.00519*** | -0.00598*** | -0.00546*** |         |
|                                  | (0.000384) | (0.000384) | (0.000393) | (0.000395) |         |
| Census Form Return Rate          | -0.822*** | -1.426*** | -0.573*** | -0.840*** |         |
|                                  | (0.123)  | (0.126)  | (0.128)  | (0.132)  |         |
| Log distance to nearest homicide (km) | -0.0217*** | -0.159*** | -0.0249*** | -0.0687*** |
|                                  | (0.00589) | (0.0121)  | (0.00596) | (0.00687) |         |
| Homicide Count 2016              | 0.231***  | 0.136***  | 0.230***  | 0.209***  |         |
|                                  | (0.0211)  | (0.0222)  | (0.0217)  | (0.0221)  |         |
| Police: Relative Black           | 0.287***  | -0.495*** |         |         |         |
|                                  | (0.0336)  | (0.0628)  |         |         |         |
| Relative Black Share X Police: Relative Black | -0.0410+  | 0.0649   |         |         |         |
|                                  | (0.0228)  | (0.0410)  |         |         |         |
| Supervisor: Relative Black       | 0.487***  |         |         |         |         |
|                                  | (0.0318)  | (0.0628)  |         |         |         |
| Relative Black Share X Supervisor: Relative Black | -0.0661*** |         |         |         |         |
|                                  | (0.0194)  | (0.0628)  |         |         |         |
| Observations                     | 24,571   | 23,381   | 23,381   | 21,821   | 20,972   |
| R-squared                        | 0.006    | 0.059    | 0.157    | 0.065    | 0.079    |
| Fixed effects                    | NA       | NA       | City     | NA       | NA       |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is police hours observed in BGs (extending home visits brackets to 18 hours), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.11: Disparities in Neighborhood Police Exposure (Extending Home Visits Brackets to 24 Hours)

| VARIABLES                              | (1)                      | (2)                      | (3)                      | (4)                      | (5)                      |
|----------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Relative Black Share                   | 0.0805***                | 0.0591***                | 0.0229**                 | 0.0478***                | 0.0599***                |
|                                        | (0.00712)                | (0.00784)                | (0.00776)                | (0.00823)                | (0.00862)                |
| Relative Hispanic Share                | 0.0553***                | 0.0376***                | -0.00321                 | 0.0108                   | 0.0229+                  |
|                                        | (0.00988)                | (0.0114)                 | (0.0104)                 | (0.0115)                 | (0.0117)                 |
| Relative Asian Share                   | 0.0176*                 | -0.0212***               | -0.0169**                | -0.0231***               | -0.0135*                 |
|                                        | (0.00739)                | (0.00603)                | (0.00582)                | (0.00632)                | (0.00677)                |
| log(Population)                        | 0.499***                 | 0.415***                 | 0.526***                 | 0.551***                 | 0.551***                 |
|                                        | (0.0206)                 | (0.0208)                 | (0.0213)                 | (0.0213)                 | (0.0218)                 |
| % College Graduates                    | 1.046***                 | 0.973***                 | 0.967***                 | 1.173***                 | 1.173***                 |
|                                        | (0.0604)                 | (0.0597)                 | (0.0617)                 | (0.0617)                 | (0.0631)                 |
| Median Household Income (1K)           | -0.00527***              | -0.00515***              | -0.00571***              | -0.00517***              | -0.00517***              |
|                                        | (0.000389)               | (0.000390)               | (0.000398)               | (0.000400)               | (0.000400)               |
| Census Form Return Rate                | -0.945***               | -1.443***               | -0.702***                | -0.977***                | -0.977***                |
|                                        | (0.124)                  | (0.127)                  | (0.129)                  | (0.132)                  | (0.133)                  |
| Log distance to nearest homicide (km)  | -0.0309***              | -0.160***               | -0.0340***               | -0.0786***               | -0.0786***               |
|                                        | (0.00594)                | (0.0122)                 | (0.00600)                | (0.00691)                | (0.00691)                |
| Homicide Count 2016                    | 0.217***                 | 0.137***                 | 0.215***                 | 0.194***                 | 0.194***                 |
|                                        | (0.0211)                 | (0.0223)                 | (0.0218)                 | (0.0221)                 | (0.0221)                 |
| Police: Relative Black                 | 0.281***                 | -0.514***               | -0.0238                  | 0.0809*                  | 0.0809*                  |
|                                        | (0.0336)                 | (0.0629)                 | (0.0226)                 | (0.0406)                 | (0.0406)                 |
| Relative Black Share X Police: Relative Black | -0.0238                  | 0.0809*                  |                       |                         |                         |
|                                        | (0.0225)                 | (0.0406)                 |                         |                         |                         |
| Supervisor: Relative Black             | 0.496***                 |                         |                         |                         |                         |
|                                        | (0.0319)                 |                         |                         |                         |                         |
| Relative Black Share X Supervisor: Relative Black | -0.0645**              |                         |                         |                         |                         |
|                                        | (0.0194)                 |                         |                         |                         |                         |
| Observations                           | 24,571                   | 23,381                   | 23,381                   | 21,821                   | 20,972                   |
| R-squared                              | 0.006                    | 0.059                    | 0.156                    | 0.065                    | 0.079                    |
| Fixed effects                          | NA                       | NA                       | City                     | NA                       | NA                       |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is police hours observed in BGs (extending home visits brackets to 24 hours), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.12: Disparities in Neighborhood Police Exposure (Exclude Shifts with Pings Spend More than 3 Hours’ in Police Stations)

| VARIABLES | (1) | (2) | (3) | (4) | (5) |
|-----------|-----|-----|-----|-----|-----|
| Police Exposure in a Census Block Group: arsinh(Hours) | | | | | |
| Relative Black Share | 0.0695*** | 0.0379*** | 0.0184* | 0.0486*** | 0.0661*** |
|                      | (0.00709) | (0.00776) | (0.00716) | (0.00798) | (0.00820) |
| Relative Hispanic Share | 0.0355*** | 0.0146 | -0.0148 | 0.0151 | 0.0267* |
|                      | (0.00881) | (0.0102) | (0.00964) | (0.0107) | (0.0109) |
| Relative Asian Share | 0.00967 | -0.0212*** | -0.0141** | -0.0209*** | -0.0106+ |
|                      | (0.00618) | (0.00546) | (0.00533) | (0.00575) | (0.00611) |
| log(Population) | 0.361*** | 0.354*** | 0.397*** | 0.401*** | |
|                      | (0.0193) | (0.0194) | (0.0200) | (0.0206) | |
| % College Graduates | 0.933*** | 0.774*** | 0.973*** | 1.017*** | |
|                      | (0.0565) | (0.0556) | (0.0579) | (0.0597) | |
| Median Household Income (1K) | -0.00580*** | -0.00420*** | -0.00565*** | -0.00640*** | |
|                      | (0.000360) | (0.000353) | (0.000368) | (0.000371) | |
| Census Form Return Rate | -0.939*** | -1.322*** | -0.623*** | -0.675*** | |
|                      | (0.116) | (0.119) | (0.122) | (0.125) | |
| Log distance to nearest homicide (km) | 0.00491 | -0.130*** | 0.0196*** | 0.0396*** | |
|                      | (0.00544) | (0.0114) | (0.00551) | (0.00646) | |
| Homicide Count 2016 | 0.285*** | 0.141*** | 0.310*** | 0.317*** | |
|                      | (0.0209) | (0.0218) | (0.0217) | (0.0222) | |
| Police: Relative Black | -0.422*** | -0.0769 | |
|                      | (0.0326) | (0.0613) | |
| Relative Black Share X Police: Relative Black | -0.0546* | 0.0938* | |
|                      | (0.0240) | (0.0426) | |
| Supervisor: Relative Black | -0.208*** | |
|                      | (0.0310) | |
| Relative Black Share X Supervisor: Relative Black | -0.0898*** | |
|                      | (0.0196) | |

Observations: 24,571 23,381 23,381 21,821 20,972  
R-squared: 0.004 0.051 0.171 0.060 0.065  
Fixed effects: NA NA City NA NA

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is police hours observed in BGs (exclude shifts with pings spend more than 3 hours in police stations), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.13: Disparities in Neighborhood Police Exposure (Including all Pings)

| VARIABLES                                      | (1)       | (2)       | (3)       | (4)       | (5)       |
|------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| Police Exposure in a Census Block Group: arsinh(Hours) | 0.0667*** | 0.0360*** | 0.0161*   | 0.0459*** | 0.0615*** |
| Relative Black Share                            | (0.00726) | (0.00797) | (0.00738) | (0.00813) | (0.00841) |
| Relative Hispanic Share                         | 0.0351*** | 0.0121    | -0.0159   | 0.0127    | 0.0241*   |
|                                                 | (0.00906) | (0.0105)  | (0.00993) | (0.0109)  | (0.0111)  |
| Relative Asian Share                            | 0.0118+   | -0.0199***| -0.0126*  | -0.0190** | -0.00891  |
|                                                 | (0.00642) | (0.00564) | (0.00552) | (0.00593) | (0.00633) |
| log(Population)                                 | 0.381***  | 0.366***  | 0.421***  | 0.429***  |           |
|                                                 | (0.0198)  | (0.0199)  | (0.0206)  | (0.0211)  |           |
| % College Graduates                             | 0.938***  | 0.821***  | 0.967***  | 1.043***  |           |
|                                                 | (0.0580)  | (0.0571)  | (0.0594)  | (0.0612)  |           |
| Median Household Income (1K)                    | -0.00605***| -0.00449***| -0.00582***| -0.00550***|           |
|                                                 | (0.000371)| (0.000364)| (0.000380)| (0.000383)|           |
| Census Form Return Rate                         | -0.823*** | -1.315*** | -0.518*** | -0.623*** |           |
|                                                 | (0.119)   | (0.121)   | (0.125)   | (0.128)   |           |
| Log distance to nearest homicide (km)           | 0.00486   | -0.133*** | 0.0198*** | 0.0274*** |           |
|                                                 | (0.00567) | (0.0116)  | (0.00574) | (0.00669) |           |
| Homicide Count 2016                             | 0.286***  | 0.148***  | 0.307***  | 0.308***  |           |
|                                                 | (0.0210)  | (0.0220)  | (0.0219)  | (0.0223)  |           |
| Police: Relative Black                          | -0.425*** | -0.297*** |           |           |           |
|                                                 | (0.0338)  | (0.0631)  |           |           |           |
| Relative Black Share X Police: Relative Black    | -0.0534*  | 0.0899*   |           |           |           |
|                                                 | (0.0249)  | (0.0443)  |           |           |           |
| Supervisor: Relative Black                      | -0.0727*  |           |           |           |           |
|                                                 | (0.0320)  |           |           |           |           |
| Relative Black Share X Supervisor: Relative Black| -0.0857***|           |           |           |           |
|                                                 | (0.0205)  |           |           |           |           |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is police hours observed in BGs (including all pings), transformed in arsinh values.

Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.14: Disparities in Neighborhood Police Exposure (Excluding Pings Faster than 25 mph)

| VARIABLES                              | (1)               | (2)               | (3)               | (4)               | (5)               |
|----------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                                        | Police Exposure in a Census Block Group: arsinh(Hours) |                   |                   |                   |                   |
| Relative Black Share                   | 0.0740***         | 0.0431***         | 0.0199**          | 0.0533***         | 0.0695***         |
|                                        | (0.00725)         | (0.00795)         | (0.00736)         | (0.00811)         | (0.00838)         |
| Relative Hispanic Share                | 0.0414***         | 0.0219*           | -0.0116           | 0.0226*           | 0.0343**          |
|                                        | (0.00905)         | (0.0105)          | (0.00986)         | (0.0109)          | (0.0112)          |
| Relative Asian Share                   | 0.0132*           | -0.0193***        | -0.0121*          | -0.0182**         | -0.00783          |
|                                        | (0.00660)         | (0.00562)         | (0.00551)         | (0.00503)         | (0.00643)         |
| log(Population)                        | 0.372***          | 0.359***          | 0.412***          | 0.421***          |                   |
|                                        | (0.0197)          | (0.0198)          | (0.0205)          | (0.0210)          |                   |
| % College Graduates                    | 1.005***          | 0.848***          | 1.030***          | 1.105***          |                   |
|                                        | (0.0578)          | (0.0571)          | (0.0593)          | (0.0610)          |                   |
| Median Household Income (1K)           | -0.00621***       | -0.00470***       | -0.00604***       | -0.00579***       |                   |
|                                        | (0.000367)        | (0.000362)        | (0.000376)        | (0.000379)        |                   |
| Census Form Return Rate                | -0.903***         | -1.341***         | -0.604***         | -0.702***         |                   |
|                                        | (0.118)           | (0.121)           | (0.124)           | (0.127)           |                   |
| Log distance to nearest homicide (km)  | -0.00137          | -0.142***         | 0.0126*           | 0.0207**          |                   |
|                                        | (0.00561)         | (0.0116)          | (0.00569)         | (0.00663)         |                   |
| Homicide Count 2016                    | 0.278***          | 0.138***          | 0.300***          | 0.300***          |                   |
|                                        | (0.0210)          | (0.0220)          | (0.0218)          | (0.0223)          |                   |
| Police: Relative Black                 | -0.384***         | -0.252***         |                   |                   |                   |
|                                        | (0.0337)          | (0.0628)          |                   |                   |                   |
| Relative Black Share X Police: Relative Black | -0.0671**         | 0.0859+           |                   |                   |                   |
|                                        | (0.0251)          | (0.0442)          |                   |                   |                   |
| Supervisor: Relative Black             |                   | -0.0774*          |                   |                   |                   |
|                                        |                   | (0.0318)          |                   |                   |                   |
| Relative Black Share X Supervisor: Relative Black | -0.0917***         |                   |                   |                   |                   |
|                                        |                   | (0.0203)          |                   |                   |                   |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is police hours observed in BGs (excluding pings moving faster than 25 mph), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.15: Disparities in Neighborhood Police Exposure in Neighborhoods (Log Specification)

| VARIABLES                                | (1)       | (2)       | (3)       | (4)       | (5)       |
|------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| Police Exposure in a Census Block Group: log(Hours) |           |           |           |           |           |
| Relative Black Share                     | 0.0864*** | 0.0455*** | 0.0184+   | 0.0570*** | 0.0794*** |
|                                          | (0.00959) | (0.0106)  | (0.00994) | (0.0105)  | (0.0109)  |
| Relative Hispanic Share                  | 0.0574*** | 0.0232+   | -0.0141   | 0.0207    | 0.0389**  |
|                                          | (0.0119)  | (0.0139)  | (0.0134)  | (0.0143)  | (0.0147)  |
| Relative Asian Share                     | 0.0159+   | -0.0245** | -0.0156+  | -0.0253** | -0.0112   |
|                                          | (0.00868) | (0.00810) | (0.00797) | (0.00848) | (0.00903) |
| Log Population                           | 0.453***  | 0.448***  | 0.500***  | 0.511***  |           |
|                                          | (0.0241)  | (0.0242)  | (0.0248)  | (0.0254)  |           |
| % College Graduates                      | 1.043***  | 0.883***  | 1.079***  | 1.191***  |           |
|                                          | (0.0743)  | (0.0736)  | (0.0755)  | (0.0778)  |           |
| Median Household Income (1K)             | -0.00704***| -0.00528***| -0.00704***| -0.00661***|           |
|                                          | (0.000477)| (0.000469)| (0.000484)| (0.000487)|           |
| Census Form Return Rate                  | -1.014*** | -1.579*** | -0.616*** | -0.727*** |           |
|                                          | (0.151)   | (0.153)   | (0.155)   | (0.159)   |           |
| Log distance to nearest homicide (km)    | 0.000385  | -0.182*** | 0.0156*   | 0.0214*   |           |
|                                          | (0.00718) | (0.0148)  | (0.00723) | (0.00859) |           |
| Homicide Count 2016                      | 0.331***  | 0.152***  | 0.350***  | 0.349***  |           |
|                                          | (0.0242)  | (0.0253)  | (0.0248)  | (0.0254)  |           |
| Police: Relative Black                   | -0.477*** | -0.378*** |           |           |           |
|                                          | (0.0417)  | (0.0777)  |           |           |           |
| Relative Black Share X Police: Relative Black | -0.104*** | 0.128*    |           |           |           |
|                                          | (0.0317)  | (0.0556)  |           |           |           |
| Supervisor: Relative Black               | -0.0574   |           |           |           |           |
|                                          | (0.0412)  |           |           |           |           |
| Relative Black Share X Supervisor: Relative Black | -0.139*** |           |           |           |           |
|                                          | (0.0272)  |           |           |           |           |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is log police hours observed in BGs (excluding pings moving faster than 50 mph and dropping zero-valued observations). Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.16: Disparities in Neighborhood Police Exposure and Downstream Disparities (Log Specification)

| VARIABLES                        | (1) log(Hours) | (2) log(Arrests) | (3) log(Arrests/Hour) | (4) log(Hours) | (5) log(Arrests) | (6) log(Arrests/Hour) |
|----------------------------------|----------------|------------------|-----------------------|----------------|------------------|-----------------------|
| Relative Black Share             | 0.177***       | 0.371***         | 0.198***              | 0.0899**       | 0.174***         | 0.0844*               |
|                                  | (0.0224)       | (0.0246)         | (0.0287)              | (0.0275)       | (0.0231)         | (0.0350)              |
| Relative Hispanic Share          | 0.0184         | 0.188***         | 0.172***              | -0.0488+       | 0.0543**         | 0.105***              |
|                                  | (0.0215)       | (0.0191)         | (0.0226)              | (0.0250)       | (0.0192)         | (0.0272)              |
| Relative Asian Share             | 0.109***       | -0.0151          | -0.124***             | 0.0531**       | -0.0251*         | -0.0783***            |
|                                  | (0.0161)       | (0.0137)         | (0.0166)              | (0.0167)       | (0.0124)         | (0.0168)              |
| Log Population                   | 0.540***       | 0.155***         | -0.386***             | -0.235*        | -1.064***        | -0.386***             |
|                                  | (0.0544)       | (0.0367)         | (0.0560)              | (0.165)        | (0.0995)         | (0.168)               |
| % College Graduates              | 0.818***       | -0.235*          | 1.064***              | -0.00768***    | -0.000418        | 0.00739***            |
|                                  | (0.105)        | (0.069)          | (0.168)               | (0.00136)      | (0.000801)       | (0.00132)             |
| Median Household Income (1K)     | -1.545***      | -3.447***        | -1.915***             | -0.0687***     | -0.127***        | -0.0586***            |
|                                  | (0.360)        | (0.242)          | (0.384)               | (0.0150)       | (0.00826)        | (0.0149)              |
| Census Form Return Rate          | 0.143***       | 0.210***         | 0.0651+               | 4.462          | 4.478            | 4.462                 |
|                                  | (0.0432)       | (0.0261)         | (0.0383)              | 4.177          | 4.193            | 4.177                 |
| Observations                     | 4.462          | 4.478            | 4.462                 | 4.177          | 4.193            | 4.177                 |
| R-squared                        | 0.021          | 0.137            | 0.047                 | 0.079          | 0.315            | 0.091                 |

Notes: The sample of six cities with arrest data include: Chicago, Philadelphia, San Antonio, Columbus, Seattle and Nashville. All race variables are mean-centered, relative Black (Hispanic, Asian) shares are defined as the ratio of % Black (Hispanic, Asian) in a BG to the % in that city. Police (Supervisor) Relative Black defined as the ratio of % Black of a department’s sworn officers (supervisors) to the % in that city. The dependent variables are: police hours observed in a BGs (excluding pings moving faster than 50 mph), Number of arrests in that BG, and the ratio of those two measures under logarithm transformation (zero-valued observations are dropped). Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.17: Disparities in Neighborhood Police Exposure (Clustered Standard Errors)

| VARIABLES | (1) | (2) | (3) | (4) | (5) |
|-----------|-----|-----|-----|-----|-----|
| Police Exposure in a Census Block Group: arsinh(Hours) | 0.0718*** | 0.0401*** | 0.0184+ | 0.0505*** | 0.0666*** |
| | (0.0108) | (0.0111) | (0.00956) | (0.0112) | (0.0115) |
| Relative Black Share | 0.0393*** | 0.0157 | -0.0149 | 0.0166 | 0.0283+ |
| | (0.0132) | (0.0146) | (0.0133) | (0.0152) | (0.0156) |
| Relative Hispanic Share | 0.0120 | -0.0198** | -0.0124+ | -0.0186* | -0.00841 |
| | (0.00906) | (0.00681) | (0.00687) | (0.00727) | (0.00817) |
| Relative Asian Share | 0.376*** | 0.363*** | 0.416*** | 0.424*** |
| | (0.0218) | (0.0215) | (0.0227) | (0.0234) |
| Log Population | 0.947*** | 0.813*** | 0.976*** | 1.053*** |
| | (0.0755) | (0.0723) | (0.0775) | (0.0796) |
| % College Graduates | -0.00620*** | -0.00459*** | -0.00601*** | -0.00569*** |
| | (0.000456) | (0.000433) | (0.000466) | (0.000470) |
| Median Household Income (1K) | -0.814*** | -1.313*** | -0.511*** | -0.613*** |
| | (0.146) | (0.146) | (0.153) | (0.157) |
| Census Form Return Rate | 0.00469 | -0.138*** | 0.0191* | 0.0268** |
| | (0.00820) | (0.0146) | (0.00829) | (0.00978) |
| Log distance to nearest homicide (km) | 0.286*** | 0.143*** | 0.308*** | 0.308*** |
| | (0.0220) | (0.0223) | (0.0230) | (0.0235) |
| Police: Relative Black | -0.400*** | -0.272** |
| | (0.0485) | (0.0904) |
| Relative Black Share X Police: Relative Black | -0.0653+ | 0.0847 |
| | (0.0347) | (0.0563) |
| Supervisor: Relative Black | -0.0737 |
| | (0.0452) |
| Relative Black Share X Supervisor: Relative Black | -0.0899*** |
| | (0.0260) |

Notes: This table presents OLS estimates of exposure disparities among census block groups (BGs) across (Column 1,2,4,5) and within 23 large cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares are defined as the ratio of % Black (Hispanic, Asian) in a BG to the % in that city, Police (Supervisor) Relative Black defined as the ratio of % Black of a department’s sworn officers (supervisors) to the % in that city. The dependent variable is police hours observed in a BG (excluding pings moving faster than 50 mph), transformed into arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors clustered at the tract level are reported in the parentheses.
Table A.18: Disparities in Neighborhood Police Exposure and Downstream Disparities (Clustered Standard Errors)

| VARIABLES                      | (1) | (2) | (3) | (4) | (5) | (6) |
|--------------------------------|-----|-----|-----|-----|-----|-----|
| Relative Black Share           | 0.160*** | 0.439*** | 0.219*** | 0.0465+ | 0.212*** | 0.109*** |
|                                | (0.0211) | (0.0386) | (0.0264) | (0.0247) | (0.0316) | (0.0257) |
| Relative Hispanic Share        | 0.0361+  | 0.226*** | 0.161*** | -0.0541* | 0.104*** | 0.109*** |
|                                | (0.0197) | (0.0285) | (0.0249) | (0.0214) | (0.0279) | (0.0248) |
| Relative Asian Share           | 0.0626*** | -0.00349 | -0.0619*** | 0.0140  | -0.0178 | -0.0401*** |
|                                | (0.0162) | (0.0186) | (0.0114) | (0.0155) | (0.0157) | (0.0107) |
| Log Population                 | 0.409*** | -0.0307  | -0.259*** | -0.00765*** | 0.0327*** | 0.00327*** |
|                                | (0.0449) | (0.0421) | (0.0346) | (0.145)  | (0.128)  | (0.124)  |
| % College Graduates            | 0.557*** | 0.278*  | -0.320**  | -0.000448 | 0.000385 | 0.000385 |
|                                | (0.145)  | (0.128)  | (0.124)   | (0.00100) | (0.000895) | (0.000830) |
| Median Household Income (1K)   | -1.173*** | -4.717*** | -2.276*** | -0.0621*** | -0.156*** | -0.0695*** |
|                                | (0.316)  | (0.344)  | (0.311)   | (0.0129)  | (0.0106)  | (0.0108)  |
| Census Form Return Rate        | 0.140*** | 0.299*** | 0.122***   | 0.0368*** | (0.0320) | (0.0284) |
|                                | (0.0308) | (0.0320) | (0.0284)  | (0.0106)  | (0.0106)  | (0.0108)  |
| Log distance to nearest homicide (km) | 0.489*** | 1.240*** | 0.812***   | -0.186   | 5.220*** | 4.391*** |
|                                | (0.0485) | (0.0622) | (0.0464)  | (0.406)  | (0.398)  | (0.346)  |
| Homicide Count 2016            | 5.940   | 5.940    | 5.876      | 5.604    | 5.604    | 5.542    |
| Constant                       | 0.020   | 0.127    | 0.065      | 0.092    | 0.306    | 0.131    |

**Notes:** The sample of six cities with arrest data include: Chicago, Philadelphia, San Antonio, Columbus, Seattle and Nashville. All race variables are mean-centered, relative Black (Hispanic, Asian) shares are defined as the ratio of % Black (Hispanic, Asian) in a BG to the % in that city. Police (Supervisor) Relative Black defined as the ratio of % Black of a department’s sworn officers (supervisors) to the % in that city. The dependent variables are: police hours observed in a BGs (excluding pings moving faster than 50 mph, mean 15.6), Number of arrests in that BG (mean 9.2), and the ratio of those two measures (mean 5.1), all transformed into arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors clustered at the tract level are reported in the parentheses.
Table A.19: Disparities in Neighborhood Police Exposure (During Non-working Hours)

| VARIABLES                        | (1) arsinh(Hours) | (2) arsinh(Hours) | (3) arsinh(Hours) | (4) arsinh(Hours) | (5) arsinh(Hours) |
|----------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Relative Black Share             | 0.0735***          | 0.0401***          | 0.0222***          | 0.0510***          | 0.0683***          |
|                                  | (0.00660)          | (0.00720)          | (0.00671)          | (0.00746)          | (0.00768)          |
| Police: Relative Black           | -0.372***          | -0.104+            | -0.0710***         | -0.0708+           | -0.161***          |
|                                  | (0.0312)           | (0.0575)           | (0.0241)           | (0.0399)           | (0.0286)           |
| Supervisor: Relative Black       |                    |                    |                    |                    | -0.0869***         |
|                                  |                    |                    |                    |                    | (0.0178)           |
| Relative Hispanic Share          | 0.0459***          | 0.0231*            | -0.00491           | 0.0240*            | 0.0356***          |
|                                  | (0.00823)          | (0.00954)          | (0.00893)          | (0.00994)          | (0.0101)           |
| Relative Asian Share             | 0.0113+            | -0.0185***         | -0.0121*           | -0.0165**          | -0.00093           |
|                                  | (0.00683)          | (0.00607)          | (0.00491)          | (0.00534)          | (0.00672)          |
| log(Population)                  | 0.338***           | 0.330***           | 0.365***           | 0.369***           |                    |
|                                  | (0.0181)           | (0.0182)           | (0.0188)           | (0.0193)           |                    |
| % College Graduates              | 0.522***           | 0.679***           | 0.804***           | 0.941***           |                    |
|                                  | (0.0528)           | (0.0519)           | (0.0543)           | (0.0559)           |                    |
| Median Household Income (1K)     | -0.00506***        | -0.00388***        | -0.00516***        | -0.00492***        |                    |
|                                  | (0.000332)         | (0.000328)         | (0.000342)         | (0.000345)         |                    |
| Census Form Return Rate          | -1.045***          | -1.284***          | -0.687***          | -0.735***          |                    |
|                                  | (0.108)            | (0.111)            | (0.114)            | (0.117)            |                    |
| Log distance to nearest homicide (km) | -0.00827   | -0.117***          | 0.00371            | 0.0190**           |                    |
|                                  | (0.00506)          | (0.0107)           | (0.00513)          | (0.00603)          |                    |
| Homicide Count 2016              | 0.244***           | 0.129***           | 0.270***           | 0.275***           |                    |
|                                  | (0.0199)           | (0.0208)           | (0.0206)           | (0.0209)           |                    |
| Observations                     | 24,571             | 23,381             | 23,381             | 21,821             | 20,972             |
| R-squared                        | 0.006              | 0.051              | 0.169              | 0.059              | 0.064              |
| Fixed effects                     | NA                 | NA                 | City               | NA                 | NA                 |

Notes: This table presents OLS estimates of exposure disparity among census block groups (BGs) across 23 cities (Column 1,2,4,5) and within cities (Column 3). All race variables are mean-centered, relative Black (Hispanic, Asian) shares defined as ratio of % Black (Hispanic, Asian) in BG to % in city, Police (Supervisor) Relative Black defined as ratio of % Black of sworn officers (supervisors) to % in city. The dependent variable is police hours observed in BGs (during non-working hours), transformed in arsinh values. Household income is measured in thousands of dollars, census return rates range from 0-1. Robust standard errors are reported in parentheses.
Table A.20: Disparities in NYC Neighborhood Police Exposure

| VARIABLES                              | (1)          | (2)          | (3)          | (4)          |
|----------------------------------------|--------------|--------------|--------------|--------------|
| Police Exposure in a Census Block Group: arsinh(Hours) |              |              |              |              |
| Relative Black Share                   | 0.0496***    | 0.107***     | 0.0618***    | 0.101***     |
|                                        | (0.0138)     | (0.0175)     | (0.0138)     | (0.0175)     |
| Relative Hispanic Share                | 0.0175       | 0.136***     | 0.0299       | 0.109***     |
|                                        | (0.0197)     | (0.0289)     | (0.0196)     | (0.0288)     |
| Relative Asian Share                   | -0.0220      | 0.0237       | -0.0195      | 0.0157       |
|                                        | (0.0142)     | (0.0155)     | (0.0141)     | (0.0153)     |
| Log Population                         | 0.390***     | 0.365***     |              |              |
|                                        | (0.0462)     | (0.0455)     |              |              |
| % College Graduates                    | 1.327***     | 1.218***     |              |              |
|                                        | (0.129)      | (0.130)      |              |              |
| Median Household Income (1K)           | -0.00133+    | -0.00219**   |              |              |
|                                        | (0.000697)   | (0.000669)   |              |              |
| Census Form Return Rate                | -0.0312      | 0.0990       |              |              |
|                                        | (0.237)      | (0.238)      |              |              |
| Log distance to nearest homicide (km)  | -0.137***    | -0.139***    |              |              |
|                                        | (0.0243)     | (0.0244)     |              |              |
| Homicide Count 2016                    | 0.304**      | 0.290**      |              |              |
|                                        | (0.0985)     | (0.0981)     |              |              |
| Observations                           | 6,226        | 5,821        | 6,062        | 5,672        |
| R-squared                              | 0.004        | 0.064        | 0.006        | 0.059        |

Notes: This table presents the OLS regression estimates of the disparity in police presence among census block groups (BGs) in New York City. Column 1-2 includes the full sample; Column 3-4 excludes BGs in Precinct 1 (Wall Street), 6 (the West Village), 8 (Penn Station, Grand Central), 14 (Midtown South) and 18 (Midtown North). The dependent variable is the police hours observed in census block groups (excluding pings moving faster than 50 mph). Relative Black (Hispanic, Asian) shares are defined as the ratio of % Black (Hispanic, Asian) in BG to % Black (Hispanic, Asian) in the city. Household income is measured in thousands of dollars, census form return rates range from 0-1. Robust standard errors are reported in parentheses.