

Long-Term Exposure to Neighborhood Policing and the Racial/Ethnic Gap in High School Graduation

Joscha Legewie and Nino José Cricco

ABSTRACT Researchers are increasingly exploring the consequences of policing for the educational outcomes of minority youth. This study contributes to this literature by asking three questions. First, what are racial/ethnic disparities in long-term exposure to neighborhood policing? Second, how does this exposure affect high school graduation? Third, how much of the ethnoracial gap in high school graduation would remain if neighborhood policing was equalized? To address these questions, we use data from the New York City Department of Education and follow five cohorts of NYC public school students from middle to high school. Our findings reveal starkly different experiences with neighborhood policing across racial/ethnic groups. Using novel methods for time-varying treatment effects, we find that long-term exposure to neighborhood policing has negative effects on high school graduation, with important differences across racial/ethnic groups. Using gap-closing estimands, we show that assigning a sample of Black and Latino students to the same level of neighborhood policing as White students would close the Black–White gap in high school graduation by more than one quarter and the Latino–White gap by almost one fifth. Alternatively, we explore interventions where policing is solely a function of violent crime, which close the Black–White gap by as much as one tenth. Our study advances previous research by focusing on cumulative, long-term exposure to neighborhood policing and by assessing various counterfactual scenarios that inform research and policy.

KEYWORDS Policing • Education • Inequality • Neighborhoods • Racial disparities

Introduction

Neighborhood policing is an important aspect of urban life that is central to debates about racial inequities. Previous research has shown that exposure to neighborhood policing has a negative impact on academic performance and other outcomes (Ang 2021; Gottlieb and Wilson 2019; Hirschfield 2009; Hjalmarsson 2008; Kirk and Sampson 2013; Legewie and Fagan 2019; Shedd 2015). This research focuses on single incidents of police stops, arrests, or acts of police violence and short-term exposure to neighborhood policing. Exposure to policing, however, cumulates over extended periods of time, such that systematic ethnic and racial differences in

exposure can grow over adolescence, resulting in cumulative disadvantages for minority youth (Justice 2021). Building on prior research on the temporal dimensions of neighborhood effects (Wodtke et al. 2011), our study contributes to this growing literature by focusing on ethnic and racial disparities in long-term exposure to neighborhood policing.

Using administrative data from the New York City Department of Education and the New York City Police Department, we follow five cohorts of 231,177 NYC public school students over an eight-year period from middle to high school. First, we document racial and ethnic disparities in long-term exposure to neighborhood policing over key developmental periods. Second, we focus on the effect of long-term exposure to policing on high school graduation. Using innovative methods for time-varying treatment effects (Wodtke et al. 2011; Zhou and Wodtke 2020) allows us to examine the role of cumulative exposure across middle and high school. These models address the dynamic relation between neighborhood crime and policing, in which the level of policing in one period is affected by crime in previous periods. Third, using novel gap-closing estimands, we assess several counterfactual scenarios that help us understand how the racial/ethnic gap in high school graduation would change for a sample of students if exposure to neighborhood policing were equalized or based solely on neighborhood crime (Lundberg 2021).

Descriptively, we show that differential neighborhood policing cumulates to create striking ethnic and racial disparities in exposure to the criminal justice system over adolescence. Though levels of neighborhood policing decline over the observation period, ethnic and racial disparities in cumulative exposure persist across cohorts. We also show that the cumulative nature of exposure matters: compared with our measure of cumulative exposure, focusing on a single year of exposure during middle or high school understates the negative impact of neighborhood policing on minority students' high school graduation rates. Counterfactual scenarios illustrate that assigning a sample of Black and Latino students to the same level of neighborhood policing as White students would reduce the Black–White gap in high school graduation by 27.8% and the Latino–White gap by 17.5%. However, assigning neighborhood policing solely as a function of violent crime reduces the Black–White gap to a more modest extent by 10.3%.

Our results highlight policing as one of many mechanisms through which neighborhoods shape children's life chances (Chetty et al. 2014; Harding et al. 2010; Sampson 2012) and create starkly different residential experiences for Black and White youth (Massey and Denton 1993; Peterson and Krivo 2010). By showing how long-term exposure to neighborhood policing matters for high school graduation in addition to crime and other common neighborhood characteristics (Sharkey and Torrats-Espinosa 2017; Torrats-Espinosa 2020), these findings also heed the call to examine how policing shapes social structure above and beyond its effects on crime (Bell 2021).

Neighborhood Policing and Educational Outcomes

A growing effort among social scientists has examined how ethnic and racial inequalities in direct and indirect contact with the criminal justice system shape educational

outcomes. Researchers focusing on direct criminal justice system exposure have suggested that students who experience arrests (Hirschfield 2009; Kirk and Sampson 2013; Lopes et al. 2012; Sweeten 2006) and juvenile incarceration (Aizer and Doyle 2015) are more likely to drop out of high school and less likely to enroll in higher education (Kirk and Sampson 2013; Widdowson et al. 2016). Other research has documented the deleterious effects of indirect exposure to the criminal justice system on educational outcomes via parental incarceration (for a review, see Foster and Hagan 2009, 2015), vicarious exposure through friends or family members (Gottlieb and Wilson 2019), or exposure to neighborhood and school-level policing (Ang 2021; Bacher-Hicks and de la Campa 2020; Browning et al. 2021; Legewie and Fagan 2019). This work has consistently documented the negative effects of various types of direct and indirect criminal justice contact on educational outcomes, such as test scores or high school graduation.

Most important for the current study, several articles have focused on neighborhood- or school-level exposure to policing. Legewie and Fagan (2019), for example, showed that neighborhood-level exposure to aggressive policing programs has substantial negative impacts on minority children's test scores, with larger effects for Black than for Latino students. Ang (2021) focused on incidents of police violence in the residential environment and similarly found negative effects on minority students' GPA, with no effects on White students. Closely related research has focused on school-level exposure to police stops and documented comparable negative effects on Black students' high school graduation rates, with potential positive effects for White students (Bacher-Hicks and de la Campa 2020). This work has consistently found larger effects on Black students as the racial group disproportionately targeted by policing.

Two key mechanisms explain the effect of neighborhood-level proactive policing on educational outcomes. The first focuses on eroded trust in state institutions and system avoidance. Negative encounters with the police—such as mistreatment, procedural injustice among friends and family members, or neighborhood-level exposure to aggressive policing programs—can negatively impact perceptions of police legitimacy, reduce trust in government, and lead to withdrawal from state institutions, including schools (Bell 2020; Geller and Fagan 2019). Other research has focused on broader systems of surveillance across state institutions, describing system avoidance as a behavioral response in which individuals avoid institutions that are involved in surveillance and keep formal records (Brayne 2014:368). Both distrust in law enforcement and avoidance of state institutions have implications for educational outcomes, such as high school graduation. Indeed, empirical research has directly tied system avoidance following paternal incarceration to reductions in parental involvement in schooling (Haskins and Jacobsen 2017), and a national analysis from the Urban Institute found that more than 65% of high school students attend schools with a law enforcement presence (Lindsay et al. 2018). Exposure to police officers at school, together with zero-tolerance discipline policies, highlights how distrust of the legal system may impact school attendance and educational outcomes more broadly.

A growing literature documents a second mechanism, which focuses on the negative health effects of police contact that can impact children's educational performance. Geller et al. (2014), for example, showed that participants who report prior encounters with the police display higher rates of trauma and anxiety, particularly when stops were intrusive or perceived as unfair. Building on the stress process

paradigm, Sugie and Turney (2017) looked at a set of criminal justice contacts, including arrest, conviction, and incarceration, and found negative consequences for mental health. Sewell and colleagues focused on neighborhood-level exposure to policing and showed similar negative effects on stress, trauma, anxiety, and other mental health problems (Sewell and Jefferson 2016; Sewell et al. 2016; Sewell et al. 2020). Toro and collaborators (2019) linked these health effects to educational outcomes. They showed that part of the relationship between direct and vicarious police contact and grades in school is mediated by psychological distress, sleep problems, and self-rated health. Both processes explain the potential effect of neighborhood-level proactive policing on educational outcomes.

Cumulative Exposure to Neighborhood Policing and the Racial/Ethnic Gap in High School Graduation

While previous research has documented the social consequences and costs of proactive policing programs for the education of minority youth, this work focused either on single incidents of police stops, arrests, or acts of police violence or on short-term exposure to neighborhood policing. For example, Legewie and Fagan (2019) examined the effect of immediate exposure to an aggressive policing program over a single year on test scores, and Ang (2021) focused on the acute effect of police killings in the residential environment on GPA. This approach ignores the potential for cumulative effects of exposure to policing over extended periods of time that are experienced by many minority youth. In the present study, we follow five cohorts of middle school students in New York City over eight years and focus on long-term exposure to policing throughout adolescence. This longitudinal perspective advances the literature in three important ways.

First, research focused on the acute or “short-run” effects of neighborhood policing potentially underestimates the effect of cumulative exposure. Many of the mechanisms at the core of policing effects and the effects of racism on individual outcomes focus on long-term and repeated exposure. System avoidance and legal estrangement, for example, are cumulative processes of disengagement from formal institutions that develop in response to sustained and repeated experiences of injustice over an extended period of time (Bell 2017). Incidents of police violence, racial discrimination, or other encounters that initially act as acute stressors translate to chronic stressors with additional health consequences as a result of sustained and repeated exposure to policing and structural racism. Accordingly, the focus on long-term exposure to neighborhood policing documents the cumulative effect that is essential for understanding the consequences of neighborhood policing for child development.

Second, a longitudinal perspective allows us to better measure racial and ethnic disparities in exposure to neighborhood policing. Policing in New York City and many metropolitan areas underwent major changes over recent decades. After a steep increase in the use of the Stop, Question, and Frisk (SQF) operations during the 2000s, the use of police stops peaked in 2011 with over 650,000 incidents. In response to the public outcry against the SQF program and the *Floyd v. City of New York* lawsuit, the New York Police Department (NYPD) dramatically reduced the number of stop and frisk operations over the following years, reaching about 45,000 in 2014. As a result,

early cohorts in our sample were exposed to an average of 2,210 police stops in their residential census tract, compared with an average of 1,157 stops for later cohorts. At the same time, families move between neighborhoods, with implications for their local exposure to neighborhood policing (de Souza Briggs and Keys 2009; Wodtke et al. 2011). In light of these shifts, a longitudinal perspective more accurately reflects the experiences of adolescents in their neighborhoods.

Third, a longitudinal perspective allows us to disentangle the dynamic relationship between neighborhood policing and neighborhood crime. The latter is associated with both neighborhood policing and children's educational attainment (for a review, see Sharkey 2018), and behavioral adaptations to crime develop over extended periods (Harding 2009). Policing can thus have positive consequences for youths' educational outcomes by reducing students' exposure to violent crime over time. Research suggests that declines in violent crime attributable to exogenous increases in the availability of funds to hire police officers via federal funds substantially raised English Language Arts (ELA) test scores, particularly among Black youth (Torrats-Espinosa 2020). Examining the effect of recent exposure to police stops while adjusting for violent crime might thus control away the positive impact of prior levels of policing on declines in subsequent crime levels. Our longitudinal perspective uses novel methods to adjust for time-varying confounders, allowing us to examine the effect of policing on children's high school graduation while considering the dynamic relationship between neighborhood policing and crime.

Together, these advances allow us to more precisely measure and assess the consequences of exposure to neighborhood policing, with implications for our understanding of its effects on child development, urban inequality, and the racial/ethnic gap in high school graduation. To leverage these insights, we further study several counterfactual scenarios that help us assess how the racial/ethnic gap in high school graduation would change depending on different levels of exposure to neighborhood policing.

Data and Methods

Data

Our analyses follow five cohorts of middle school students over eight years using administrative school district records from the New York City Department of Education. The school district records consist of student-level data from all NYC public school students in grades 6 to 12 from the school years 2006 to 2018. We focus our analysis on the 2005–2006 to 2009–2010 (five) cohorts of middle school students. Each cohort is defined as all students who enrolled in sixth grade for the first time in a respective school year. We track these cohorts for eight years to capture their long-term exposure to neighborhood policing during an important developmental period prior to our key outcome variable, high school graduation.

We link student data to information on pedestrian stops from the SQF program and crime complaints from the NYPD based on residential census tracts. The SQF program regulates police stops in situations where officers reasonably suspect that a person has committed, is committing, or is about to commit a felony or a Penal Law misdemeanor (Ridgeway 2007). Stops are well documented and reliably recorded on

the “Stop, Question and Frisk Report Worksheet” (UF-250 form) during the height of the SQF program, but they are possibly underreported in later years (Braga et al. 2022; Eterno and Silverman 2012; Ridgeway 2007). The possible underreporting of stops in later years is an important data limitation and is discussed later. NYPD crime complaints include geocoded, incident-level felony, misdemeanor, and violation crimes reported to the NYPD. Official crime data are limited to incidents known to the police through citizen or police reporting. This data limitation, however, is less problematic when studying police behavior because police cannot respond to crime that is unknown to them. While unreported crime likely impacts educational outcomes as well, it is presumably not related to neighborhood police stops or arrests and therefore is not a major concern for our analysis.

Outcome

Our *main dependent variable* is high school graduation, which is a hugely important milestone in the educational trajectory of adolescents with implications for a range of social, economic, and health outcomes later in life (Rumberger 1987; Rumberger and Rotermund 2012). We measure whether students graduate within eight years from their initial enrollment in sixth grade, allowing for one additional year compared with on-time graduation. We exclude students who leave NYC public schools (see following details), so our analyses compare graduating students to students who drop out or are still actively enrolled at the end of our observation period.

Treatment and Covariates

Our *main independent variable* measures cumulative, neighborhood-level exposure to police stops in the six years after students enroll in sixth grade. SQF operations in New York City were a core component of proactive policing programs that use police stops to engage citizens, targeting low-level crimes and minor disorderly behavior (Zimring 2013). These operations are particularly salient for middle and high school students because they frequently target young people of color (Figures and Legewie 2019; Geller 2021). In supplementary analysis, we present results for the cumulative number of low-level arrests, defined as all misdemeanor and violation arrests in students’ residential census tract. While arrests are still uncommon for students in our sample, they are an alternative measure of proactive policing that allows us to assess the robustness of our findings.

We define $A_t \in \{0, 1, 2, \dots, 5\}$ as the number of police stops in a student’s residential census tract during the fall term of the calendar year. To measure cumulative exposure to police stops, we sum over years 1 to 5 as $cum(A) = \sum_{k=1}^5 A_k$ and divide this student-level measure into quintiles defined over all students in the sample.¹

¹ Less than 1% of the sample (2,941 students or 0.869%) drop out of school before the end of the period during which we measure cumulative exposure to police stops. In supplementary analysis, we exclude these students from the analytic sample. The results are substantively the same as the findings presented here.

The result is a categorical measure of cumulative exposure to neighborhood policing in the residential environment during middle and high school, ranging from very low to very high. “Very low” indicates that a student experienced between 0 and 201 police stops during years 1 to 5 (first quintile), “low” indicates 202 to 393 stops (second quintile), “average” indicates 394 to 680 stops (third quintile), “high” indicates 681 to 1,208 stops (fourth quintile), and “very high” indicates 1,209 to 10,866 stops (fifth quintile). Compared to a continuous measure, this categorical variable provides two key advantages:² first, it allows us to measure nonlinear effects of cumulative exposure to neighborhood policing, and second, it makes it possible to identify gap-closing estimands and therefore directly link the two parts of our analysis.

In additional analysis, we measure exposure to police stops during a single year in either middle or high school. These measures are similarly divided into quintiles for “middle school exposure” ($t=1$) and “high school exposure” ($t=3$). They allow us to compare the effect of cumulative exposure with short-term exposure over a single year, as is more commonly used in previous research.

In addition, we use three measures of crime as time-varying, neighborhood-level covariates $L_i \in \{0,1,2,\dots,5\}$: the number of violent crimes, the number of property crimes, and the number of misdemeanors in the spring term. To ensure a clear temporal order between treatment and confounders across our analyses, these time-varying confounders are measured during the spring term, while the treatment variable is measured during the fall term of the same calendar year. Table A1 in the online appendix illustrates this temporal structure for the 2005–2006 middle school cohort.

Finally, our analyses include *baseline covariates* on the student and neighborhood levels. On the student level, we control for cohort, gender, free lunch status as a measure of parental socioeconomic background, English learner status as a measure of immigrant background, and sixth-grade ELA and mathematics test scores. Both free lunch status and English learner status are binary variables that indicate whether a student ever received free lunch or was designated as an English learner by the NYC Department of Education. Adjusting for cohort ensures that we control for all time-specific characteristics that are common across students from the same cohort, such as general economic conditions or changes in the reporting practices of police stops (including possible underreporting).

On the neighborhood level, we control for several characteristics of student’s baseline neighborhood (residential census tract in sixth grade) derived from the 2010 decennial census and the 2006–2010 American Community Survey five-year estimates. These variables include police precinct fixed effects; population size; racial composition in terms of proportions Black, Asian, Latino, and other residents, with proportion White as a reference; residential instability; and concentrated disadvantage. The last two variables are indices constructed from an exploratory maximum likelihood factor analysis with one-factor solutions. The factor analysis for concentrated disadvantage includes poverty rate, unemployment rate, professional jobs,

² Table A2 in the online appendix reports the regression results for a continuous (logged) measure of cumulative exposure. Converting continuous treatment variables into categorical variables can be problematic if the distribution of students within quintiles differs across groups. The results in Table A2 alleviate these concerns. They show a similar pattern, although the results provide clearer evidence for a potential negative effect on White students.

Table 1 Descriptive summary statistics for key variables of New York City public school students

Variable	All	Black	Latino	White
Number of Students	231,177	85,490	109,291	36,396
Percentage High School Graduation	80.6	79.0	78.6	90.3
Cumulative Exposure to Policing and Crime				
Neighborhood police stops (fall, number)	794.8	950.9	838.5	296.9
Neighborhood police stops (fall, %)				
Very low (first quintile)	20.0	12.8	15.3	51.4
Low (second quintile)	20.0	17.2	19.6	27.6
Average (third quintile)	20.0	21.5	21.2	12.9
High (fourth quintile)	20.0	23.5	22.2	5.3
Very high (fifth quintile)	20.0	25.0	21.8	2.8
Neighborhood low-level arrests (fall)	480.5	520.6	544.2	194.6
Neighborhood violent crime (spring)	72.6	83.4	79.1	27.7
Neighborhood property crime (spring)	91.5	93.1	94.5	78.6
Neighborhood misdemeanor crime (spring)	441.1	467.9	481.5	257.2
School exposure to police stops (full year)	726.5	840.8	760.7	354.8
Neighborhood Characteristics (measured at $t=1$)				
Avg. population	4,875	4,570	5,180	4,671
Avg. concentrated disadvantage	0.5	0.7	0.6	-0.5
Avg. residential instability	0.3	0.3	0.6	-0.5
Avg. % White	20.7	8.6	16.6	61.6
Avg. % Black	32.6	58.0	21.6	6.4
Avg. % Latino	36.2	26.9	50.0	16.6
Avg. % Asian	8.3	4.2	9.7	13.8
Student Characteristics				
Percentage female	51.3	52.9	50.8	49.1
Percentage free/reduced lunch	83.4	89.7	88.4	54.0
Percentage English learner status	25.3	3.5	44.5	19.1
Avg. ELA score	654.1	652.2	650.5	669.6
Avg. mathematics score	666.1	660.9	663.2	687.3

Note: All continuous variables are standardized for the analysis.

share of high school graduates, and share of single-mother families; that for residential instability includes percentage of renter-occupied units, share of residents who moved between 2000 and 2009, and housing unit rental vacancy rate. Concentrated disadvantage and residential instability are both standardized on the neighborhood level. Finally, we control for cumulative exposure to police stops around school defined as the number of police stops within 500 meters of a school. This control variable ensures that our results for neighborhood-level exposure to policing are not driven by exposure to policing at school.

Table 1 provides summary statistics for all the variables by race and ethnicity.

Estimation Strategy

Estimating the effect of cumulative exposure to neighborhood police stops on high school graduation is challenging because policing is a time-varying treatment that is closely linked to crime. The level of neighborhood crime at a particular point in time

is affected by recent policing, which itself is influenced by previous criminal activity. This dynamic relationship raises concerns about posttreatment confounding (Zhou and Wodtke 2020). The naive approach to condition on posttreatment confounders is problematic because it may induce bias by blocking causal pathways, controlling away the effect of the treatment on the outcome that operates through the time-varying confounder, or by leading to spurious associations between treatment and outcome via collider stratification bias if these confounders share unobserved common causes with the treatment.

One approach to overcome this challenge is the use of marginal structural models with residual balancing to construct weights designed to account for dynamic causal relationships between time-varying treatments and confounders (Imai and Kim 2019; Wodtke et al. 2011; Zhou and Wodtke 2020). Residual balancing requires modeling the conditional means of the posttreatment confounders \mathbf{X}_j to obtain a set of weights that balance the residuals from these models across future levels of treatment \mathbf{A} and prior levels of the treatment and the confounders. Estimating marginal structural models using these weights creates a pseudo-population where time-varying, posttreatment confounders (\mathbf{X}_{it}) do not predict future treatments, conditional on prior values of the treatment (\mathbf{A}_{it}) and prior values of the confounder (\mathbf{X}_{it-1}). In this pseudo-population, the residualized posttreatment confounders \mathbf{X}'_{it} are balanced across levels of the treatment \mathbf{A}_{it} while remaining uncorrelated to the observed past (\mathbf{A}_{it-1} and \mathbf{X}_{it-1}). This procedure properly adjusts for biases arising from posttreatment confounding without overcontrolling for the effect of the treatment or inducing collider stratification bias. For details on the implementation and construction of weights, see Zhou and Wodtke (2020).

In the context of this study, we implement residual balancing to purge the effects of crime on policing from posttreatment confounding. We model all time-varying control variables as a function of lagged measures of time-varying control (\mathbf{X}_{jt-1}) and treatment variables (\mathbf{A}_{jt-1}). These time-varying variables j include counts of violent, property, and misdemeanor crimes during the spring term, modeled as a function of the treatment during the previous fall, and counts of violent, property, and misdemeanor crimes during the preceding spring.³ We then implement the residual balancing procedure with the R package *rbw* (Zhou and Wodtke 2020). Using the reweighted sample, we estimate the following marginal structural model:

$$Y_{ij} = \alpha + \sum_{k=1}^4 \delta_k \mathbf{A}_{ik}^{\text{quintile}} + \beta_1 \mathbf{X}_i + \beta_2 \mathbf{U}_{ij} + \epsilon_{ij},$$

where $\sum_{k=1}^4 \delta_k \mathbf{A}_{ik}^{\text{quintile}}$ refers to four indicator variables for low, average, high, and very high level of neighborhood policing in student i 's residential neighborhood from years 2 to 6 in our sample ($t=1$ to $t=5$) as a measure of cumulative exposure. \mathbf{X}_i represents the time-invariant covariates on the student level, such as gender, free lunch and English learner status, sixth-grade ELA and mathematics test scores, and

³ We also include drug and weapons crimes as time-varying covariates when estimating the effect of pedestrian stops and misdemeanor arrests on the subset of cohorts for which we observe these variables across the observation period. These results are substantively identical to the more parsimonious models and are not included.

indicator variables for four of the five cohorts, with the 2005–2006 cohort as the reference category. Finally, U_j represents the baseline control variables on the neighborhood level (census tract in grade six) and includes police precinct fixed effects; population size; racial composition in terms of proportions Black, Asian, Latino, and other residents; residential instability; and concentrated disadvantage.

These models provide unbiased and consistent estimates of marginal effects for the target population under three key assumptions. The first assumption is that the models for the conditional mean of the time-varying confounders are correctly specified. Misspecifying these models can lead to a weighted pseudo-population in which future treatments are orthogonal to the time-varying covariates without resembling the target population, leading to bias in estimates of the treatment effect for the population of interest (Zhou and Wodtke 2020). We mitigate these concerns by checking the robustness of our estimates to different model specifications for the time-varying covariates, where we (1) include a set of baseline confounders in the models for the time-varying covariates and (2) estimate similar models on a subset of a sample for which we have additional sets of measured time-varying covariates. The second assumption states that the specified balancing conditions are sufficient. We mitigate these concerns by assessing the robustness of our estimates when we include interactions between the time-varying covariates and higher order terms in the models for the time-varying confounders. Finally, similar to other research using marginal structural models, our estimates are subject to the sequential ignorability assumption, stating that, conditional on past treatments and observed confounders, the treatment at each time point is unconfounded by unobserved confounders including unobserved individual characteristics. Compared to other recent research on the effects of neighborhood- or school-level exposure to policing, our approach comes with trade-offs. It allows us to examine the effects of long-term exposure to neighborhood policing stops while accounting for the dynamic relation between policing and crime, but does not leverage more plausibly exogenous sources of variation from quasi-experimental designs such as Legewie and Fagan (2019), Bacher-Hicks and de la Campa (2020), or Ang (2021).

Gap-Closing Estimates

In the second step of our analyses, we use gap-closing estimands to determine how the racial/ethnic gap in high school graduation would change depending on different levels of exposure to neighborhood policing (Lundberg 2021; VanderWeele and Robinson 2014). Though related to Kitagawa–Blinder–Oaxaca decompositions (Blinder 1973; Kitagawa 1955; Oaxaca 1973), gap-closing estimands are distinct in that they explicitly invoke a causal claim: they are defined as the disparity in an outcome (such as high school graduation) we would expect across groups (such as race/ethnicity) when a sample of the population receives a counterfactual intervention to the treatment (such as exposure to neighborhood policing). The counterfactual treatment assignment can be either fixed to a certain value or stochastic.

In our analysis, we examine how the racial/ethnic gap in high school graduation would change under four counterfactual scenarios: (1) if we intervened so that all students experienced very low levels of neighborhood policing; (2) if a sample of

students all experienced the same level of neighborhood policing as White students; (3) if the level of neighborhood policing was entirely determined by the level of crime; and (4) if the level of neighborhood policing was solely based on crime, but using the policing–crime relation for the last cohort in our sample. Over the study period, the use of SQF dramatically declined, so that in later years the same number of violent crimes predict a lower level of policing.

Identifying gap-closing estimands directly builds on our estimation strategy discussed earlier. In particular, we convert the function to predict the outcome from the foregoing marginal structural model to an estimate of the gap-closing estimand using the g -formula (Hernán and Robins 2020:166; Lundberg 2021). To implement this approach, we first use the outcome model to predict unobserved potential outcomes under all five possible values of the treatment variable (neighborhood police stops). We then calculate the group-specific estimates of the expected outcome under each counterfactual assignment rule by averaging over all observations in each group weighted by the sample weight and assignment probability for each treatment category. The difference in these group-specific estimates of the predicted outcome is an estimator of the gap-closing estimand, and the standard errors are based on bootstrapping (for more details, see Lundberg 2021:18).⁴ Their causal interpretation is subject to the same assumptions discussed earlier.

Sample Restrictions and Missing Data

We restrict our analytic sample in several ways. First, we focus on White, Black, and Latino students because the sample size is sufficiently large to support our analysis. This restriction leaves us with 287,064 students across five cohorts. Second, our analyses exclude 55,887 students (19.47%) who left NYC public schools before the end of our observation period because they transfer to a private school, leave the NYC school district, or are discharged for other reasons that are not related to graduation or dropout. This restriction is an important limitation of administrative school district records that raises concerns about selection out of the sample. We address this challenge by using inverse probability weighting to control for various forms of attrition (for details, see Huber 2012). The weights are defined as the inverse of the predicted values from a logistic regression that predicts whether students remain in the sample using the same set of predictors as in the main analysis.

These restrictions leave us with an analytic sample of 231,177 students across five cohorts. The frequency of missing values is low for most variables, ranging from almost 0% to 3%. However, it is as high as 15.5% for free lunch status and English learner status, and is around 6% for other covariates. To address this issue, we use multiple imputation with five imputed data sets based on the chained equation

⁴ Lundberg (2021) also proposed a doubly robust estimator that combines an estimator based on predicted outcomes like the one discussed here with an estimator based on predicted treatment probabilities. The doubly robust estimator is more robust to certain misspecifications. Our analysis relies on the predicted outcomes approach using the g -formula because it directly builds on our estimation strategy that is particularly suited for settings with time-varying treatment and controls.

approach (Van Buuren and Groothuis-Oudshoorn 2011). The imputation is based on a model that includes all relevant variables from the final analysis.

Results

We begin by describing racial/ethnic disparities in long-term exposure to neighborhood policing. The five cohorts in our study came of age during a period of changing policing policies in New York City. Table 2 presents the average number of Stop, Question, and Frisk operations in students' residential environment (census tract) over a five-year period (cumulative exposure) by race/ethnicity and cohort.⁵ The average Black student in the 2005–2006 middle school cohort experienced 1,861 SQF operations in their census tract during middle and high school, or roughly 1.0 SQF operation per day. This cumulative exposure for Black students in the 2005–2006 cohort ranges from 319 stops for students in low-policing neighborhoods (5th percentile) to 7,835 stops for students in high-policing neighborhoods (95th percentile). Accordingly, some Black students were exposed to an average of 4.3 police stops in their census tract—a relatively small geographic area—every single day over this five-year period. For each subsequent cohort, the cumulative exposure declined (except for 2006–2007), reaching an average of 986 SQF operations for Black students in the 2009–2010 cohort. While SQF operations were likely underreported in later years (Braga et al. 2022), the decline reflects a substantial change in policing policy in NYC. Across the five cohorts, Latino students experienced slightly lower but overall similar levels of policing in their immediate residential environment. White students, however, were consistently exposed to substantially lower levels of policing. On average, White students in the 2005–2006 cohort were exposed to 568 police stops in their neighborhood over a five-year period, corresponding to 0.3 stops per day, compared with 1.0 and 0.9 stops per day for Black and Latino students, respectively. Cumulative exposure among White students further decreased for subsequent cohorts, averaging 299 police stops for the 2009–2010 cohort. While the level of policing substantially declined over time, racial disparities in cumulative exposure remained consistent. For the 2005–2006 cohort, the cumulative exposure ratio indicates that Black students were exposed to 3.27 times the number of police stops in their neighborhood as White students over middle and high school, and this ratio was remarkably constant across cohorts despite dramatic declines in the use of SQF. The Latino/White exposure ratio similarly remained relatively constant across cohorts on a slightly lower level (e.g., 2.97 for the 2005–2006 cohort).

In the next step of the analysis, we estimate the effect of cumulative, long-term exposure to SQF on high school graduation. Table 3 shows the results from marginal structural models for White, Black, and Latino students, and Figure 1 illustrates the key coefficients. Long-term exposure to SQF is associated with a decreased likelihood of graduating from high school for Black and Latino students, whereas the evidence for White students is

⁵ Note that the descriptive statistics presented here focus on neighborhood police stops during the entire school year and not just the fall term as the measure used in the regression analysis to ensure a clear temporal order between the time-varying treatment and confounder. Table 1 presents descriptive statistics for the measures used in the analysis.

Table 2 Mean cumulative exposure to Stop, Question, and Frisk over five years by race/ethnicity and cohort

Cohort	Black	Latino	White	Black/White Ratio	Latino/White Ratio
2005–2006	1,861 (319, 7,835)	1,689 (326, 6,384)	568 (124, 2,236)	3.27	2.97
2006–2007	1,877 (342, 7,403)	1,726 (319, 6,484)	573 (139, 2,423)	3.27	3.01
2007–2008	1,729 (330, 6,335)	1,527 (292, 5,596)	485 (114, 2,267)	3.56	3.15
2008–2009	1,367 (270, 4,923)	1,203 (233, 4,523)	413 (99, 1,785)	3.31	2.91
2009–2010	986 (197, 3,713)	866 (158, 3,286)	299 (69, 1,312)	3.30	2.90

Note: The 5th and 95th percentiles are shown in parentheses.

mixed. Using “very low” exposure as the reference category (first quintile), we find a gradually increasing negative effect size for higher levels of exposure. For Black students, “low” compared to “very low” exposure to police stops during middle and high school is associated with a 2.3-percentage-point-lower graduation rate. “Average” exposure is associated with a 5.1-percentage-point-lower graduation rate, “high” exposure with a 6.6-percentage-point-lower rate, and “very high” exposure with an 8.8-percentage-point-lower rate. To put the size of this effect into perspective, 6.6- and 8.8-percentage-point-lower graduation rates correspond to 8.4% and 11.1% decreases, respectively, in the graduation rate for Black students (i.e., rates of 72.4% and 70.2%, respectively, compared with the observed graduation rate of 79.0%). The Black–White gap in high school graduation is 11.3 percentage points in our sample, and hence the estimated effect size corresponds to a substantial proportion of that gap.

Latino students similarly experienced a negative effect of police exposure on high school graduation, but the size of the effect is somewhat smaller. “High” compared with “very low” exposure to police stops is associated with a 4.9-percentage-point-lower graduation rate for Latino students, and “very high” exposure with a 4.7-percentage-point-lower rate. The difference in the effect size between Black and Latino students is meaningful but only statistically significant for “very high” exposure (see the “L–B” column in Table 3). For White students, the sample size is insufficient to draw clear conclusions, particularly for higher levels of exposure. While the point estimates indicate that White students experienced a smaller but still negative effect of cumulative exposure to policing, the uncertainty in the estimates is large and the estimates are not statistically significant. However, we do find statistically significant differences in the coefficient estimates between Black and White and between Latino and White students for most levels of exposure. Additional analysis presented in Table A3 in the online appendix shows similar patterns with somewhat smaller effect sizes for neighborhood exposure to low-level arrests on high school graduation, reaffirming the results with a different measure of proactive neighborhood policing.

Table 3 Marginal structural models: Effect of cumulative, long-term exposure to neighborhood police stops on high school graduation, by race/ethnicity

	Black	Latino	White	Difference in Effects ^a		
				B–W	L–W	L–B
Cumulative SQF Exposure (ref. = very low)						
Low	–0.023*** (0.006)	–0.024*** (0.005)	–0.012** (0.005)	0.011 (0.007)	0.012 (0.007)	–0.001 (0.007)
Average	–0.051*** (0.007)	–0.041*** (0.006)	–0.012 (0.006)	0.039*** (0.010)	0.029*** (0.008)	0.010 (0.010)
High	–0.066*** (0.009)	–0.049*** (0.007)	–0.021* (0.010)	0.045*** (0.013)	0.028* (0.013)	0.017 (0.011)
Very high	–0.088*** (0.013)	–0.047*** (0.010)	–0.034 (0.018)	0.053* (0.022)	0.013 (0.020)	0.041* (0.017)
Student Characteristics						
Female	0.056*** (0.005)	0.038*** (0.004)	0.032*** (0.004)	–0.024*** (0.007)	–0.006 (0.005)	–0.018** (0.006)
Free or reduced lunch	–0.043*** (0.010)	–0.032*** (0.005)	–0.039*** (0.004)	0.004 (0.010)	–0.007 (0.006)	0.012 (0.010)
English learner status	0.038 (0.023)	0.026*** (0.004)	0.023*** (0.005)	–0.014 (0.025)	–0.003 (0.006)	–0.012 (0.023)
ELA score at <i>t</i> =0	0.048*** (0.003)	0.042*** (0.003)	0.013*** (0.002)	–0.035*** (0.004)	–0.029*** (0.003)	–0.006 (0.004)
Math score at <i>t</i> =0	0.101*** (0.003)	0.110*** (0.003)	0.063*** (0.002)	–0.038*** (0.004)	–0.047*** (0.003)	0.009* (0.004)
School police stops (log)	–0.015** (0.004)	–0.002 (0.004)	–0.013*** (0.004)	0.002 (0.006)	–0.011* (0.005)	0.013* (0.006)
Neighborhood Characteristics						
Population size	0.004 (0.005)	0.004 (0.003)	0.007** (0.003)	0.003 (0.006)	0.003 (0.004)	–0.001 (0.007)
Residential instability	0.009 (0.005)	0.007 (0.004)	–0.002 (0.003)	–0.011 (0.006)	–0.009 (0.005)	0.013* (0.006)
Concentrated disadvantage	–0.013* (0.005)	–0.013** (0.004)	–0.008 (0.007)	0.004 (0.008)	–0.004 (0.008)	0.000 (0.007)
Percentage Black	0.017 (0.012)	–0.001 (0.005)	–0.031*** (0.009)	–0.048*** (0.013)	–0.030** (0.010)	–0.018 (0.012)
Percentage Asian	0.000 (0.009)	0.002 (0.002)	–0.002 (0.002)	–0.002 (0.009)	–0.004 (0.003)	0.002 (0.009)
Percentage Latino	0.006 (0.010)	0.002 (0.005)	–0.010 (0.007)	–0.016 (0.013)	–0.012 (0.009)	–0.005 (0.010)
Percentage other	–0.001 (0.002)	–0.004 (0.003)	–0.005 (0.003)	–0.004 (0.004)	–0.001 (0.004)	–0.002 (0.003)
Cohort and Precinct						
Fixed Effects	✓	✓	✓	✓	✓	✓
Number of Observations	85,490	109,291	36,396	231,177	231,177	231,177

Notes: Standard errors are shown in parentheses. SQF = Stop, Question, and Frisk.

^a The effect differences across groups are based on fully interactive models.

p* < .05; *p* < .01; ****p* < .001

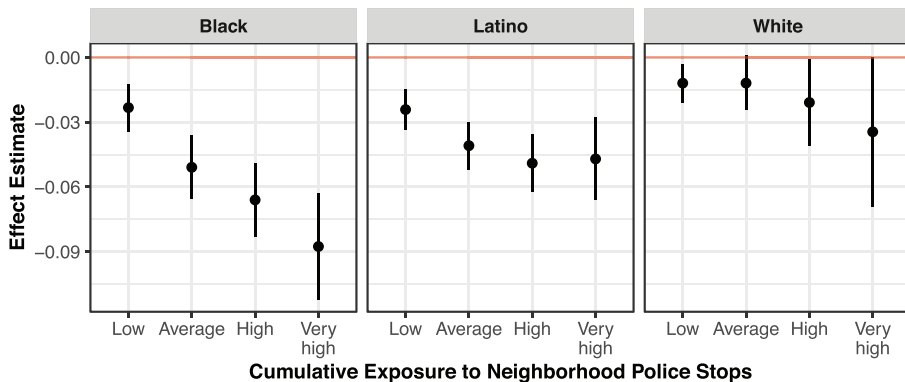


Fig. 1 Effect of cumulative, long-term exposure to neighborhood police stops on high school graduation, by race/ethnicity. Lines show 95% confidence intervals.

Table 4 Effect of cumulative exposure compared with exposure over a single year during middle or high school among Black students

	Cumulative Exposure	Middle School Exposure (t=1)	High School Exposure (t=3)
SQF Exposure (ref. = very low)			
Low	-0.023*** (0.006)	0.001 (0.011)	-0.024** (0.009)
Average	-0.051*** (0.007)	0.005 (0.011)	-0.038*** (0.010)
High	-0.066*** (0.009)	-0.004 (0.012)	-0.050** (0.011)
Very high	-0.088*** (0.013)	-0.015 (0.014)	-0.054*** (0.014)
Student and Neighborhood Characteristics	✓	✓	✓
Cohort Fixed Effects	✓	✓	✓
Precinct Fixed Effects	✓	✓	✓
Number of Observations	85,490	85,490	85,490

Notes: The difference in effect size between cumulative and middle school exposure is statistically significant at the 0.01 level for the coefficients “average,” “high,” and “very high.” For cumulative compared with high school exposure, the difference in effect size is statistically significant at the .05 level for the coefficient “very high.” SQF = Stop, Question, and Frisk.

p < .01; *p < .001

Table 4 compares the effect of cumulative exposure to police stops for Black students with the effect of exposure over a single year in middle or high school. Table A4 in the online appendix presents the same results for White and Latino students. Overall, the effect size of cumulative exposure is larger compared with the effect of exposure during a single year in middle or high school, but the magnitude and statistical significance of these differences in effect size vary across the level of

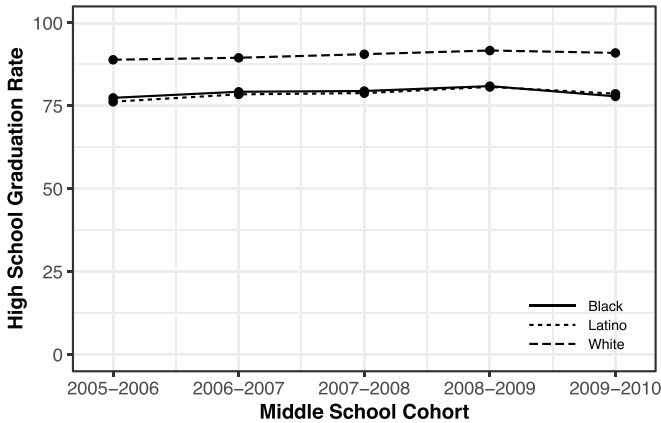


Fig. 2 High school graduation rates across cohorts and racial/ethnic groups

treatment. Compared with a single year of exposure during middle school, the effect of cumulative exposure on high school graduation is consistently larger, and this difference is statistically significant at the 0.01 level for the coefficients “average,” “high,” and “very high” in relation to “very low” SQF exposure. Comparing a single year of exposure to SQF during high school with cumulative exposure similarly shows that the effect size of cumulative exposure is either essentially the same (for the “low” compared to “very low” levels) or larger. However, the differences in effect size are statistically significant only for “very high” compared to “very low” exposure levels. These findings highlight the importance of focusing on long-term exposure to policing to understand the consequences of sustained experience with the police.

Gap-Closing Estimands

The analyses so far reveal a large and statistically significant negative effect of long-term exposure to neighborhood policing on high school graduation. However, it remains unclear whether neighborhood policing plays a meaningful role in explaining the Black–White and Latino–White gaps in high school graduation and whether interventions to policing would reduce the gap. Figure 2 shows that the Black–White and Latino–White gaps are 11.3 and 11.7 percentage points, respectively, and persist across the five cohorts in our study. In the next part of the analysis, we use gap-closing estimands to determine how this racial/ethnic gap in high school graduation would change if we intervened to assign some students to a lower (or higher) level of exposure to neighborhood police stops under different counterfactual scenarios.

First, we examine how the racial/ethnic gap in high school graduation would change under a deterministic scenario, where we intervene to assign a sample of students to the lowest level of policing. As shown in Table 5, after assigning students to the lowest level of policing, the Black–White and Latino–White disparities would be reduced to 7.0 and 8.8 percentage points, respectively. These disparities would represent a 38.6% and 25.4% reduction of the gap, respectively, highlighting the degree to which the racial/ethnic gap in high school graduation is a consequence of neighborhood policing.

Second, we examine how the racial/ethnic gap in high school graduation would change if we intervened so that a sample of students experienced the same level of neighborhood policing as White students. The assignment rule is stochastic and based on the distribution of White students across the five categories of our treatment variable with the following assignment probabilities: 51.4% for the first quintile, 27.6% for the second, 13.0% for the third, 5.3% for the fourth, and 2.8% for the fifth. (See the online Table A5 for the assignment probabilities under each of the four interventions discussed here.) Under this intervention, the Black–White and Latino–White disparities would be reduced to 8.2 and 9.7 percentage points, respectively, which correspond to a 27.8% and 17.5% reduction of the gap. This reduced racial/ethnic gap in high school graduation rates is a result of both a larger effect of neighborhood policing on Black students and a substantial reduction in cumulative exposure for both Black and Latino students when assigning them to the distribution of exposure among White students. It indicates that group differences in exposure explain a substantial part of the gap in high school graduation, but important differences remain.

Third, we assess how the racial/ethnic gap in high school graduation would change if we intervened so that the level of neighborhood policing is entirely determined by the level of crime. For this purpose, we use student-level data from all five cohorts to predict cumulative exposure to police stops as a function of neighborhood crime using an ordered logistic regression. This model allows us to derive the assignment probabilities for all students using the predicted probabilities for each of the five categories of the treatment variable. Table A5 presents the average assignment probabilities by race/ethnicity. The results of the gap-closing estimates presented in Table 5 indicate that this intervention would do little to close the racial/ethnic gap in high school graduation. In particular, the Black–White and Latino–White disparities would remain at 11.2 and 11.7 percentage points, respectively, which correspond to a change of 1.1% and 3.4%. The reason for this finding is that basing policing on crime alone changes little about racial/ethnic disparities in police exposure, as documented in Table A5 for this third intervention.

Lastly, we focus on a similar intervention in which police exposure is solely a function of crime, but instead of using data from all cohorts, we use data from the 2009–2010 cohort—the last cohort in our study. This cohort came of age during a period of substantially lower levels of police stops (see Table 2). Compared with the previous intervention, cumulative exposure to policing under this intervention is lower across all racial/ethnic groups simply because the overall number of police stops dramatically declined over time: the same level of neighborhood crime predicts a lower level of police exposure (see Table A5). Under this intervention, the Black–White and Latino–White disparities in high school graduation would be 10.2 and 10.9 percentage points, respectively, which correspond to a modest reduction of 10.3% of the Black–White gap and a smaller change of 6.9% for the Latino–White gap. This counterfactual scenario informs two important issues. First, it speculates about a world without a spike in the use of police stops during the 2000s and early 2010s. SQF is one of the most prominent and controversial policing programs of the recent past. A generation of minority youth in New York City and other places with similar programs was exposed to startlingly high levels of police stops in their residential environment. Our results suggest that without the dramatic increase in

Table 5 Gap-closing estimands with 95% bootstrapped confidence intervals

	Black	Latino	White	B–W	L–W
Observed Graduation Rate	79.0%	78.6%	90.3%		
Observed gap (percentage points)				11.3	11.7
(1) Intervention: Very Low Exposure to Policing					
Counterfactual graduation rate	84.0%	82.2%	91.0%		
	(83.2, 85.2)	(81.5, 83.0)	(90.4, 91.3)		
Counterfactual gap (percentage points)				7.0	8.8
				(5.6, 7.7)	(7.7, 9.5)
Percentage of gap closed				38.6%	25.4%
				(32.4, 50.9)	(19.5, 34.3)
(2) Intervention: White Exposure to Policing					
Counterfactual graduation rate	82.1%	80.7%	90.3%		
	(81.6, 82.9)	(80.2, 81.1)	(90.0, 90.6)		
Counterfactual gap (percentage points)				8.2	9.7
				(7.4, 8.7)	(9.1, 10.2)
Percentage of gap closed				27.8%	17.5%
				(23.2, 34.5)	(13.4, 22.0)
(3) Intervention: Policing as Function of Crime					
Counterfactual graduation rate	79.0%	78.9%	90.3%		
	(78.7, 79.5)	(78.5, 79.2)	(89.9, 90.6)		
Counterfactual gap (percentage points)				11.2	11.7
				(10.7, 11.7)	(10.9, 11.9)
Percentage of gap closed				1.1%	3.4%
				(-2.3, 5.1)	(-0.4, 6.1)
(4) Intervention: Policing as Function of Crime Based on 2009–2010 Cohort					
Counterfactual graduation rate	80.4%	79.6%	90.5%		
	(80.0, 80.9)	(79.3, 79.9)	(90.1, 90.8)		
Counterfactual gap (percentage points)				10.2	10.9
				(9.5, 10.6)	(10.4, 11.3)
Percentage of gap closed				10.3%	6.9%
				(7.6, 15.4)	(4.0, 10.5)

Note: “Percentage of gap closed” is defined as (observed–counterfactual) / observed. Table A5 in the online appendix presents the average assignment probabilities by race/ethnicity under each of the four interventions.

the use of SQF, the Black–White gap in high school graduation would be 10.2 percentage points smaller, with higher graduation rates across all three groups. From a policy perspective, the intervention is informative because it explores the expected disparities in high school graduation under a largely race-neutral allocation of police resources. The counterfactual intervention is more realistic because police exposure

is directly linked to crime, empirically informed by current levels of police stops, and continues to show racial/ethnic disparities. However, the intervention also assumes that the higher level of police stops in earlier years did not help reduce crime.

Discussion

Policing is a divisive political issue that is central to debates about racial inequities. A growing body of research contributes to this debate and examines the social consequences and costs of policing for the health, education, and civic engagement of minorities. The results presented in this article contribute to this work by providing the first systematic assessment of long-term exposure to neighborhood policing. A longitudinal perspective highlights how unequal exposures to neighborhood policing cumulate over adolescence and allows us to disentangle the dynamic relationship between neighborhood policing, crime, and educational attainment.

Using administrative data from the New York City Department of Education and the New York City Police Department, we follow five cohorts of 231,177 NYC public school students over an eight-year period from middle to high school. First, we document racial and ethnic disparities in long-term exposure to neighborhood policing over key developmental periods. The longitudinal perspective crystallizes racial and ethnic disparities in exposure to neighborhood policing with profoundly different experiences for Black, Latino, and White youth. Similar to the way in which Massey and Denton (1993) (see also Peterson and Krivo 2010) described the lack of overlap in neighborhood conditions experienced by White and Black people in urban areas, a high level of neighborhood policing experienced by White students is comparable to the average experience for Black and Latino students. These disparities have important implications for our understanding of urban inequality and replicate disparities in other forms of criminal justice contact, such as arrest or incarceration (Weaver et al. 2019; Wildeman 2009).

Second, we examine the effect of cumulative exposure to policing across middle and high school on high school graduation using innovative methods for time-varying treatment effects. These models address the dynamic relation between neighborhood crime and policing, capturing the full effect of policing on educational attainment without “controlling away” the potentially beneficial effect of policing that operates indirectly through reductions in violent crime. Our results show that the effect of long-term exposure to SQF is large and statistically significant for Black students and, to a smaller extent, for Latino students. Furthermore, our analyses show that the effects of cumulative exposure matter above and beyond the effects of differences in exposure observed during single-year periods at different developmental stages. These findings illustrate that ignoring cumulative, long-term exposure to neighborhood policing underestimates the full extent to which policing impacts educational outcomes. They demonstrate that Black and Latino youth are more likely to experience aggressive forms of neighborhood policing throughout adolescence and are disproportionately impacted by this exposure. Together, the racial/ethnic differences in both exposure to and the effect of long-term neighborhood policing create a double disadvantage, particularly for Black students, that perpetuates systematic and institutionalized inequalities. This double disadvantage constitutes a form of “hobbling”

(Justice 2021), a social process that restricts demographically targeted children's right to a public education, limits their social mobility, disempowers communities subjugated by race and class (Weaver and Geller 2019), and sustains structural racism.

While administrative school district records allow us to create a unique longitudinal data set, these data lack detailed information on underlying mechanisms. We could not examine the two key processes—institutional trust and trauma—that link long-term exposure to neighborhood policing to high school graduation. Future research should address this limitation with a specific focus on cumulative exposure to policing.

Our research echoes the notion that residential environments have an important effect on children's life chances (Chetty et al. 2014; Sampson 2012). We show that neighborhood policing can be an important contributor to the negative effects of growing up in a disadvantaged neighborhood and highlight policing practices as one of many dimensions through which residential environments can affect an individual's outcomes (Harding et al. 2010). In addition to considering how the absence of positive mechanisms, such as collective efficacy, contributes to the detrimental effects of neighborhoods on their residents' well-being, future research should also consider how the presence of negative mechanisms, such as systems avoidance and the erosion of trust in state institutions, disempowers their residents and shapes their perceptions of neighborhoods (Bell 2020).

Aside from focusing on disparities in and the effect of long-term exposure to neighborhood policing, this article uses novel gap-closing estimands (Lundberg 2021) to examine several counterfactual scenarios that help us understand how the racial/ethnic gap in high school graduation would change for a sample of students if exposure to neighborhood policing were equalized or solely based on neighborhood crime. This analysis is the first to assess whether neighborhood policing plays a meaningful role in explaining the Black–White and Latino–White gaps in high school graduation and whether changes in policing policy would reduce these gaps. The findings show that assigning a sample of Black and Latino students to the same level of neighborhood policing as White students would reduce the Black–White gap in high school graduation by 27.8% and the Latino–White gap by 17.5%. Alternatively, we show that if neighborhood policing was solely a function of violent crime, the Black–White gap would close by up to 10.2%, but only if the level of police stops is lower than at the peak of the SQF program.

From a scientific perspective, these findings indicate that neighborhood policing accounts for almost a third of the Black–White gap in high school graduation and to a smaller extent for the Latino–White gap. This assessment, however, is limited by the far-reaching and sometimes implausible nature of claims about a radically different world. From a policy perspective, the gap-closing estimands portray the expected disparities in high school graduation under a largely race-neutral allocation of police resources and suggest that such an intervention would make a meaningful but not large difference for such disparities. Overall, gap-closing estimands are a novel and innovative way to explore the role of policing policy for an important and consequential aspect of racial/ethnic inequalities—the gap in high school graduation rates. Building on Lundberg's work (2021), our article presents one of the first applications of this approach to a concrete applied problem that is relevant for population science and beyond. ■

Acknowledgments For helpful comments and advice, we thank Xiang Zhou, Ian Lundberg, and David Brady. The study was approved by the institutional review board at Harvard University (IRB Protocol ID IRB18-1584). Replication code is available at <https://osf.io/6br57/>. This research was funded by National Science Foundation grant 1850666.

References

- Aizer, A., & Doyle, J. J., Jr. (2015). Juvenile incarceration, human capital, and future crime: Evidence from randomly assigned judges. *Quarterly Journal of Economics*, *130*, 759–803.
- Ang, D. (2021). The effects of police violence on inner-city students. *Quarterly Journal of Economics*, *136*, 115–168.
- Bacher-Hicks, A., & de la Campa, E. (2020). *Social costs of proactive policing: The impact of NYC's stop and frisk program on educational attainment* (Working paper). Retrieved from <https://drive.google.com/file/d/1sSxhfmDY3N1VAN5XwyRObE65tmAZzhTj/view>
- Bell, M. C. (2017). Police reform and the dismantling of legal estrangement. *Yale Law Journal*, *126*, 2054–2150.
- Bell, M. C. (2020). Located institutions: Neighborhood frames, residential preferences, and the case of policing. *American Journal of Sociology*, *125*, 917–973.
- Bell, M. C. (2021). Next-generation policing research: Three propositions. *Journal of Economic Perspectives*, *35*(4), 29–48.
- Blinder, A. S. (1973). Wage discrimination: Reduced form and structural estimates. *Journal of Human Resources*, *8*, 436–455.
- Braga, A. A., MacDonald, J. M., & McCabe, J. (2022). Body-worn cameras, lawful police stops, and NYPD officer compliance: A cluster randomized controlled trial. *Criminology*, *60*, 124–158.
- Brayne, S. (2014). Surveillance and system avoidance: Criminal justice contact and institutional attachment. *American Sociological Review*, *79*, 367–391.
- Browning, C. R., Tarrence, J., LaPlant, E., Boettner, B., Schmeer, K. K., Calder, C. A., . . . Ford, J. L. (2021). Exposure to police-related deaths and physiological stress among urban Black youth. *Psychoneuroendocrinology*, *125*, 104884. <https://doi.org/10.1016/j.psyneuen.2020.104884>
- Chetty, R., Hendren, N., Kline, P., & Saez, E. (2014). Where is the land of opportunity? The geography of intergenerational mobility in the United States. *Quarterly Journal of Economics*, *129*, 1553–1623.
- de Souza Briggs, X., & Keys, B. J. (2009). Has exposure to poor neighbourhoods changed in America? Race, risk and housing locations in two decades. *Urban Studies*, *46*, 429–458.
- Eterno, J., & Silverman, E. B. (2012). *The crime numbers game: Management by manipulation*. Boca Raton, FL: CRC Press.
- Figures, K. D., & Legewie, J. (2019). Visualizing police exposure by race, gender, and age in New York City. *Socius*, *5*. <https://doi.org/10.1177/2378023119828913>
- Foster, H., & Hagan, J. (2009). The mass incarceration of parents in America: Issues of race/ ethnicity, collateral damage to children, and prisoner reentry. *Annals of the American Academy of Political and Social Science*, *623*, 179–194.
- Foster, H., & Hagan, J. (2015). Punishment regimes and the multilevel effects of parental incarceration: Intergenerational, intersectional, and interinstitutional models of social inequality and systemic exclusion. *Annual Review of Sociology*, *41*, 135–158.
- Geller, A. (2021). Youth–police contact: Burdens and inequities in an adverse childhood experience, 2014–2017. *American Journal of Public Health*, *111*, 1300–1308.
- Geller, A., & Fagan, J. (2019). Police contact and the legal socialization of urban teens. *Russell Sage Foundation Journal of the Social Sciences*, *5*(1), 26–49.
- Geller, A., Fagan, J., Tyler, T., & Link, B. G. (2014). Aggressive policing and the mental health of young urban men. *American Journal of Public Health*, *104*, 2321–2327.
- Gottlieb, A., & Wilson, R. (2019). The effect of direct and vicarious police contact on the educational achievement of urban teens. *Children and Youth Services Review*, *103*, 190–199.
- Harding, D. J. (2009). Violence, older peers, and the socialization of adolescent boys in disadvantaged neighborhoods. *American Sociological Review*, *74*, 445–464.

- Harding, D. J., Gennetian, L., Winship, C., Sanbonmatsu, L., & Kling, J. R. (2010). *Unpacking neighborhood influences on education outcomes: Setting the stage for future research* (NBER Working Paper 16055). Cambridge, MA: National Bureau of Economic Research.
- Haskins, A. R., & Jacobsen, W. C. (2017). Schools as surveilling institutions? Paternal incarceration, system avoidance, and parental involvement in schooling. *American Sociological Review*, *82*, 657–684.
- Hernán, M. A., & Robins, J. M. (2020). *Causal inference: What if* (1st ed.). Boca Raton, FL: Chapman & Hall/CRC.
- Hirschfeld, P. (2009). Another way out: The impact of juvenile arrests on high school dropout. *Sociology of Education*, *82*, 368–393.
- Hjalmarrsson, R. (2008). Criminal justice involvement and high school completion. *Journal of Urban Economics*, *63*, 613–630.
- Huber, M. (2012). Identification of average treatment effects in social experiments under alternative forms of attrition. *Journal of Educational and Behavioral Statistics*, *37*, 443–474.
- Imai, K., & Kim, I. S. (2019). When should we use unit fixed effects regression models for causal inference with longitudinal data? *American Journal of Political Science*, *63*, 467–490.
- Justice, B. (2021). Hobbling: The effects of proactive policing and mass imprisonment on children's education. *Annual Review of Law and Social Science*, *17*, 31–51.
- Kirk, D. S., & Sampson, R. J. (2013). Juvenile arrest and collateral educational damage in the transition to adulthood. *Sociology of Education*, *86*, 36–62.
- Kitagawa, E. M. (1955). Components of a difference between two rates. *Journal of the American Statistical Association*, *50*, 1168–1194.
- Legewie, J., & Fagan, J. (2019). Aggressive policing and the educational performance of minority youth. *American Sociological Review*, *84*, 220–247.
- Lindsay, C. A., Lee, V., & Lloyd, T. (2018, June 21). *The prevalence of police officers in U.S. schools*. Urban Institute. Retrieved from <https://www.urban.org/urban-wire/prevalence-police-officers-us-schools>
- Lopes, G., Krohn, M. D., Lizotte, A. J., Schmidt, N. M., Vásquez, B. E., & Bernburg, J. G. (2012). Labeling and cumulative disadvantage: The impact of formal police intervention on life chances and crime during emerging adulthood. *Crime & Delinquency*, *58*, 456–488.
- Lundberg, I. (2021). *The gap-closing estimand: A causal approach to study interventions that close disparities across social categories* (SocArXiv papers). <https://doi.org/10.31235/osf.io/gx4y3>
- Massey, D., & Denton, N. (1993). *American apartheid: Segregation and the making of the underclass*. Cambridge, MA: Harvard University Press.
- Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International Economic Review*, *14*, 693–709.
- Peterson, R. D., & Krivo, L. J. (2010). *Divergent social worlds: Neighborhood crime and the racial-spatial divide*. New York, NY: Russell Sage Foundation.
- Ridgeway, G. (2007). *Analysis of racial disparities in the New York Police Department's stop, question, and frisk practices* (Technical report). Santa Monica, CA: RAND Corporation. Retrieved from https://www.rand.org/pubs/technical_reports/TR534.html
- Rumberger, R. W. (1987). High school dropouts: A review of issues and evidence. *Review of Educational Research*, *57*, 101–121.
- Rumberger, R. W., & Rotermund, S. (2012). The relationship between engagement and high school dropout. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 491–513). New York, NY: Springer Science+Business Media.
- Sampson, R. J. (2012). *Great American city: Chicago and the enduring neighborhood effect*. Chicago, IL: University of Chicago Press.
- Sewell, Abigail, & Jefferson, K. A. (2016). Collateral damage: The health effects of invasive police encounters in New York City. *Journal of Urban Health*, *93*(Suppl. 1), 42–67.
- Sewell, Abigail, Jefferson, K. A., & Lee, H. (2016). Living under surveillance: Gender, psychological distress, and stop-question-and-frisk policing in New York City. *Social Science & Medicine*, *159*, 1–13.
- Sewell, Alyasah, Feldman, J. M., Ray, R., Gilbert, K. L., Jefferson, K. A., & Lee, H. (2020). Illness spillovers of lethal police violence: The significance of gendered marginalization. *Ethnic and Racial Studies*, *44*, 1089–1114.
- Sharkey, P. (2018). The long reach of violence: A broader perspective on data, theory, and evidence on the prevalence and consequences of exposure to violence. *Annual Review of Criminology*, *1*, 85–102.

- Sharkey, P., & Torratts-Espinosa, G. (2017). The effect of violent crime on economic mobility. *Journal of Urban Economics*, 102, 22–33.
- Shedd, C. (2015). *Unequal city: Race, schools, and perceptions of injustice*. New York, NY: Russell Sage Foundation.
- Sugie, N. F., & Turney, K. (2017). Beyond incarceration: Criminal justice contact and mental health. *American Sociological Review*, 82, 719–743.
- Sweeten, G. (2006). Who will graduate? Disruption of high school education by arrest and court involvement. *Justice Quarterly*, 23, 462–480.
- Toro, J. D., Thomas, A., Wang, M.-T., & Hughes, D. (2019). *The health-related consequences to police stops as pathways to risks in academic performance for urban adolescents* (Working Paper, No. wp19-09-ff). Princeton, NJ: Princeton University, School of Public and International Affairs, Center for Research on Child Wellbeing.
- Torratts-Espinosa, G. (2020). Crime and inequality in academic achievement across school districts in the United States. *Demography*, 57, 123–145.
- Van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software*, 45(3), 1–67. <https://doi.org/10.18637/jss.v045.i03>
- VanderWeele, T. J., & Robinson, W. R. (2014). On the causal interpretation of race in regressions adjusting for confounding and mediating variables. *Epidemiology*, 25, 473–484.
- Weaver, V. M., & Geller, A. (2019). De-policing America's youth: Disrupting criminal justice policy feedbacks that distort power and derail prospects. *Annals of the American Academy of Political and Social Science*, 685, 190–226.
- Weaver, V. M., Papachristos, A., & Zanger-Tishler, M. (2019). The great decoupling: The disconnection between criminal offending and experience of arrest across two cohorts. *Russell Sage Foundation Journal of the Social Sciences*, 5(1), 89–123.
- Widdowson, A. O., Siennick, S. E., & Hay, C. (2016). The implications of arrest for college enrollment: An analysis of long-term effects and mediating mechanisms. *Criminology*, 54, 621–652.
- Wildeman, C. (2009). Parental imprisonment, the prison boom, and the concentration of childhood disadvantage. *Demography*, 46, 265–280.
- Wodtke, G. T., Harding, D. J., & Elwert, F. (2011). Neighborhood effects in temporal perspective: The impact of long-term exposure to concentrated disadvantage on high school graduation. *American Sociological Review*, 76, 713–736.
- Zhou, X., & Wodtke, G. T. (2020). Residual balancing: A method of constructing weights for marginal structural models. *Political Analysis*, 28, 487–506.
- Zimring, F. E. (2013). *The city that became safe: New York's lessons for urban crime and its control*. New York, NY: Oxford University Press.

Joscha Legewie (corresponding author)
jlegewie@fas.harvard.edu

Legewie • Department of Sociology, Harvard University, Cambridge, MA, USA; <https://orcid.org/0000-0001-8963-0567>

Cricco • Department of Sociology, Harvard University, Cambridge, MA, USA