

The Effect of Local Violence on Children's Attention and Impulse Control

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As one of the leading causes of death among young people, interpersonal violence is an urgent public health problem.^{1,2} Violence has a disproportionate impact on children, it is highly concentrated in space, and a great deal of evidence suggests that the effects of violence extend beyond the direct victims of assaults or homicides. Direct and indirect exposure to violence is associated with negative health consequences and psychobiological symptoms of distress, such as posttraumatic stress disorder, depression, and difficulty concentrating.^{3–6} Furthermore, the threat or the experience of violence during childhood can induce high levels of stress, which manifests itself in children's compromised cognitive functioning, as well as in their academic performance, emotional responses, and social interactions.^{7–13}

We considered how the burden of violence in a child's community can alter the child's behavior and functioning in the classroom setting. We specifically focused on violence exposure among young children facing socioeconomic disadvantage. Research over the past 2 decades has highlighted stark poverty-related disparities in children's school readiness as early as kindergarten entry and has underscored poor children's much higher likelihood of exposure to a wide range of stressful life events, including neighborhood violence.^{14–17} Yet exposure to violence remains a relatively unexplored pathway through which poor children's opportunities for learning may be compromised. In examining this pathway, we hypothesized that exposure to extreme community violence, in the form of local homicides, would have an acute impact on children's ability to regulate behavior, maintain attention, and control impulses in the classroom setting. If local violence affects behavior and performance in the classroom, the results would provide evidence for an additional mechanism by which the problem of community violence extends into key domains of social life, with consequences that have the potential to alter

Objectives. We examined whether the burden of violence in a child's community environment alters the child's behavior and functioning in the classroom setting.

Methods. To identify the effects of local violence, we exploited variation in the timing of local homicides, based on data from the Chicago Police Department, relative to the timing of interview assessments conducted as part of a randomized controlled trial conducted with preschoolers in Head Start programs from 2004–2006, the Chicago School Readiness Project. We compared children's scores when exposed to recent local violence with scores when no recent violence had occurred to identify causal effects.

Results. When children were assessed within a week of a homicide that occurred near their home, they exhibited lower levels of attention and impulse control and lower preacademic skills. The analysis showed strong positive effects of local violence on parental distress, providing suggestive evidence that parental responses may be a likely pathway by which local violence affects young children.

Conclusions. Exposure to homicide generates acute psychological distress among caregivers and impairs children's self-regulatory behavior and cognitive functioning. (*Am J Public Health.* 2012;102:2287–2293. doi:10.2105/AJPH.2012.300789)

educational trajectories and a range of subsequent health and social outcomes.^{18–20}

However, identifying the causal impact of community violence on children's behavioral and cognitive functioning is difficult because families do not randomly select into violent (or nonviolent) environments.^{7,21,22} Associations between community violence and children's outcomes may be a result of unobserved characteristics of families that lead some families to be at higher risk for having to move into (or not being able to move out of) violent community settings.^{19,23} Those same unobserved parental characteristics may also place children's likelihood of school success in jeopardy.

To address this problem, we departed from the traditional approach to identifying the impact of community violence on children, which involves making comparisons among children living within different communities. Instead, we exploited variation in the timing of local violence—in this case, homicide—relative to the timing of assessments conducted as part of a randomized controlled trial, the

Chicago School Readiness Project (CSRP).^{24,25}

The CSRP was designed to assess the effects of a classroom intervention geared toward improving self-regulation and cognitive skills among a sample of students in Head Start classrooms in Chicago. Using data from the CSRP merged with data on homicides across Chicago, we hypothesized that exposure to recent homicides occurring within close geographic proximity to children's homes affects children's ability to maintain focus, control impulses, and perform well on tests of preacademic cognitive skills.

METHODS

Data came from 2 sources: the CSRP and police records from the Chicago Police Department. The CSRP is a multicomponent, classroom-based preschool intervention study.^{24,25} Using a clustered randomized controlled trial design, the CSRP measured child school readiness in 18 Head Start sites in the Fall and Spring of the preschool year. A total of

496 children participated in the CSRP with cohort 1 participating in 2004–2005 and cohort 2 participating in 2005–2006. Children were 49.24 months in age, on average (SD = 7.48). Families were predominantly low income with a mean income-to-needs ratio of 0.70 (SD = 0.58). Additional demographic characteristics of these children and their families are presented in Table 1.

Measures

Our outcomes of interest measured multiple dimensions of children’s self-regulation and pre-academic skills (brief descriptions are provided here, and more detailed descriptions of all outcome measures are available as a supplement to the online version of this article at <http://www.ajph.org>). Children’s self-regulatory behavior was based on the Preschool Self-Regulation Assessment (PSRA),²⁶ which was used in the CSRP to capture children’s strengths and difficulties in behavioral self-regulation along (1) global

dimensions of attention and impulse control as well as (2) component dimensions of executive functioning and effortful control. Procedurally, the PSRA first obtains a direct assessment of children’s executive functioning and effortful control, where the assessor records live-coded latencies or performance levels for a range of lab-based tasks that have been adapted for field administration.²⁷ Children’s performance on 2 executive functioning tasks and 4 effortful control tasks were standardized and then averaged into 2 composites. After the tasks were administered, the 28-item PSRA Assessor Report was completed.²⁶ Providing a global picture of children’s emotions, attention, and impulsivity throughout the assessor–child interaction, items were coded by using a Likert scale ranging from 0 to 3, with some items reverse-coded to minimize automatic responding.

Preacademic skills were measured with assessments of vocabulary and early math skills. A shortened version of The Peabody Picture

Vocabulary Test ($\alpha = 0.78$) with 24 items was administered to the child by the assessor (PPVT-III).^{27–29} A parallel Spanish-language version of the PPVT, entitled the *Test de Vocabulario en Imagenes Peabody*³⁰ was administered to Spanish-proficient and bilingual children. The Early Math Skills ($\alpha = 0.82$) portion of the cognitive assessment consists of 19 items and covers basic addition and subtraction.²⁸ This set of measures has been used extensively in national surveys of Head Start–enrolled 4-year-old children’s school readiness and has demonstrated high levels of internal, criterion, and predictive validity for low-income, ethnic minority children.³¹

Lastly, parents’ mental health was measured with the K6, a 6-question scale of psychological distress developed for the US National Health Interview Survey.³² Parents were interviewed by a group of master’s level assessors in the fall of their child’s preschool year. Items were coded 0 to 4 and a mean score was calculated ranging from 0 to 4 ($\alpha = 0.78$).

We derived our measure of exposure to violence from incident-level records of all homicides that occurred in the city of Chicago during the CSRP data collection period. To assess the exposure of CSRP study youths to a homicide occurring in their community, we geocoded all homicides to precise geographic coordinates. Then we determined whether a homicide occurred within a specified geographic distance of the child’s home within the week before the assessment.

Analytic Strategy

The analytic strategies utilized in this paper exploited variation in exposure to local violence among individual children or among children living within the same geographic area who were assessed at different times. We defined a child as “exposed” to a local homicide if a homicide occurred within a given geographic radius of the child’s home within a week of the CSRP assessment. Children who were assessed more than 7 days after the homicide but before 14 days were excluded from the analysis to avoid any potential contamination of the treatment—previous research has found that the acute effects of local homicides on older adolescents appear to fade after a week to 10 days.¹² To assess the importance of proximity in analyzing the effects of

TABLE 1—Descriptive Statistics of 414 Preschool Children in Chicago School Readiness Project Trials, 2004–2006

	Fall Measurement, % or Mean (SD)	Spring Measurement, Mean (SD)
Child		
Executive functioning	0.01 (0.83)	0.07 (0.81)
Effortful control	0.02 (0.67)	0.04 (0.65)
Attention	2.11 (0.78)	2.35 (0.68)
Impulse control	2.36 (0.68)	2.42 (0.63)
PPVT English	0.44 (0.16)	0.57 (0.18)
PPVT Spanish	0.45 (0.17)	0.49 (0.16)
Early math skill English	0.41 (0.19)	0.54 (0.20)
Early math skill Spanish	0.33 (0.18)	0.48 (0.22)
Boy	49	
African American race/ethnicity	66	
Hispanic race/ethnicity	26	
Treatment	51	
Age, mo	50.36 (6.72)	
Caregiver		
Income-to-needs ratio	0.70 (0.60)	
Completed < 12th grade	25	
High-school diploma or GED	37	
Some college	26	
≥ bachelor’s degree	8	
Living with partner	41	
Mental health problem	0.70 (0.74)	

Note. GED = general equivalency diploma; PPVT = The Peabody Picture Vocabulary Test.

community violence, we used multiple definitions of exposure, beginning with a geographic radius of 2500 feet surrounding the homicide, followed by a smaller radius of 2000 feet, 1500 feet, and, finally, 1000 feet. The number of children exposed to a local homicide within 2500 feet was 74 (17.87%), within 2000 feet was 40 (9.66%), within 1500 feet was 19 (4.59%), and within 1000 feet was 7 (1.69%).

We generated 2 sets of estimates to model the effects of exposure to violence on the set of outcome variables. We labeled the first estimates “child fixed effects” estimates, and these rely on variation in exposure to local homicides among individual children. We regressed the dependent variable, measuring a given domain of self-regulation (or cognitive skills), on an indicator for a recent homicide within a specified radius of the child’s home, with fixed effects for each child, along with controls for the month and year at which the assessment occurred, as in equation 1:

$$(1) Y_i = \alpha + \beta(\text{Homicide})_i + \gamma(\text{Child})_i + \delta(\text{Year})_i + \eta(\text{Month})_i + \varepsilon_i,$$

where Y_i is child i ’s score on the measure of self-regulation, *Homicide* is an indicator taking on a value of unity if the child’s assessment was conducted within a week following a homicide within the specified radius, and β represents the effect of a local and recent homicide on the child’s score on the given measure of self-regulation. *Child* represents a set of indicators for each child in the sample; *Year* and *Month* represent calendar year and month of year indicators. The inclusion of child fixed effects means that the estimator relies on variation in exposure to local homicides among individual children across the 2 assessments. We generated separate estimates using the different geographic radii to define exposure.

We labeled a second set of estimates homicide “zone fixed effects,” which rely on variation in the relative timing of homicides and self-regulation assessments among all children living within a specified radius of each specific homicide. As an example, consider a homicide that occurs within 1000 feet of the homes of 8 children in the sample. Two of these children are assessed within the week following the homicide, whereas 3 of the remaining children are assessed several weeks earlier and the other 3

are assessed a month later. To identify the acute effect of the homicide on self-regulation, this method compares the scores of the 2 children who were assessed in the week following the homicide with the scores of the other 6 children, all of whom were exposed to the same homicide but were assessed at different times. The same comparison is made for every homicide to which at least 1 sample member is exposed within a week before the assessment.

In these models we regressed the child’s score on a given measure of self-regulation on an indicator for exposure to a recent homicide within a given radius of the child’s home and within a week before the assessment, with fixed effects for every child living within the homicide “zone,” meaning the radius of specified length surrounding each homicide. The zone fixed effects specification is the same as in equation 1, except instead of child fixed effects we included a set of dummy variables indicating whether the child lived within the specified radius of the homicide.

Unlike the child fixed effects specification, there is some variation in observable characteristics of children living nearby each local homicide. Thus, although the method relies on the assumption that there is no systematic heterogeneity among students living within the same zone of a homicide who were assessed at different times, we included controls for observable characteristics to increase precision in the estimate. Control variables in this specification included measures of race/ethnicity, gender, and age of the student, caregiver educational attainment, income relative to needs, whether the caregiver was married or lived with a domestic partner, and an indicator for membership in the experimental group, which we included to control for effects of the experimental treatment provided through the CSR. Individual children can appear in the data multiple times if they were exposed to multiple homicides close to the home—to adjust standard errors for possible clustering of error terms within individuals, results from the “zone fixed effects” specifications used the Huber–White sandwich estimator.

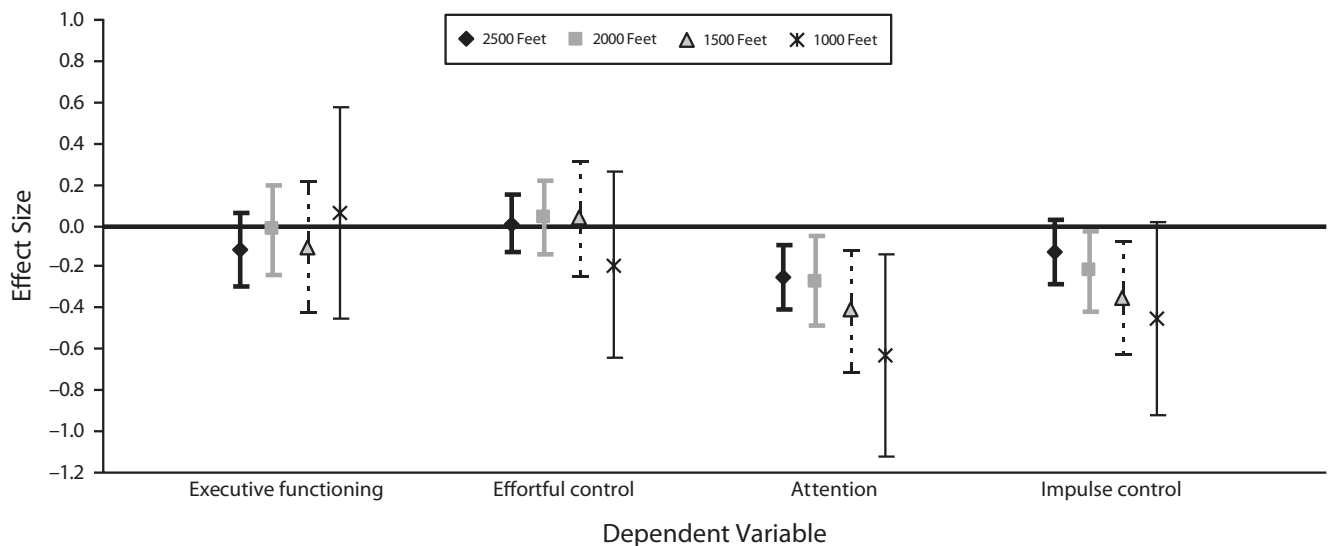
The 2 sets of estimates are presented to assess how stable the results were across different analytic approaches. The main

difference between the 2 approaches lies in the composition of the control groups. In each case, the treatment group was composed of students who were exposed to a homicide near the home within a week of the assessment. The control group for the child fixed effects estimates was the students themselves; we compared student scores from the assessment occurring after a local homicide with the student’s scores from the assessment occurring at a time when no recent homicides had taken place. The control group for the “zone fixed effects” estimates was composed of other children living in similar proximity to a homicide but assessed at a different time. The core assumption was that the relative timing of homicides and assessments was exogenous among students living within the specified radius of the homicide, allowing for the identification of the causal effect of exposure to the homicide on student self-regulation.

RESULTS

Figure 1 shows results from child fixed effects estimates of homicide effects on self-regulation (as with all results, tables with full regression coefficients are available as a supplement to the online version of this article at <http://www.ajph.org>). Results from child fixed effects models show that local homicides had strong effects on students’ attention and impulse control, and had no effects on children’s scores on tasks of executive function or effortful control. When we used the child fixed effects approach, results showed that exposure to a homicide within 2500 feet of the home lowered attention by 0.25 points (SD = 0.33) and impulse control by 0.23 points (SD = 0.35), whereas exposure to a homicide within 1000 feet lowered attention by 0.63 points (SD = 0.83) and impulse control by 0.45 points (SD = 0.68). We also conducted falsification tests to assess whether there was an effect of exposure to homicides that occurred in the week *after* the assessment. All results were null and estimated “effects” hovered around zero.

We found similar results when we used homicide zone fixed effects (see materials available as a supplement to the online version of this article at <http://www.ajph.org>). We conducted additional analyses to assess how long the effect of local violence appears to



Note. Estimates represent effects of homicides occurring within distances of 2500 feet, 2000 feet, 1500 feet, and 1000 feet of child's residential address.

FIGURE 1—Estimates of homicide effects on 4 dimensions of self-regulation, attention, and impulse control using child fixed effects specifications, among Chicago preschoolers in the Chicago School Readiness Project Trials, 2004–2006.

persist. Results from these analyses were consistent with a linear relationship between the number of days since a local homicide and children's scores on the assessments of attention and impulse control, but one that fades out roughly 10 to 14 days after the incident of violence. More detail on the additional models that led to this conclusion is available from the authors on request

Homicide Effects on Children's Vocabulary and Math Scores

We used the same sequence of analyses to estimate homicide effects on preacademic cognitive skills. The results from child fixed effects estimates for PPVT scores and Early Math Skills scores are shown in the main text in Figure 2, and in the second set of rows in Table C (available as a supplement to the online version of this article at <http://www.ajph.org>). Estimates using homicide zone fixed effects also can be found in the supplementary materials.

When we used the child fixed effects approach, we found that the effects of homicides occurring within 2500 feet and 2000 feet on PPVT scores were negative but nonsignificant, whereas the effects of homicides occurring within a radius of 1500 and 1000 feet from the child's home were statistically significant.

Exposure to a homicide within 1500 feet reduced PPVT scores by 1.47 points (SD = 0.33), and exposure to a homicide within 1000 feet of the home by 3.53 points (SD = 0.80). Effects on math scores were negative but nonsignificant. When we used the homicide zone fixed effects approach, the magnitude of the effect on PPVT scores of homicides within 1500 and 1000 feet of the child's home was quite similar to what was found in the child fixed effect estimates. However, only the effect of homicides occurring within 1000 feet of the child's address was statistically significant.

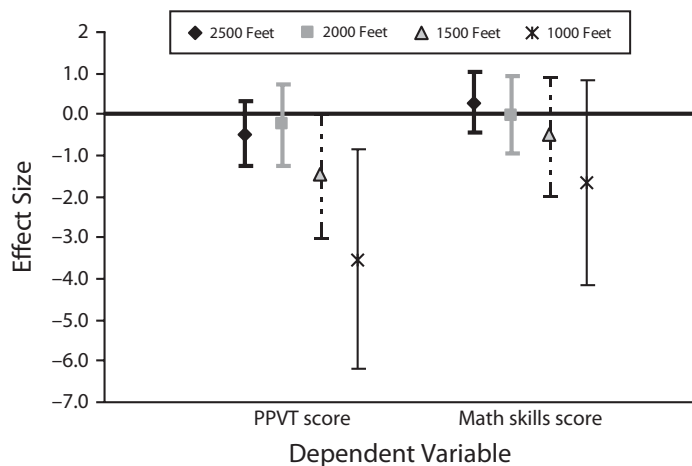
Mediation Analysis

To assess whether the effects of homicides on vocabulary scores were mediated by impaired attention, we conducted an additional set of analyses that estimated the effects of local homicides on PPVT scores while controlling for the measure of attention. This analysis was limited to students who were given the PPVT assessments and the self-regulation assessments on the same day, which was almost the entire sample. Results (shown in Figures C and D, available as supplements to the online version of this article at <http://www.ajph.org>) provide mixed support for the hypothesis that attention partially mediates the relationship

between exposure to local violence and PPVT scores.

Results from child fixed effects specifications showed that, without adjustment for attention, exposure to a homicide within 1500 feet of the child's address reduced PPVT scores by 1.30 points, a marginally significant effect (Figure C, available as a supplement to the online version of this article at <http://www.ajph.org>). After we adjusted for attention, the effect size was -0.51 points and was not significant. Without adjustment for attention, exposure to a homicide within 1000 feet of the child's address reduced PPVT scores by 3.53 points, a highly significant effect. After we adjusted for attention, the negative effect of exposure to local homicide was -2.09 points and was not significant. Results when we used homicide zone fixed effects, which are shown in Figure D (available as a supplement to the online version of this article at <http://www.ajph.org>), provide less evidence of mediation. In these estimates, only exposure to homicide within 1000 feet of the child's residence had a significant negative effect—the effect size was smaller when we controlled for attention, but was still quite large and statistically significant.

Overall, our results provided only partial support for the hypothesis that impaired attention mediates the relationship between local violence and performance on cognitive



Note. Estimates represent effects of homicides occurring within distances of 2500 feet, 2000 feet, 1500 feet, and 1000 feet of child's residential address

FIGURE 2—Estimates of homicide effects on The Peabody Picture Vocabulary Test (vocabulary) scores and Math Skills Scores using child fixed effects specifications among Chicago preschoolers in the Chicago School Readiness Project Trials, 2004–2006.

assessments. Although the effects of local homicides were weaker in models that controlled for children's attention, in most models there remained a direct effect of local violence on PPVT scores that was not explained by attention.

Homicide Effects on Parents' Mental Health Symptoms

A final set of analyses assessed the direct effects of local homicides on parents' self-reported mental health. Parents' mental health was assessed once, and on a different date than children's assessments. As a consequence, it was not possible to estimate parent fixed effects specifications (which require multiple assessments) or to assess whether parental mental health mediated the relationship between homicide exposure and children's self-regulation or cognition. Instead, we used the homicide zone fixed effects specification to estimate the effects of local homicides on parents' summed scores from the K6 instrument, providing only suggestive evidence as to whether parental mental health may be a mechanism linking local violence with children's outcomes.

Estimates were based on a Poisson regression with homicide zone fixed effects and full results can be found in the supplemental materials (Figure E, available as a supplement

to the online version of this article at <http://www.ajph.org>). To summarize, the results indicated that local homicides substantially increased parents' mental health symptoms. Exposure to a homicide within 2500 feet of the home address increased mental health symptoms by 43%, a highly significant effect. The magnitude of the effect grew larger for homicides closer to the home. Exposure to a homicide within 1500 feet of the home address increased mental health symptoms by 69%. There were too few parents exposed to homicides within 1000 feet of the home residence to generate stable estimates of homicides within this distance.

Although these results suggest strong homicide effects on parents' mental health, the results should be interpreted with caution because of limitations of the analysis. The most important limitation was that items from the K6 scale of mental health refer to mental health symptoms in the 30 days before the interview, whereas the treatment under study was the effect of exposure to a local homicide within the week before the interview. Because of this discrepancy in reference periods, an implicit assumption of this analysis is that respondents weighted more heavily their mental health symptoms in the period immediately preceding the interview, as opposed to symptoms experienced several weeks earlier.

In an additional analysis we relaxed this assumption and estimated the effect of homicides occurring in the 30 days before the interview date. The effect sizes from this specification were generally smaller in magnitude, but the effects remained positive and statistically significant, with the exception of the analysis estimating the effect of homicides occurring within 1500 feet.

DISCUSSION

This study provides evidence that local homicides have strong impacts on preschoolers' attention and impulse control and on their performance on vocabulary assessments. Results thus highlight the way that a major public health problem, interpersonal violence, can have consequences that spread throughout a community and affect the behavior of children living within the vicinity in which a violent incident occurs. These findings, in highlighting the grave negative consequences of exposure to higher versus lower levels of violence, suggest that lack of safety represents a primary (but certainly not the only) form of social inequality for families and children in our sample, with high costs to the formation of human capital for the economically and racially stratified urban communities in which they reside.

Limitations

One limitation of the analysis is that it is not equipped to identify the long-term impacts of local violence on children's development of self-regulation or cognitive skills. The primary reason for this is that the method relies on variation in the timing of exposure to local homicides among individual children or among children living within the same environment. This approach does not allow for the identification of permanent or long-term impacts of local violence, but it does allow us to make more convincing estimates of the acute impacts of local violence than is possible when one uses standard analytical approaches that rely on variation among individuals living in different communities. The core assumption of the methods is that the relative timing of homicides and assessments is exogenous among individual students or among students living within the specified radius of the homicide, allowing for the identification of the causal effect of the

homicide on student self-regulation and cognitive function.

Although the methods are conservative because they only allow for inferences about the acute impacts of violence, the results suggest that the costs of violence, even if episodic, are high. Children living in the area where a homicide took place exhibited substantial behavioral and cognitive consequences, indicating that community violence, one of the most severe public health problems in urban areas, has major educational consequences. Previous research has demonstrated the academic costs of homicides on adolescents,^{12,32} but our results indicate that the consequences of community violence may be present even for the youngest learners in schools and Head Start programs.

A logical and important question that follows from these findings is one of mechanisms. How might homicides in close proximity to children's homes have such negative consequences for their attention, impulsivity, and early cognitive skills? The analyses provide preliminary support for parental psychological distress as a potential mediating process through which exposure to violence might affect young children's self-regulatory and cognitive outcomes. Such mediation is aligned with emerging findings from developmental science in the contexts of poverty and public policy that suggest that children's neurocognitive and neuroendocrine functioning may be directly as well as indirectly affected by environmental hazards such as loud and unpredictable ambient noise, crowding, and residential instability.³³ The chaotic environmental conditions and the perceptual, allostatic, emotional, and neuroendocrine sequelae that accompany the occurrence of a local homicide are unknown. The next empirical step will be to better understand and test these multiple direct and indirect potential pathways of influence linking exposure to local violence and early learning.

Conclusions

Whereas most research on exposure to violence focuses attention on those who witness an incident of violence directly, the findings presented here suggest that violence has a wider impact that is felt by children across a community. These findings signal the need

for renewed attention to the ways in which children carry the burden of community violence with them into the school setting, with the potential to disrupt individual learning and classroom climate. More broadly, our findings highlight ways that public health policy for neighborhoods and cities goes hand-in-hand with educational policy—reducing violent crime is a potentially important means of reducing educational disparities between low-income children and their more economically advantaged counterparts who may be housed and schooled in safer communities. ■

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Contributors

P. T. Sharkey took the lead on the design and analysis of the data, writing of the article, and approval of the final version. N. Tirado-Strayer substantially contributed to the analysis, writing, and preparation of the article. A. V. Papachristos and C. C. Raver substantially contributed to the analysis and writing of the article.

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Human Participant Protection

This research was reviewed and approved by institutional review boards at New York University, the University of Chicago, and the District of Chicago Public Schools.

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