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The Academic Effects of Chronic Exposure to Neighborhood Violence

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Abstract

We estimate the causal effect of repeated exposure to violent crime on test scores in New York City. We use two distinct empirical strategies; value-added models linking student performance on standardized exams to violent crimes on a student's residential block, and a regression discontinuity approach that identifies the acute effect of an additional crime exposure within a one-week window. Exposure to violent crime reduces academic performance. Value added models suggest the average effect is very small; approximately -0.01 standard deviations in English Language Arts (ELA) and mathematics. RD models suggest a larger effect, particularly among children previously exposed. The marginal acute effect is as large as -0.04 standard deviations for students with two or more prior exposures. Among these, it is even larger for black students, almost a 10^{th} of a standard deviation. We provide credible causal evidence that repeated exposure to neighborhood violence harms test scores, and this negative effect increases with exposure.

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Keywords: Neighborhood Effects; Crime; Academic Performance; Racial Disparities; Educational Outcomes

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I. Introduction

Chronic exposure to violent crime is a continuing problem facing children in the United States. Even in New York City, now one of the country's safest large cities, many youth live in neighborhoods plagued by violent crime. In 2010, almost half of 4th to 8th graders in New York lived on a block where a homicide or felony assault occurred. Roughly a quarter lived on a block where two or more violent crimes occurred, and over 4,000 students lived on blocks with nine or more violent crimes. There is abundant evidence that children living in such violent neighborhoods are more disadvantaged, score lower on standardized exams and cognitive assessments, and have lower attendance, yet there is little credibly causal evidence of the impact of exposure to chronic violence. In this paper, we help to close this gap.

Our previous work has shown exposure to violence has a negative effect on short run outcomes, or an "acute effect." Children exposed to a violent crime right before an assessment or standardized test score lower compared to children exposed after (Sharkey, 2010; Sharkey et al., 2014). In this paper, we estimate the longer-term effects of neighborhood violence, as well as the causal impact of *chronic exposure* to violent crime on academic performance. Repeated violence exposure may sensitize children so that the impact of an additional incident of violence should be greatest for children in the most violent communities. In contrast, children may become desensitized to chronic violence; the impact of an additional incident should be weakest for children exposed to multiple violent crimes on their communities.

Isolating this causal effect has proven difficult because disparities in academic performance between students from more and less violent communities may reflect sorting according to unobserved child or family characteristics, or reflect unobserved environmental

stressors other than violence. We estimate the causal effect of chronic exposure to violent crime using two distinct empirical strategies, which draw on unique and detailed data on students and crime occurrences in New York City.

First, we exploit rich student-level longitudinal data and use value-added models linking student performance on standardized exams to violent crime exposures. We compare test scores of children exposed to homicides or aggravated assaults on their residential block in the year prior to taking a standardized exam with those living in the same census tract but not exposed to violence on their block. This strategy yields causal estimates if exposure to violent crime within census tracts is conditionally random.

Second, we follow Sharkey (2010) and Sharkey et al. (2014) and use a regression discontinuity (RD) approach that exploits the timing of the violent crime relative to the testing date to estimate an acute effect on test scores within a one-week window. We compare children exposed in the week before the test with those exposed in the week after. Importantly, we stratify the sample by the number of crime exposures in the year prior to the one-week window. If the timing of a crime relative to the test is random, this strategy yields a causal estimate of the acute effect of *an additional* crime exposure, identifying how the acute effect of violent crime varies with a student's history of prior exposures. Taken together, these analyses provide insight into the longer-term effects of living in a violent neighborhood and shed light on the question of whether children become sensitized or desensitized with additional exposures to violence.

To preview our value added results, exposure to violent crime in the year prior to testing lowers tests scores in English Language Arts (ELA) and Mathematics. On average, this negative effect is approximately 0.01 standard deviations. Students exposed to violent crime on their block

three or more times in a year score 0.02 standard deviations lower than students in their neighborhood not exposed to crime. Performance decreases with additional exposure, although the marginal effect declines. Taken together, we see no evidence of *desensitization* among the full sample.

Turning to RD results, we find a significant acute effect for children living on blocks that have experienced multiple incidents of violence over the course of the prior year, and no effect for children without prior exposures. To be precise, among the subset of students exposed to two or more crimes in the prior year, the negative impact of a recent incident of violence is 0.04. For those not exposed or with one prior exposure it is -0.002 and insignificant. The negative effect on ELA is substantially larger for black students exposed twice or more, amounting to a 0.08 decrease. These analyses provide strong evidence that children become sensitized to violent environments—in other words, the acute effect of violent crime increases with a student's history of prior exposures.

The rest of the paper is organized as follows. Section II provides background and a brief review of the literature. Section III presents data. We describe the empirical strategy in section IV and results in Section V. Discussion of the results and conclusion follow.

II. Literature Review

Neighborhood Effects and Neighborhood Disadvantage

The link between neighborhoods, educational, and behavioral outcomes has been widely documented (Ellen & Turner, 1997; Leventhal & Brooks-Gunn, 2000; Burdick-Will et al., 2011). Observational studies have shown that children in poor neighborhoods tend to perform worse

academically. For example, African American children living in "severely" disadvantaged neighborhoods in Chicago exhibit lower verbal ability (Sampson et al., 2008), and children from disadvantaged communities are less likely to graduate from high school (Garner & Raudenbush, 1991; Harding, 2003). In contrast, Jacob (2004) exploits the demolition of public housing in Chicago as an exogenous source of variation of neighborhood characteristics and finds little evidence of neighborhood effects on student performance.

Experimental studies provide inconsistent evidence of the effects of neighborhoods on academic performance. Initial studies of the Moving to Opportunity demonstration (MTO) conducted in five sites (Baltimore, Boston, Chicago, Los Angeles, and New York City) show no effects of moving to a better neighborhood on academic achievement (Sanbonmatsu et al., 2006), and mixed to no impacts in later evaluations (Sanbonmatsu et al., 2011). Focusing on the Chicago and Baltimore sites, Burdick-Will and colleagues (2011) find positive impacts of moving on the reading achievement of African-American students. In a more recent study of the MTO sample, Chetty et al. (2015) find that children assigned to the experimental group when aged 13 or younger are more likely to attend college, attend better colleges, and have higher earnings, suggesting positive longer-term impacts of moving to better neighborhoods.

Existing research illuminates the link between neighborhoods and child and adolescent outcomes, but does not fully isolate the specific dimensions of neighborhood "disadvantage" that significantly affect children's academic performance. One neighborhood factor that plays an important role in shaping the experiences of children and youth is violent crime. Harding (2009) investigates the relationship between neighborhood violence on high school graduation and teenage pregnancy finding that neighborhood violence is an important mediator of

neighborhood disadvantage. Further, Burdick-Will and colleagues (2011) suggest that neighborhood violence is one of the unexplored mechanisms that may explain differences in outcomes across MTO sites.

Neighborhood Violence and Academic Performance

A rich body of work documents that violent environments are negatively associated with academic performance. Grogger (1997) finds that school violence reduces the probability of high school graduation and college attendance. Bowen and Bowen (1999) find that greater exposure to both neighborhood and school violence is associated with lower school attendance and grades among 1,828 respondents of a nationally representative sample of students in grades 6 to 12. Studies on elementary school students reach similar conclusions (Delaney-Black et al., 2002; Lord & Mahoney, 2007; and Milam, Furr-Holden & Leaf, 2010). For example, Delaney-Black and colleagues (2002) find that violence is linked to lower IQ and reading scores among a sample of 299 first grade students. Most of these studies are largely correlational making it difficult to disentangle the effect of violent crime from other sources of neighborhood disadvantage. Aizer (2009) uses various measures of violent crime – including victimization – and a fixed effects strategy to isolate the effect of crime on children's cognitive and behavioral outcomes. In models with family fixed effects the author finds small decreases in the reading scores of children who know someone in a gang, although she cautions differences in ability not fully controlled by the family fixed effects might still drive this finding.

More recent studies have estimated the causal relationship between exposure to neighborhood violence and academic performance. Sharkey (2010) and Sharkey et al. (2014) identify an acute effect of exposure to violent crime on academic and cognitive outcomes.

Sharkey (2010) finds a negative effect of exposure to homicides on reading and vocabulary performance of African-American children aged 5 to 17 years living in Chicago. The author exploits the timing of homicides and assessment dates, and compares the performance of children living in the same neighborhood but tested at different times. This paper uses samples of more than 2,000 assessments and the outcome of interests are scores on a vocabulary subtest of the Wechler Intelligence Scale for Children-Revised (WISC-R), and scores on a letter and reading subtest from the Wide Range Achievement Test (WRAT3). The results show that the strongest effects of exposure to violence are for African-American children, with exposure to homicides less than a week before an assessment lowering reading and vocabulary scores for these students by 0.5 and 0.6 standard deviations, respectively.

Sharkey et al. (2014) use a similar approach to isolate the acute effect of exposure to neighborhood violent crime on standardized test performance for students in grades 3 through 8 attending New York City public schools and living in high poverty census tracts. They compare the test scores of students exposed to a violent crime one week before the test with the performance of children exposed one week after, under the assumption that the timing of neighborhood violence relative to the standardized test date is plausibly random. Results show that exposure to violence lowers ELA tests scores by 0.026 standard deviations, on average, but it has no effect on math. In this paper, the acute effect is largely driven by black students in elementary school who score 0.06 standard deviations lower on ELA exams after an exposure to violent crime. Compared to Sharkey (2010), this paper uses a much larger sample of almost 40,000 observations from 2005 to 2010, and focuses on state standardized exams. It is restricted, however, to students living in high poverty census tracts, thereby limiting the generalizability of

these findings. Further, it provides strong evidence of a casual effect of violence exposure on test scores, but sheds little light on the effect of chronic exposure to violent crime on academic success. That is, are these acute effects the result of stress and anxiety that affect concentration and test-taking, or do they persist, and potentially compound, over time?

Chronic Exposure to Violence

There is little evidence, regarding the effects of chronic exposure to crime on academic performance. Psychological theories of adaptation to violence and other environmental stressors suggest two possible hypotheses about how chronic exposure to violence may affect student performance (Foster & Brooks-Gunn, 2009; Ng-Mak et al., 2004; McCart et al., 2007). The "sensitization" hypothesis (maladaptation) argues that the cumulative toll of living within a violent environment may make children more sensitive to each additional exposure, suggesting that the impact of an additional incident of violence should be greatest for children who live in the most violent communities (Ng-Mak et al., 2004). An alternative hypothesis, the "desensitization" hypothesis (adaptation), argues that children who are frequently exposed to crime may become desensitized to the effects of these events. In this case, higher levels of violence eventually result in children suffering lower levels of emotional distress in response to an additional incident of violence (Foster & Brooks-Gunn, 2009; Ng-Mak et al., 2004).

The existing literature has found support for both theories. In an early longitudinal study focused on a sample of 436 African-American sixth graders, Farrell and Bruce (1997) find no relationship between emotional distress and exposure to violence, supporting the notion that children become desensitized when exposed to chronic violence. Similarly, in a cross-sectional study based on a sample of 471 6th graders in New York City, Ng-Mak and colleagues (2004) find

that higher levels of community violence are correlated with more mild symptoms of emotional distress, also supporting the desensitization hypothesis. However, the authors also find additional exposures to violence are correlated with more aggressive behavior. They refer to this mixed result as "pathologic adaptation." Relying on a nationally representative sample of children and adolescents aged 12 to 17 years and interviewed by phone, McCart and colleagues (2007) observe a positive relationship between higher exposure to community violence and post-traumatic stress disorder symptoms (PTSD), which they interpret as providing little support for the view that chronic exposure to violence desensitizes children. Campbell and Schwartz (1996) reach a similar conclusion. They study a sample of 400 middle school students in Philadelphia and find that exposure to violence is correlated with emotional distress, somatization, and PTSD. These negative consequences are particularly salient for children experiencing higher levels of violence. There is also evidence of a link between additional exposures to violence and lower academic outcomes: Hurt and colleagues (2001) find that higher levels of violence are correlated with lower grade point averages and attendance within a sample of 119 inner city 7 year-olds suggesting children are not desensitized by violence.

The literature also finds the relationship between exposure to violence and behavioral and academic outcomes persists over time. In a longitudinal study based on a sample of 2,600 6^{th}, 8^{th} and 10^{th} graders in an urban school district interviewed in 1994 and 1996, Schwab-Stone et al. (1999) find that exposure to violence was still correlated with higher levels of emotional distress and externalizing behaviors after two years. Gorman-Smith and Tolan (1998) use a sample of 245 African-American children, and also report a relationship between exposure to violence in the prior year and current levels of aggression and depression. Henrich et al. (2004)

find evidence that the link between community violence and lower academic achievement also persists in the long-run. Using a sample of urban middle school students, the authors find that witnessing violence is associated with lower achievement in 6th grade that persisted in 8th grade. More recently, Burdick-Will (2016) examines the effect of exposure to violent crime in the year prior to the third grade test on subsequent academic growth. She combines violent crime occurrences at the block-group level in Chicago with administrative records of a cohort of first-time third graders in 2002 enrolled in Chicago Public Schools until 2011. Using student fixed effects models, the author finds that students living in violent block-groups experienced slower academic growth in both reading and math.

In sum, the existing literature provides evidence that exposure to neighborhood violence affects both emotional and behavioral outcomes, as well as academic performance. But the effects of repeated exposure – and whether children affected by exposure to violence are sensitized or desensitized – remain uncertain. We examine these effects and explore whether they differ by race and gender.[1]

III. Data

We use student level data from the New York City Department of Education (NYCDOE), and point specific crime data from the New York City Police Department (NYPD) from 2004 to 2010. The crime data record crimes that were reported in New York City during these years. It includes the date, time, and offense class of all crimes (except rape), and we assign them to

[1] Separate analyses by gender are motivated by research finding that males and females may use different coping mechanisms in response to exposure to violence that can result in differences in performance (Osofsky, 1999; Rasmussen et al., 2004).

specific blockfaces using ArcGIS. Shown in Figure 1, a blockface consists of both sides of the street between two intersections. This paper focuses on violent crimes, and specifically on homicides and aggravated assaults.[2] These are very serious crimes, and presumed to be more traumatic than other type of crimes.[3] They are also more likely to be reported (Hart & Rennison, 2003). We calculate that each year all violent crimes account for 8 to 9 percent of reported crimes in New York City.

The education data contain individual-level records of all students enrolled in New York City public schools in grades 4 through 8 between school years 2004/05 and 2009/10 for at least three years since third grade.[4] The data include a rich set of demographic characteristics including race/ethnicity, gender, participation in special education, limited English proficiency, date of birth, country of birth, home language, whether a student received free or reduced price lunch, grade level, and test scores in ELA and math. Importantly, we know each student's residential address in October of each year, which we assign to a blockface to match students with the crime data. We assume, therefore, that students are living on the same block between the fall of that year and the spring of the following year, when they take standardized tests. While we cannot know for sure whether a student has witnessed a crime, we label students as exposed if a violent

[2] In this paper the definition of violent crime does not include robberies, which are included in the Uniform Crime Report (UCR) Part I definition of violent crime. Forcible rape is also part of the UCR Part I definition but the spatial coordinates for these crimes are omitted from our data.

[3] The data also has information about property crime including burglary, larceny, motor vehicle theft, and arson. The data contains information about other crime types that are less serious offenses such as drug sales/use, weapons, simple assault, prostitution, gambling, graffiti, trespassing, disturbing the peace, and moving vehicle violations.

[4] Third grade is the first tested grade, so this restriction facilitates empirical work to estimate one year, and two-year value added models.

crime has taken place on their blockface. We create crime exposure measures by counting the number of crimes that occurred on a students' blockface in a given window of time.

We use two analytic samples. Our value added sample contains 1,264,113 observations (382,489 unique students), distributed across 1,181 schools and 2,160 census tracts. Over 40 percent of students in this sample are exposed to at least one violent crime in the year prior to testing (table 1). Specifically, 18 percent of students are exposed to just one violent crime, 9 percent are exposed to two violent crimes, and 14 percent are exposed to three or more violent crimes. Children exposed to violent crime do worse on a range of outcomes. They score lower on the ELA and math tests, and have lower attendance. For example, students exposed three or more times score, on average, 0.21 standard deviations lower in ELA and 0.24 lower in math. Significantly, the more exposures, the worse they perform. Students repeatedly exposed to crime are also more disadvantaged; a larger share are poor and a larger fraction are black or Hispanic.

Our RD sample includes 37,041 observations and 34,164 unique students over the same time period (AY 2004/05-2009/10). Table 2 presents descriptive statistics comparing students exposed before and after the ELA test stratified by exposure prior to the one-week window. The majority of students in this sample are black or Hispanic, especially in the group with prior crime exposures. Indeed, half of the sample with prior exposures is comprised of Hispanic students; black students represent 40 percent. Almost all students, regardless of their prior exposure are poor – receiving free or reduced price lunch.

IV. Empirical Strategy

Value Added Models

We begin by estimating value added regression models linking student performance on standardized tests to violent crime exposure in the year between tests. We estimate the following baseline regression:

$$(1)\quad Test_{ict} = \alpha_t + \beta Crime_{ict} + \lambda Test_{ict-1} + X'_{ict}\theta + \gamma_g + \delta_c + \varepsilon_{ict}$$

In this specification, *test* represents student *i*'s test score on a standardized test (ELA or math), measured as z scores standardized for each grade citywide, with a mean of zero and a standard deviation of one; *t* indexes time, and *c* indexes census tracts. *Crime* takes a value of 1 if *i* was exposed to a homicide or assault in the year prior to testing – defined as the year between test dates or inter-test year[5] – and it is 0 otherwise.[6] The impact of violent crime is identified by comparing the performance of two otherwise similar students – one living on a block on which a violent crime occurred; the other living in the same census tract, but on a block with no violent crime in the year prior to testing. β is the coefficient of interest, and it captures the impact of violent crime on test scores. It will be an unbiased estimate if the location of violent crimes across blockfaces within census tracts is conditionally random – that is, uncorrelated with student

[5] For example, for a student in fourth grade the inter-test year is the period between the third grade test and the fourth grade test.

[6] We consider a student "exposed to violent crime" if a crime occurred on their residential blockface. We do not assume the student witnessed the crime or was the victim of a crime. Because the blockface is a very small geographic unit it is likely that a resident of a blockface would be aware of a serious offense such as a homicide or aggravated assault.

performance. $Test_{itc-1}$ are *i*'s test scores lagged one year, X' is a vector of student demographic controls, α_t, γ_g, and δ_c are year, grade, and census tract fixed effects, respectively.

We estimate an extended version of equation (1) to explore whether the effect of violent crime varies with the number of exposures that takes the following form:

$$(2)\quad Test_{itc} = \alpha_t + \beta_1 One_{itc} + \beta_2 Two_{itc} + \beta_3 Three_{itc} + \lambda Test_{itc-1} + X'_{itc}\theta + \gamma_g + \delta_c + \varepsilon_{itc}$$

In this specification, *One* equals 1 if *i* was exposed to one violent crime only, *Two* equals 1 if *i* was exposed to two crimes only, and *Three* equals one if *i* was exposed three times or more in the year before a standardized test. In this extended model β_1, β_2, and β_3 are the coefficients of interest. We estimate alternative versions of both specifications replacing census tract with school fixed effects.

Finally, to capture whether exposure persists over the longer term we estimate equation (1) as a two-year value added model. This extended specification includes an indicator for violent crime exposure in year *t* – the year prior to the test – and in year *t-1* – two years prior to the test, and we control for test performance lagged two years. For this reason, in these models our sample is limited to students in grades 5 to 8 between AY 2006/07 and 2009/10.

Regression Discontinuity Design

Our second approach is an RD model that exploits variation in the timing of homicides and aggravated assaults relative to the test date. This strategy compares students exposed to violent crime in the week before the test with students exposed in the week after. Equation (3) outlines this baseline specification:

$$(3)\ Test_{it} = \alpha_t + \beta Crime_{it} + X'_{it}\theta + \gamma_g + \varepsilon_{it}$$

In this model *test* is still the outcome of interest, and *Crime* equals 1 if student *i* was exposed to a violent crime in the week before the test and it is 0 if exposure happened in the week after. β is the coefficient of interest. The model also includes year (α_t) and grade (γ_g) fixed effects, and a vector of student controls (*X'*). We restrict the sample to students exposed to violent crime on their blockface either the week before or after the test, and exclude students exposed both before and after in a given year.

This approach should yield an unbiased estimate of the causal effect if the timing of the crime relative to the test is effectively random. As shown in table 2 students exposed before and after are similar by race, gender and poverty status. The samples also look fairly similar on a broader set of demographic characteristics including participation in special education, limited English proficiency and nativity status. To further establish the similarity between the treatment and comparison groups we estimate a series of regressions of each demographic characteristic on the crime exposure dummy that equals 1 if a student was exposed to a homicide or assault in the week before the test, and 0 if exposure happened the week after. The model also includes year, grade, and census tract fixed effects. We conduct this test for all students, and we also stratify the sample by exposure in the prior year. Results from these regressions – reported on

table 1A in the appendix – provide further evidence that the samples are balanced on demographic controls.[7]

Incorporating Prior Exposure

To identify the impact of an additional crime exposure on test scores we estimate equation (3) stratifying the sample by the number of violent crimes on a student's block in the year prior to the one-week window (figure 2). As before, we define one year as the period between test dates, and to calculate previous exposure we count the number of crimes on a student's block in the year prior to the test minus the crimes that occurred in the week right before the test. In this way, if a student was not exposed in the period prior to the one week window, β captures the acute effect of one exposure. Conversely, if a student was exposed once before the one-week window, β identifies the impact of the second exposure. For students exposed to two violent crimes in the prior year, this coefficient identifies the acute effect of the third crime exposure.

We should note that the interpretation of these coefficients depends on whether there is selection into the prior exposure categories. To test whether such selection exists, we estimate a series of separate binary regressions of each demographic characteristic on four crime exposure dummy variables (no prior exposure, one exposure, two exposures, or three or more previous exposures; 44 regressions in total). Results from these regressions show little evidence of selection into one of these crime categories within census tracts (table 2A in the appendix). In all specifications discussed in this paper, standard errors are clustered at the census tract level.

[7] Note that foreign born is sometimes significant. Importantly, our findings are not sensitive to excluding foreign born.

V. Results

We begin by examining results of the value added specifications. Table 3 reports results for ELA. Panel A shows that students exposed to violent crime score significantly lower (-0.28) compared to students not exposed to crime. This coefficient is greatly reduced by the addition of previous test scores and student controls, falling to -0.03 (column 2). With census tract fixed effects it drops further to -0.01 (column 4). Panel B shows that the negative effect of violent crime on test scores seems to increase with the number of exposures, with a larger effect for students exposed three or more times within a year compared to those not exposed. Value added results in columns 2 to 4 show that for the approximately 14 percent of our sample exposed this many times, test score losses can range from 0.02 to 0.04 standard deviations lower.[8] The marginal effect of crime, however, decreases. Taken together, these results suggest no evidence of *desensitization* to violence.[9]

We then investigate differences by race/ethnicity and gender to reach a similar conclusion. Table 4 shows results from these subgroup analyses. Black students exposed to violent crime score consistently lower on ELA regardless of their level of exposure, and with the largest test score losses for those exposed three or more times compared to those not exposed. The magnitude of these estimates, however, does not differ from the main average effect. Hispanic students seem to only be affected by higher levels of violence, scoring 0.012 standard

[8] As shown in table 1, 232,031 observations are exposed once, and 115,124 are exposed twice. Overall, 5.17% of the observations in the sample are exposed to three crimes only (65,4146), and 8.82% are exposed to four or more crimes (111,485).

[9] We also estimated a linear and quadratic specification, and reach similar results. Tables available from authors.

deviations lower in ELA when exposed to three or more violent crimes. Table 4 suggests that whites are particularly sensitive to violence, scoring 0.03 standard deviations lower when exposed to two crimes. We should note, however, that there are very few whites exposed to such levels of violence. White students comprised only 6,092 of the 115,124 students exposed twice, and only 4,505 of the 176,901 students exposed to violent crime three times or more.[10] As for gender, female students exposed to three or more violent crimes suffer a significantly larger reduction in test scores than male students exposed to similar levels of violence (coefficients are 0.023 and 0.012 standard deviations, respectively), though there are no gender differences at lower levels of exposure.

Finally, we explore if the longer term effect of crime exposure persists over time, and whether it accumulates with additional yearly exposures. Results from the two-year value added specifications in table 5 show that exposure to violent crime lowers ELA test scores by approximately 0.02 standard deviations both one year prior to the test date, and two years prior (column 1). These coefficients decrease by half with the addition of school fixed effects (column 2), and in our preferred specification with census tract fixed effects (column 3). Importantly, the magnitude of the effect does not decrease with time. In all instances coefficients remain statistically significant, suggesting neighborhood violence has a persistent negative effect on academic performance. For students exposed multiple years – half of the sample was exposed to violence at least two years – these results suggest the potential for relatively large test score

[10] Results for whites and Asians are similar when we put the two groups together. In these regressions all coefficients are statistically significant. Result available from authors.

losses, and supports the notion that repeated exposure to violence harms academic performance.[11]

While the analyses in this section provide evidence that exposure to crime modestly lowers academic achievement in ELA and that children do not become desensitized to violence, it is not clear that these estimates are causal. If there are spillovers of violence to other blocks in a neighborhood, comparing students within neighborhoods may underestimate the impact. Alternatively, value-added models may still be biased due to unobservable differences between children who are exposed to violence and those not, suggesting an overestimate of the effect. To obtain more clearly causal estimates, we turn to regression discontinuity models.[12]

The Acute Effect of an Additional Crime Exposure

Table 6 presents RD results for our baseline specification, and stratified by the number of previous exposures. On average, exposure to a homicide or felony assault in the week before the test lowers ELA test scores by 0.025 standard deviations compared to students exposed the week after (column 1). Some students live in high crime neighborhoods, and are exposed to more than one incident of violence prior to the one-week window. Indeed, 40 percent of students exposed

[11] We find similar results in using and alternative one-year value added specification in which we regress test scores on two dummy variables. The first equals 1 in the year of the first crime exposure, and 0 otherwise. The second equals 1 every year after the first exposure and it is 0 in the year of first exposure and in any years prior to that. These tables are available from authors.

[12] We do not have the statistical power to estimate student fixed effects models because the sample used for identification in these models is much smaller than the number of observations in our data would suggest. In student fixed effects models the effect is identified by students exposed in some years but not in others. Students *never* or *always* exposed do not contribute to estimation, and 44 percent of students in our sample fall in this category. To be precise, of the 382,489 students 29.4 percent are never exposed, 15 percent are always exposed, and 30.9 are exposed (not) all but one year. The remaining 24.7 percent of students are sometimes exposed. In student fixed effects models coefficients are still negative but smaller and insignificant.

in a one-week window were also exposed to three or more crimes in the previous year, and only 25 percent were not exposed prior to the one-week window. Is the acute effect larger for children with more prior exposures? Columns 2 to 6 suggest that children become sensitized to violence. The acute effect of *an additional* crime exposure is largest for students exposed three or more times in the past year. These students score 0.04 standard deviations lower on average (column 5). Notice that the point estimate in column 4 is similar, however, the sample is much smaller suggesting we may not have the power to adequately estimate this effect. Conversely, there is no acute effect for students without previous exposures or with one prior exposure. In sum, the acute effect of violent crime is driven by students with *two or more* prior crime exposures. This finding provides evidence that children become sensitized to violence, meaning the impact of an additional exposure to violent crime is greatest for children exposed to higher levels of violence over the course of the prior year.[13]

We then investigate differences by race/ethnicity and gender. Table 7 shows results for black and Hispanic students. We restricted our analysis to these two groups because black and Hispanic students are overrepresented in our sample, while there are very few white and Asian students. We find the largest negative acute effect for black students exposed twice or more in the prior year (0.08 lower in ELA). Consistent with prior research (Sharkey et al., 2014), we find no acute effect for Hispanics and this difference is statistically significant as indicated in the F-

[13] Additional analyses show no acute effect of exposure on the probability of taking the standardized exam, but a negative effect of exposure on the probability of passing the ELA exam for students with previous exposures to violence. In addition, students with more previous exposures are less likely to pass the exam, giving further support to the sensitization hypothesis. Results available from authors. Results are also robust to including students exposed both before and after, and to the addition of lagged test scores. Tables available from authors.

test at the bottom of the table. [14] The number of black and Hispanic students exposed twice or more prior is similar, thus this disparity cannot be simply attributed to differences in violence exposure, and it may suggest other differences the neighborhoods of black and Hispanic students, or in how they cope with violence exposure.

We then examine differences by gender. Once again, we find that the marginal acute effect is largest for students with more prior exposure and no effect for those without prior exposures, but we do not observe significant differences between male and female students. The negative acute effect is 0.04 for females exposed twice or more in the prior year, and it is 0.03 for males, however these estimates are not statistically different from each other.

Robustness Tests

We used multiple strategies to test the robustness of the results reported in this paper. We first estimated RD models using a two-week window of exposure. Results from these models are consistent with our findings for the one-week window. The negative acute effect is driven by children with prior exposures, and those with two or more previous exposures specifically (table 8). [15] Results by race and gender are also robust to using a larger window of exposure. As table 9 shows, the acute effect is still negative and large for blacks and for females exposed twice or more in the previous year.

[14] We also estimated the same models including Asian and white students. There are no statistically significant effects for these groups. These results are available from authors.

[15] Results are also robust and qualitatively similar in an alternative specification of this test in which we open the window of exposure for those exposed before the test to two weeks and four weeks, but not for those exposed after. To be exact, in these alternative specifications we compare students exposed two (four) weeks before the test to those exposed one week after. Results available from authors.

Second, our results are robust to adding other crimes (table 10). We estimated two sets of models with controls for property crimes and robberies (another type of violent crime), as well as the interaction of these crime variables with homicides and aggravated assaults. In these specifications, the negative effect of exposure to homicides and aggravated assaults on ELA test scores persists in magnitude and significance (column 1). Effects are still driven by students with two or more prior exposures (column 3). Note that, exposure to robberies or property crimes does not have an independent effect, nor does it moderate the effect of homicides and aggravated assaults for those previously exposed.[16]

Mathematics Test

Value added results are robust to using math test scores as the outcome. The negative effect of crime exposure is 0.01, and this effect increases with the number of exposures. Results by race/ethnicity, and gender are also robust for math. Black students exposed to crime score consistently lower regardless of the number of crime exposures, while Hispanic, Asian, and white students seem to be affected by higher levels of exposure instead. Female students also score lower than male students after exposure to three or more crimes. In sum, value added results show negative effects of violent crime on both ELA and math.

[16] Additional evidence that repeated exposure matters can also be explored by examining the impact of exposure intensity and frequency. Results from an expanded specification of the RD model in which we replace the crime exposure dummy by three variables: exposure to one crime on one day, exposure to two or more crimes on one day, and exposure on two days show that the acute effect of violent crime is still driven by children with prior exposures. There is also suggestive evidence that intensity of exposure matters with the effect for two or more exposures on the same day potentially larger than the effect of one exposure. Results available from authors.

Two-year value added models are also consistent with ELA results supporting the notion that the impact of violent crime persists over time. Similar to prior evidence (Sharkey et al., 2014), we find no acute effect on math, and no evidence that prior exposure to violence moderates the acute effect of exposure for performance on math assessments.[17]

VI. Discussion

In this paper we investigate the effect of repeated exposure to neighborhood violent crime on student performance using two distinct empirical approaches. Consistent with earlier work, we find that students exposed to violent crime perform worse on reading tests. Further, we find that chronic neighborhood violence negatively affects test performance over a one-year period, and it increases the acute effect of crime exposure. That is, students who experience violent crime on a regular basis become more sensitized to violence than students for whom neighborhood crime may be an isolated event.

First, we estimate the effect of exposure over the longer term using value added models. These models show exposure to violent crime a full year or two before a test still decreases ELA and math test scores. Most students in a large city like New York are exposed to violent crime at some point in their lives, but a smaller segment are exposed to violence on a continual basis. Results from these analyses suggest that the negative effect of community violence persists over time, potentially resulting in large long-term deficits in academic performance for children living within the most violent urban neighborhoods.

[17] Tables in Appendix B.

Second, we investigate whether children become sensitized to violent crime using a regression discontinuity approach. Our results show a negative acute effect on ELA test scores for children with prior exposure to violence and no effect for children with no prior exposure. We also find a particularly strong negative effect for children with two or more prior exposures. Further, some subgroups are especially harmed by repeated exposure to crime. The negative acute effect is greater for black students chronically exposed to crime – with two or more prior exposures – amounting to 17% of the estimated black-white test score gap for this group.[18]

As for mechanisms, it is possible that children exposed to more violent crimes on their block are also more likely to have seen a crime, or know someone who is the victim of a crime, and if there is an added effect of witnessing a crime on academic performance it may drive some our results for chronic exposure. Unfortunately, we are unable to test this hypothesis with our data, and therefore we are limited in our ability to distinguish how various definitions of exposure may affect academic achievement.

We find largest effects on ELA, and smaller or no effects on math. This finding is consistent with previous research that shows neighborhood violence seems to negatively affect the development of language skills, as well as performance on reading tests (Burdick-Will et al., 2011; Sharkey et al., 2014; Sampson et al., 2008). One possible explanation for this difference is that performance in math and reading is affected by different cognitive and self-regulatory mechanisms. For example, Sharkey et al. (2012) found that exposure to homicides lowered attention, as well as impulse control. Evidence from psychology suggests that the ability to

[18] The estimated black-white test score gap in this sample is -0.47 standard deviations, and 0.078 standard deviations is 17% of that test score difference between black and white students.

control impulses may be particularly important for reading instruction and the development of reading skills, while math instruction, which usually involves more individual work, may require other skills such as self-monitoring (Liew et al., 2008).

Consistent with findings in Sharkey et al. (2014) we find no impact of violent crime for Hispanic students, why this is the case remains a puzzle considering that black and Hispanic students are exposed to similar levels of violence within our sample. These results may also reflect other differences in the neighborhood and school contexts of black and Hispanic students that moderate the impact of community violence and affect their coping strategies, and they should be further investigated. For example, it is possible that majority Hispanic neighborhoods may have a protective effect on Hispanic children who reside there (Boggess & Hipp, 2010).

There are some limitations to the present study. First, we focus on test performance as the main outcome of interest. Performance on standardized tests, albeit important in a world of high stakes testing, is not the only academic outcome that can be affected by exposure to violent crime. Exposure to violent crime can also affect school attendance, and non-academic outcomes such as obesity and fitness. Investigating these other outcomes would allow us to gain a more comprehensive view of how community violence affects all aspects of child wellbeing.

Second, we have not explored the family, neighborhood or school-level mechanisms that may alleviate (or not) the negative impact of living in a high crime neighborhood. These mechanisms are important as areas of possible policy intervention. One such mechanism relates to school climate. Students attend schools that differ along many dimensions. While some students attend schools that are “safe havens,” other students are exposed to school disorder and violence that may contribute to feelings of danger and vulnerability. For students living in

high crime neighborhoods these varying school climates may ameliorate or exacerbate the effect of neighborhood crime on academic outcomes. The effort to explore the interaction between school climate and the effects of neighborhood crime is a task for future work.

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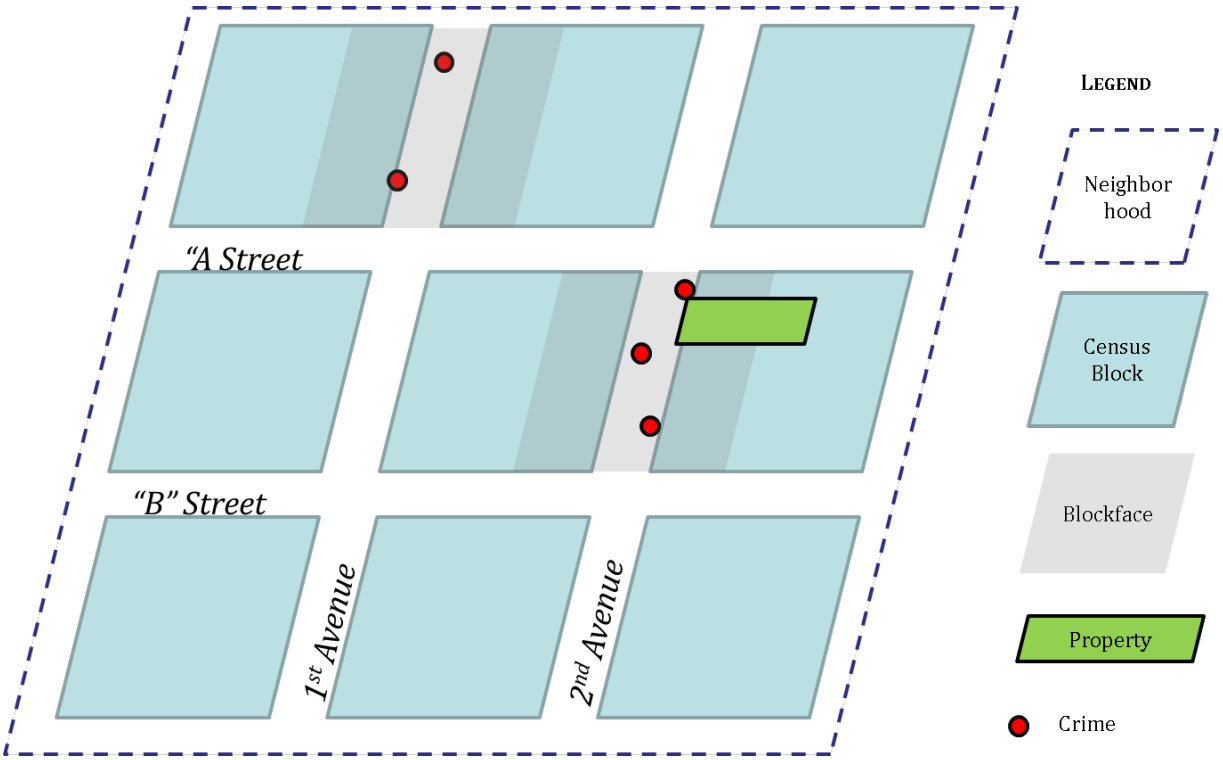
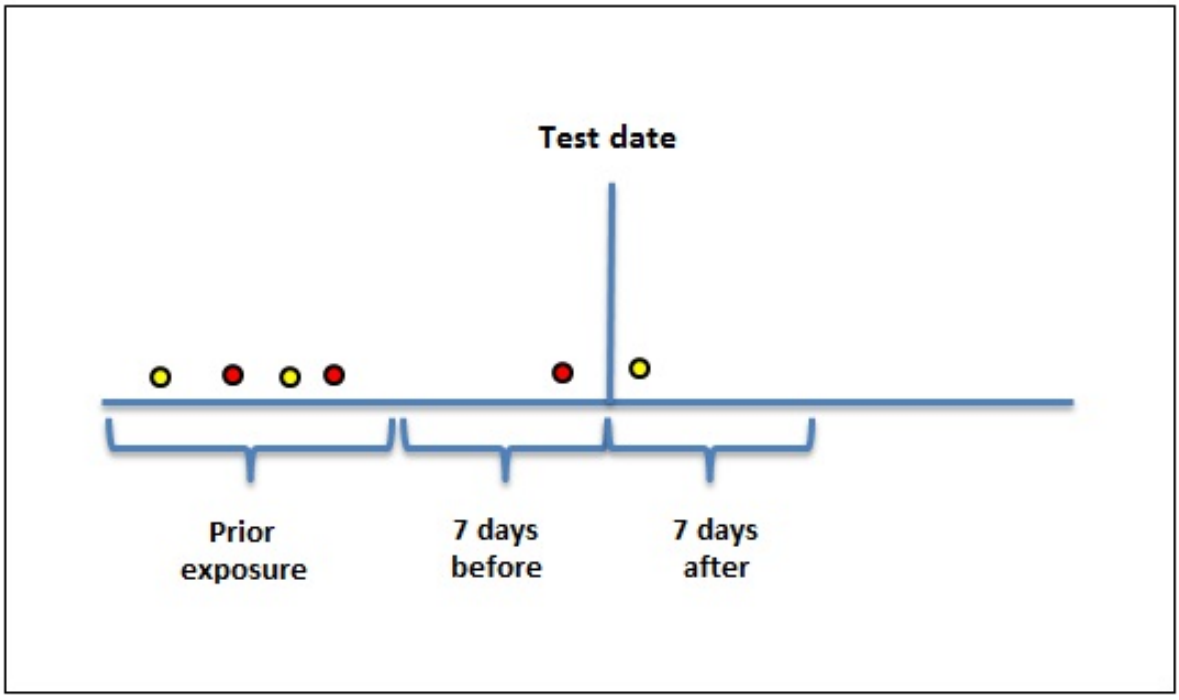
Figures

Figure 1: Blockface Geography



Notes: Students living in the shaded parts of adjacent census blocks would be coded as residing on the same blockface, and exposed to the same incidents of crime.

Figure 2: Regression Discontinuity Design, Timeline



Notes: Dots indicate crime exposures on a residential blockface relative to the test date. Prior exposure is measured in the interest period.

Tables

Table 1: Student Characteristics by Exposure to Violent Crime, ELA, Prior Year

		Exposed		
	Not exposed	Only once	Only twice	Three times
Race/Ethnicity				
Black	27.7	35.6	37.9	42.9
Hispanic	33.9	43.6	48.3	49.6
Asian	17.7	12.2	8.6	4.9
White	20.7	8.6	5.3	2.5
Gender				
Female	50.4	50.9	51.2	51.6
Poverty Status				
Free/Reduced price lunch	81.4	90.9	93.3	95.1
Other characteristics				
Foreign born	12.8	13.0	12.2	11.1
Home lang. not English	39.5	41.3	42.3	40.3
Special Education	10.5	10.9	10.9	11.5
Limited English Proficiency	4.4	6.4	7.6	8.3
Overage for grade	8.2	11.2	12.5	14.2
z_score ELA	0.16	-0.04	-0.12	-0.21
z_score MATH	0.19	-0.03	-0.12	-0.22
Attendance rate	0.94	0.93	0.93	0.92
Observations = 1,264,113	740,057	232,031	115,124	176,901
	58.54%	18.36%	9.11%	13.99%

Notes: Violent crimes include homicides and aggravated assaults that occurred on a student's block in the year before the ELA test. Students are not exposed when the number of violent crimes on their block prior to the ELA test is equal to 0. Violent crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Table 2: Student Characteristics by Exposure to Violent Crime, ELA, One Week Window

	Exposed in 1 week window			
	No previous exposure		Previous exposure	
	Before	After	Before	After
Race/ethnicity				
Black	35.8	38.6	40.8	41.6
Hispanic	44.0	41.6	52.1	49.5
Asian	11.7	11.5	4.1	5.8
White	8.5	8.3	3.0	3.1
Gender				
Female	51.8	51.4	51.1	51.0
Poverty Status				
Poor	90.4	90.3	94.6	95.0
Other characteristics				
Foreign born	13.1	14.6	11.5	13.0
Home lang. not English	40.8	40.8	41.6	41.9
Special Education	10.4	11.1	10.8	11.0
Limited English Proficiency	8.6	7.7	9.9	10.1
Overage for grade	10.8	10.4	14.8	14.0
Observations	4,646	4,752	15,083	12,560
	50.6%	49.4%	54.6%	45.4%

Notes: Column percentages. Students with no previous exposure are only exposed to a violent crime in the week before or after the ELA test. Students with previous exposure were exposed at least once in the year between ELA tests prior to the one-week window. Violent crime includes homicides and aggravated assaults. Sample includes in grades 4 to 8 between AY 2004/05-2009/10.

Table 3:Value Added Results, ELA, One Year

DV: z-score ELA	(1)	(2)	(3)	(4)
A.				
Crime	-0.279**	-0.030**	-0.014**	-0.011**
	(0.009)	(0.002)	(0.002)	(0.002)
R-squared	0.021	0.504	0.517	0.509
B.				
One crime	-0.204**	-0.021**	-0.010**	-0.008**
	(0.009)	(0.002)	(0.002)	(0.002)
Two crimes	-0.285**	-0.031**	-0.013**	-0.011**
	(0.010)	(0.003)	(0.002)	(0.002)
Three or more crimes	-0.373**	-0.043**	-0.022**	-0.017**
	(0.011)	(0.003)	(0.002)	(0.002)
Student controls	N	Y	Y	Y
School FX (1,137)	N	N	Y	N
Census tract FX (2,153)	N	N	N	Y
Observations	1,264,113	1,264,113	1,264,113	1,264,113
R-squared	0.024	0.504	0.517	0.509

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, foreign born, home language not English, limited English proficiency, overage for grade, and test scores lagged one year. All models include year and grade fixed effects. Standard errors are clustered at the census tract level. Crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Table 4: Value Added Results, ELA, One Year, Race/Ethnicity, and Gender

	Black	Hispanic	Asian	White	Male	Female
DV: z-score ELA	(1)	(2)	(3)	(4)	(5)	(6)
One crime	-0.006*	-0.004	-0.011*	-0.012+	-0.007**	-0.008**
	(0.003)	(0.003)	(0.006)	(0.007)	(0.002)	(0.003)
Two crimes	-0.012**	-0.004	-0.013	-0.031**	-0.010**	-0.012**
	(0.003)	(0.003)	(0.009)	(0.010)	(0.003)	(0.003)
Three or more crimes	-0.017**	-0.012**	-0.016	-0.018	-0.012**	-0.023**
	(0.003)	(0.003)	(0.011)	(0.014)	(0.003)	(0.003)
Student controls	Y	Y	Y	Y	Y	Y
Census tract FX	Y	Y	Y	Y	Y	Y
Observations	406,982	495,534	177,732	183,865	622,947	641,166
R-squared	0.470	0.485	0.428	0.423	0.511	0.506

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, foreign born, home language not English, limited English proficiency, overage for grade. All models include year, grade fixed effects, and test scores lagged one year. Standard errors are clustered at the census tract level. Crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Table 5: Value Added Results, ELA, Two Years

DV: z-score ELA	(1)	(2)	(3)
Crime	-0.021**	-0.011**	-0.010**
	(0.002)	(0.002)	(0.002)
Crime (t-1)	-0.021**	-0.012**	-0.012**
	(0.002)	(0.002)	(0.002)
Student controls	Y	Y	Y
Lagged test scores (t-2)	Y	Y	Y
School FX	N	Y	N
Census tract FX	N	N	Y
Observations	739,367	739,367	739,367
R-squared	0.453	0.472	0.461

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, foreign born, limited English proficiency, home language not English, special education, overage for grade. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Crime includes homicides and aggravated assaults. Sample includes students in grades 5 to 8 between AY 2006/07-2009/10.

Table 6: RD Results, ELA, One Week Window

		Previous Exposure					
DV: z-score ELA	All (1)	None (2)	One (3)	Two (4)	Three or more (5)	None or one (6)	Two or more (7)
Crime	-0.025*	0.014	-0.009	-0.038	-0.036*	-0.002	-0.038**
	(0.011)	(0.021)	(0.023)	(0.027)	(0.016)	(0.016)	(0.013)
Student controls	Y	Y	Y	Y	Y	Y	Y
Observations	37,041	9,398	7,543	5,197	14,903	16,941	20,100
R-squared	0.198	0.221	0.191	0.187	0.174	0.210	0.178

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, foreign born, limited English proficiency, home language not English, overage for grade. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Students exposed both before and after the test are excluded. Crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05 to 2009/10.

Table7: RD Results, One Week Window, Race/Ethnicity, and Gender

	Previous Exposure							
DV: z-score ELA	None (1)	One (2)	None or One (3)	Two or More (4)	None (5)	One (6)	None or one (7)	Two or more (8)
Race/Ethnicity								
Crime*Black	-0.022	-0.032	-0.035	-0.078**				
	(0.032)	(0.037)	(0.024)	(0.019)				
Crime*Hispanic	0.045	-0.011	0.011	-0.012				
	(0.028)	(0.026)	(0.019)	(0.017)				
Gender					0.019	-0.020	-0.004	-0.035+
Crime*Male					(0.026)	(0.030)	(0.020)	(0.018)
Crime*Female					0.009	0.002	-0.000	-0.041*
					(0.029)	(0.029)	(0.021)	(0.017)
Student controls	Y	Y	Y	Y	Y	Y	Y	Y
F-Stat	2.87	0.23	2.73	6.81	0.07	0.33	0.03	0.09
Prob>F	0.091	0.628	0.099	0.009	0.789	0.564	0.870	0.764
Observations	7,518	6,608	14,126	18,859	9,398	7,543	16,941	20,100
R-squared	0.153	0.154	0.152	0.156	0.221	0.191	0.210	0.178

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, poor, special education, foreign born, limited English proficiency, home language not English, overage for grade. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Students exposed both before and after are excluded. Crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Table 8: Robustness Test, RD, ELA, Two Week Window

		Previous Exposure					
DV: z-score ELA	All (1)	None (2)	One (3)	Two (4)	Three or more (5)	None or one (6)	Two or more (7)
Crime	-0.015+	0.003	0.008	-0.030	-0.025*	0.002	-0.026*
	(0.008)	(0.016)	(0.018)	(0.020)	(0.012)	(0.012)	(0.011)
Student controls	Y	Y	Y	Y	Y	Y	Y
Observations	71,079	17,998	14,167	10,964	27,950	32,165	38,914
R-squared	0.199	0.227	0.194	0.186	0.173	0.214	0.177

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, limited English proficiency, home language not English, foreign born, overage for grade. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Students exposed both before and after the test are excluded. Crime includes homicides and aggravated assaults. Sample includes students in grades 4-8 between AY 2004/05-2009/10.

Table 9: Robustness Test, RD, ELA, Two Week Window, Race/Ethnicity And Gender

	Previous Exposure							
DV: z-score ELA	None (1)	One (2)	None or one (3)	Two or more (4)	None (5)	One (6)	None or one (7)	Two or more (8)
Race/Ethnicity								
Crime*Black	-0.023	0.004	-0.014	-0.046**				
	(0.026)	(0.027)	(0.018)	(0.016)				
Crime*Hispanic	0.013	-0.012	-0.003	-0.018				
	(0.020)	(0.022)	(0.015)	(0.013)				
Gender								
Crime*Male					-0.013	0.003	-0.009	-0.014
					(0.019)	(0.022)	(0.014)	(0.013)
Crime*Female					0.017	0.013	0.013	-0.037**
					(0.021)	(0.022)	(0.015)	(0.014)
Student controls	Y	Y	Y	Y	Y	Y	Y	Y
F-Stat	1.33	0.24	0.25	2.12	1.44	0.16	1.5	1.9
Prob>F	0.248	0.623	0.615	0.146	0.231	0.689	0.222	0.169
Observations	14,347	12,303	26,650	36,566	17,998	14,167	32,165	38,914
R-squared	0.162	0.154	0.157	0.155	0.227	0.194	0.214	0.177

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, limited English proficiency, home language not English, foreign born, overage for grade. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Students exposed both before and after are excluded. Crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Table 10: Robustness Test: RD Extended Specification, Robberies and Property Crimes

		Previous Exposure	
DV: z-score ELA	All (1)	None or one (2)	Two or more (3)
A.			
Homicides & Assaults	-0.026*	-0.005	-0.040**
	(0.011)	(0.016)	(0.014)
Robberies	-0.045	-0.071	-0.029
	(0.036)	(0.062)	(0.034)
Homicides & Assaults*Robberies	0.027	0.065	0.034
	(0.043)	(0.089)	(0.044)
B.			
Homicides & Assaults	-0.029*	-0.014	-0.038**
	(0.012)	(0.017)	(0.014)
Property	-0.027	-0.053	-0.001
	(0.022)	(0.033)	(0.029)
Homicides & Assaults*Property	0.024	0.081+	0.001
	(0.029)	(0.043)	(0.039)
Observations	37,041	16,941	20,100
R-squared	0.198	0.210	0.178

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, foreign born, home language not English, limited English proficiency, overage for grade. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Students exposed both before and after are excluded. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Appendix A: Balance and Selection Tests

Table 1A: Balance Test, Demographic Characteristics and Exposure to Violent Crime, ELA, One Week Window

	Independent variable Exposure one week before		
	All	No prior exposure	Any prior exposure
Rows are separate regressions	(1)	(2)	(3)
Dependent variables:			
Black	-0.004	0.013	-0.010
	(0.006)	(0.016)	(0.007)
Hispanic	0.008	-0.003	0.013+
	(0.007)	(0.018)	(0.007)
Asian	-0.003	-0.007	-0.005
	(0.003)	(0.010)	(0.003)
White	-0.001	-0.003	0.002
	(0.003)	(0.009)	(0.003)
Female	0.004	0.023	0.002
	(0.007)	(0.018)	(0.008)
Poor	-0.007*	0.013	-0.011**
	(0.003)	(0.011)	(0.004)
Overage for grade	-0.004	0.012	-0.006
	(0.005)	(0.012)	(0.006)
Limited English proficiency	-0.000	-0.000	0.002
	(0.004)	(0.012)	(0.005)
Home language not English	-0.002	-0.000	-0.001
	(0.006)	(0.018)	(0.008)
Foreign born	-0.015**	-0.025+	-0.012*
	(0.005)	(0.014)	(0.005)
Special education	-0.006	-0.001	-0.006
	(0.004)	(0.011)	(0.004)
N in all regressions	37,041	9,398	27,643
All models have census tract FX			
Table shows results from 33 regressions			

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Each row shows results from a separate regression in which the dependent variable is a student demographic characteristic and the independent variable is an indicator equal to 1 if the student was exposed to a homicide or aggravated assault in the week before the ELA test, and it is 0 if exposed the week after. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Sample excludes students exposed both before and after the test. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Table 2A: Selection Test, Demographic Characteristics and Exposure to Violent Crime, ELA, One Week Window, by Number of Prior Exposures

	Independent variables Exposed in prior year			
Rows are separate regressions	None (1)	One (2)	Two (3)	Three or more (4)
Dependent variables:				
Black	0.003	-0.005	-0.004	0.005
	(0.009)	(0.009)	(0.008)	(0.008)
Hispanic	-0.012	0.002	0.011	0.000
	(0.011)	(0.010)	(0.010)	(0.009)
Asian	0.004	0.001	-0.002	-0.002
	(0.006)	(0.004)	(0.005)	(0.004)
White	0.005	0.002	-0.005	-0.003
	(0.004)	(0.004)	(0.004)	(0.002)
Female	0.001	0.002	0.001	-0.002
	(0.008)	(0.007)	(0.010)	(0.008)
Poor	-0.007	-0.004	0.005	0.005
	(0.005)	(0.004)	(0.004)	(0.004)
Overage for grade	-0.012*	0.001	-0.000	0.008
	(0.006)	(0.006)	(0.006)	(0.005)
Limited English proficiency	0.006	-0.002	-0.011*	0.005
	(0.006)	(0.006)	(0.006)	(0.005)
Foreign born	0.008	-0.013*	-0.006	0.008
	(0.007)	(0.006)	(0.006)	(0.005)
Home lang. not English	-0.006	-0.007	-0.002	0.011
	(0.010)	(0.009)	(0.009)	(0.009)
Special education	-0.001	-0.002	-0.004	0.005
	(0.005)	(0.005)	(0.005)	(0.004)
All models have census tract FX				
N in all regressions	37,041	37,041	37,041	37,041
Table shows results of 44 separate regressions				

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Each row represents a separate regression (44 in total) of each student demographic characteristic on a crime exposure variable equal to 1 if a student was never exposed to a homicide or aggravated assault prior to the one-week window (column 1), if the student was exposed once (column 2), if the student was exposed twice or more prior to the one-week window (column 3), and if there were three or more exposures prior (column 4). All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Students exposed both before and after the test are excluded. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Appendix B: Mathematics Results

Table 1B: Value Added Results, MATH, One Year

DV: z-score MATH	(1)	(2)	(3)	(4)
Crime	-0.303**	-0.026**	-0.011**	-0.007**
	(0.011)	(0.002)	(0.001)	(0.001)
Observations	1,323,204	1,323,204	1,323,204	1,323,204
R-squared	0.024	0.607	0.622	0.611
One crime	-0.221**	-0.019**	-0.008**	-0.006**
	(0.010)	(0.002)	(0.002)	(0.002)
Two crimes	-0.306**	-0.026**	-0.009**	-0.007**
	(0.012)	(0.002)	(0.002)	(0.002)
Three or more crimes	-0.410**	-0.037**	-0.017**	-0.011**
	(0.013)	(0.003)	(0.002)	(0.002)
Student controls	N	Y	Y	Y
School FX (1,136)	N	N	Y	Y
Census tract FX (2,154)	N	N	N	Y
Observations	1,323,204	1,323,204	1,323,204	1,323,204
R-squared	0.027	0.607	0.622	0.611

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, foreign born, home language not English, limited English proficiency, overage for grade, and test scores lagged one year. All models include year and grade fixed effects. Standard errors are clustered at the census tract level. Crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Table 2B: Value Added Results, MATH, One Year, By Race/Ethnicity, and Gender

DV: z-score MATH	Black (1)	Hispanic (2)	Asian (3)	White (4)	Male (5)	Female (6)
One crime	-0.009**	-0.002	-0.002	-0.005	-0.006*	-0.006*
	(0.003)	(0.002)	(0.005)	(0.005)	(0.002)	(0.002)
Two crimes	-0.011**	0.001	-0.018*	-0.008	-0.008**	-0.005+
	(0.003)	(0.003)	(0.008)	(0.009)	(0.003)	(0.003)
Three or more crimes	-0.011**	-0.007*	-0.006	-0.023*	-0.008**	-0.013**
	(0.003)	(0.003)	(0.009)	(0.012)	(0.003)	(0.003)
Student controls	Y	Y	Y	Y	Y	Y
Census tract FX	Y	Y	Y	Y	Y	Y
Observations	409,640	535,058	189,973	188,533	653,589	669,615
R-squared	0.544	0.553	0.514	0.534	0.608	0.615

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, foreign born, home language not English, limited English proficiency, overage for grade. All models include year, and grade fixed effects, and test scores lagged one year. Standard errors are clustered at the census tract level. Crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Table 3B: Value Added Results, MATH, Two Years, Grades 5-8, 2007-2010

DV: z-score MATH	(1)	(2)	(3)
Crime	-0.021**	-0.012**	-0.009**
	(0.002)	(0.002)	(0.002)
Crime (t-1)	-0.018**	-0.008**	-0.007**
	(0.002)	(0.002)	(0.002)
Student controls	Y	Y	Y
Lagged test scores (t-2)	Y	Y	Y
School FX	N	Y	N
Census tract FX	N	N	Y
Observations	781,268	781,268	781,268
R-squared	0.556	0.585	0.564

Standard errors in parentheses
** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, foreign born, limited English proficiency, home language not English, special education, overage for grade. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Crime includes homicides and aggravated assaults. Sample includes students in grades 5 to 8 between AY 2006/07-2009/10.

Table 4B: RD Results, MATH, One Week Window

		Previous Exposure	
DV: z-score MATH	All (1)	None or one (2)	Two or more (3)
Crime	-0.002	-0.021	0.011
	(0.010)	(0.015)	(0.013)
Student controls	Y	Y	Y
Observations	40,037	16,675	22,315
R-squared	0.190	0.222	0.153

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Student controls include: female, black, Hispanic, Asian, poor, special education, limited English proficiency, foreign born, home language not English, overage for grade. All models include year, and grade fixed effects. Standard errors are clustered at the census tract level. Students exposed both before and after the test are excluded. Crime includes homicides and aggravated assaults. Sample includes students in grades 4 to 8 between AY 2004/05-2009/10.

Appendix D: Student's yearly exposure to violent crime

Table D: Yearly Exposure to Violent Crime by Number of Years in NYC Public Schools, ELA

	Violent crime exposure (year)							
Years enrolled	0	1	2	3	4	5	6	Total
Row %								
N								
Three	34.9	25.3	21.0	18.8				
	47,498	34,435	28,527	25,595				136,055
Four	28.8	21.8	18.4	16.4	14.6			
	32,283	24,464	20,608	18,345	16,379			112,079
Five	25.5	18.8	16.5	14.7	13.0	11.7		
	23,273	17,202	15,058	13,400	11,864	10,660		91,457
Six	21.6	16.3	14.1	13.5	12.1	11.4	10.9	
	9,272	7,003	6,060	5,794	5,187	4,887	4,695	42,898
	29.4	21.7	18.4	16.5	8.7	4.1	1.2	
Total	112,326	83,104	70,253	63,134	33,430	15,547	4,695	382,489

Notes: Sample restricted to students enrolled in NYC public schools at least three years. Columns indicate how many years a student was exposed to at least one violent crime while enrolled in NYC public schools. Violent crimes include homicides and aggravated assaults that occurred on a student's block within one year of the ELA test. Percent of students exposed every year is 15. Sample includes students in grades 3 to 8 between AY 2004/05-2009/10.