THE ACUTE EFFECT OF LOCAL HOMICIDES ON CHILDREN'S COGNITIVE PERFORMANCE

SUPPORTING INFORMATION

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Data

Two datasets were used in the analysis. The first is the Longitudinal Cohort Study from the Project on Human Development in Chicago Neighborhoods (PHDCN) (1). The sampling frame for the Longitudinal Cohort Study is based on 1990 U.S. census tract data for Chicago, which were used to identify 343 neighborhood clusters ("NCs") – groups of 2-3 census tracts that contain approximately 8,000 people. Major geographic boundaries (e.g., railroad tracks, parks, freeways), knowledge of Chicago's local neighborhoods, and cluster analyses of Census data guided the construction of NCs so that they are relatively homogeneous with respect to racial/ethnic mix, socioeconomic status, housing density, and family structure. A 2-stage sampling procedure was used that included selecting a random sample of 80 of 343 Chicago NCs stratified by racial/ethnic composition (7 categories) and SES (high, medium, and low). The aim was to have an equal number of NCs in each of the 21 strata that varied by racial/ethnic composition and SES—three categories did not exist, low-income primarily white, high-income primarily Latino, and high-income Latino/African-American neighborhoods. About one-third of NCs had mixed racial/ethnic compositions SES.

Within these 80 NCs, children falling within 7 age cohorts (ages: 0, 3, 6, 9, 12, 15, and 18) were sampled from randomly selected households. This effort led to screening over 40,000 households to obtain the desired sample. Dwelling units were selected

systematically from a random start within enumerated blocks. Within dwelling units, all households were listed and age-eligible participants (household members within twelve months of age 0, 3, 6, 9, 12, 15 or 18) were selected with certainty. As a result, multiple siblings were interviewed within some households. Participants are representative of families living in a wide range of Chicago neighborhoods (16% European American, 35% African-American, and 43% Latino) and evenly split by gender. Extensive in-home interviews and assessments were conducted with the sampled children and their primary caregivers at 3 points in time over a 7-year period, at roughly 2 year intervals (Wave 1 in 1995-1997, Wave 2 in 1997-1999, and Wave 3 in 1999-2002).

The second dataset, the Three City Study of Welfare, Children and Families is a survey of children in low-income families living in low-income neighborhoods from three cities, Boston, Chicago, and San Antonio (2, 3). The study was designed to assess the well-being of low-income children and families in the period following welfare reform. The first stage of the sampling procedure involved the selection of 1990 Census block groups ranked by the percentage of children from four race/ethnic groups (Non-Hispanic white, non-Hispanic African-American, and Hispanic of any race) in families with income below the federal poverty line. A cutoff point for percentage poverty was used to identify block groups with high-poverty among each of the four race/ethnic groups.

In the second stage, lists of dwelling units within the selected block groups were constructed, units were visited and eligibility was determined. Eligibility was based on whether the family had income below 200 percent of the federal poverty line, was female or couple headed, and had a child from age 0 to 4 or 10 to 14 present. Eligible families

were subsampled at varying rates based on several characteristics designed to obtain "suitable sample yields for analysis" (3). Among selected families, one child was selected as the focal child along with the primary caregiver. The baseline survey of 2,402 focal children and caregiver pairs was conducted between March and December of 1999, and a second wave of interviews with 2,158 focal children was conducted between September 2000 and April 2001. A third wave of interviews was conducted between Februrary 2005 and January 2006 but is not included in the file used for the analysis.

Definitions of geographic boundaries

Neighborhoods are operationalized using three successively larger boundaries: block groups, census tracts, and neighborhood clusters. Block groups are contiguous clusters of blocks within census tracts, and contain between 600 and 3,000 residents, with an average of roughly 1,500 residents. census tracts, the most commonly used boundary for neighborhood studies, are small geographic areas designed to be relatively homogenous in terms of population demographic and economic characteristics. Tracts contain between 1,500 and 8,000 residents, with an average population of roughly 4,000 residents. Tracts and block groups are used by the Census Bureau for tabulating and presenting data on small geographic areas (4). Neighborhood clusters were developed by researchers from the PHDCN to represent neighborhoods in Chicago. Neighborhood clusters are composed of groups of geographically contiguous census tracts that are similar in terms of demographic and economic composition, and are constructed to contain roughly 8,000 residents (5).

PHDCN analysis details and results from alternative specifications

Results from specifications shown in the main text in Figures 1 through 4 are based on a pooled sample of PHDCN assessments conducted over three interview waves. There are two complications that arise from using the pooled data. First, individuals appear in the data at multiple points if they were assessed in more than one survey wave. To adjust standard errors for possible clustering of error terms within individuals assessed more than once, all results reported in the main text use the Huber/White sandwich estimator. The second complication is that data are not available at Waves 2 and 3 for some sample members due to attrition from the survey or residential mobility out of Chicago (because homicide data are only available within the city). Analyses were conducted using two additional analytic approaches to assess the robustness of main results to these complications.

One alternative approach is to use only responses from Wave 1 of the PHDCN survey. This approach reduces power to detect effects of local homicides, but avoids the complications arising from having multiple observations of the same individual in the dataset, and avoids complications arising from attrition from the survey or residential mobility outside of Chicago. While the standard errors are slightly larger than in the specification from the pooled sample, the estimated effects are larger in magnitude when using the Wave 1 sample. Estimated effects of homicides occurring within a week of the WISC-R assessment are stronger than those reported in Figure 1, as are all estimated effects of homicides on WRAT3 scores. In the Wave 1 sample, the effects of homicides occurring in the tract and neighborhood cluster within a week of the assessment on WRAT3 scores are large and statistically significant.

A second alternative approach is to pool data from all three waves and adjust for nonrandom attrition and nonrandom mobility out of Chicago. To carry out this approach two sets of weights were developed, the first representing the inverse probability of attrition, the second representing the inverse probability of mobility outside Chicago. In each case, selection models predicting attrition and mobility out of Chicago were derived from prior research using the PHDCN (6, 7). The product of the weights are applied to the data at Waves 2 and 3. Figure S1 reproduces results from Figure 1 of the main text but uses the weighted sample that adjusts for observable predictors of both attrition and mobility out of Chicago. Results from the weighted sample are extremely similar to the main results, with no substantive differences in effect sizes. While Figure S1 shows results only for WISC-R scores, similar findings are present for WRAT3 scores. These results indicate that non-random attrition or mobility out of Chicago do not appear to affect the main results of the analysis. Because the weights increase standard errors, unweighted results are preferable and are presented in the main analysis.

Robustness test: The effect of homicides occurring after the assessment

As a test of robustness, a set of specifications were estimated to test for effects of local homicides that occur in the days *following* the assessment. If the results described in the main text represent true effects of exposure to local homicides, there should be no effect of exposure to a local homicide that occurs in the days after the assessment. Figure S2 displays point estimates from specifications estimating the effect of a homicide within four days and seven days prior to the assessment compared with point estimates from specifications estimating the effect of exposure to a homicide within four and seven days

following the assessment. Results show that exposure to a homicide in the days following the assessment has no effect on vocabulary or reading scores. Again, identical patterns were found for WRAT3 scores as well. This analysis was repeated after removing from the control group children who were assessed in the period after a homicide. Considering that children assessed just after a homicide score lower on both assessments, the presence of these individuals in the control group might lead to an incorrect rejection of the null hypothesis. This is not the case—results were unchanged, and again there was no hint of an effect of exposure to a homicide prior to the assessment.

Results for Hispanics

Figure S3 displays results from the PHDCN WISC-R assessments when the sample is limited to Hispanics. Point estimates fluctuate around zero and have wide confidence intervals, meaning it is not possible to reject the null hypothesis of no effects. Among Hispanics there is no pattern suggesting that temporal proximity of the homicide and the assessment or geographic proximity to the homicide is related to the impact of the homicide on cognitive performance.

Analysis of heterogeneity in caregiver and child characteristics among exposed and non-exposed African-American children

While the analytic approach is designed to be robust to selection bias by making comparisons within neighborhoods, the assumption of exogenous variation in the recency of local homicides could be violated if there is systematic heterogeneity among African-American children living within the same neighborhood who were assessed at different

times. It is possible, for instance, that violence in the neighborhood may have induced some caregivers to reschedule an interview out of concern for the child's safety or psychological state. This possibility is not testable directly, but it is possible to assess whether there are observable differences in caregiver or child characteristics among children living in the same neighborhood who were or were not exposed to local homicides in the period before the assessment.

Figure S4 shows the "effect" of exposure to a homicide within four days before the interview on caregiver/family characteristics and on the child's self-reported violent behavior and performance/engagement in school, respectively. Under the assumption of exogenous variation in the recency of local homicides among children living within the same neighborhood, the results should show no systematic heterogeneity in caregiver characteristics or child violence.

To test this assumption the figure shows estimates from several neighborhood fixed effects specifications that are identical to those presented in the main text, except that caregiver and child characteristics are the dependent variables. Analyses of family income, caregiver education, caregiver marital status, and child violence are based on conditional logit fixed effects specifications with tract by survey wave fixed effects and calendar month and year fixed effects. Low family income is an indicator for caregiver-reported membership in the lowest two income categories, meaning the family earned less than $10,000 annually. Low caregiver education indicates that the caregiver has less than a high school diploma. Caregiver marital status indicates that the caregiver is married. Child violence is an indicator for any self-reported violent behavior, and is based on an assessment in which children were asked whether they had taken part in any

of twelve violent activities in the prior year. Analyses of child school performance and school engagement are based on linear neighborhood fixed effects specifications. School performance measures children's self-reported grades in school. The scale ranges from 1 to 5, with 5 indicating that the child reports receiving "mostly A's" and 1 indicating that the child reports receiving "mostly F's". School engagement is a scale measuring children's self-reported engagement in school, measured as the mean of a series items asking how well the adolescent likes school, likes his/her teachers, and how important grades and homework are. Higher values indicate greater engagement in school.

Figures S4 provides no evidence suggesting systematic heterogeneity in caregiver or child characteristics among children who are and are not assessed within a short period following a local homicide. All estimates fluctuate around zero, and none of the coefficients are close to statistical significance. The same results are found when examining heterogeneity among sample members assessed within a week of a local homicide.

Results from kernel-weighted local linear regressions

Main results shown in Figures 1 and 2 of the text suggest a linear relationship between the number of days since a homicide occurs and the child's score on a given cognitive assessment, with the effect size declining as the window of time between the homicide and the assessment expands. To examine the shape of this relationship in more detail this section describes results from a series of nonparametric regressions in which the relationship between time since homicide and cognitive scores is described with a smoothing function, local linear regression (8, 9). The dependent variables in the

smoothed regressions are the difference between the individual's score on a given assessment and the mean score among all other children of the same race in the same neighborhood. Local linear regression utilizes kernel weights that borrow more information from observations with similar durations of time since a local homicide and less information from observations with very different durations of time since a local homicide. An epanechnikov kernel function is used, with a bandwidth of five days (9). Weights are used in weighted least squares regressions of the outcome variable on time since homicide, with local regressions estimated at each duration of time and graphed using STATA's "lpoly" command. Local linear regression is used instead of simply graphing the mean of the dependent variable at each duration of time since homicide because the latter approach is biased at the boundaries of the graph, when the duration of time between the homicide and the assessment approaches zero.

Figure S5 displays plots from a set of local linear regressions of WISC-R vocabulary scores on the duration of time since homicide occurring within the block group, census tract, and neighborhood cluster, respectively, among African-Americans in the PHDCN. The solid black line shows results at the block group level. The graph reveals an approximately linear relationship between days since homicide and WISC-R scores, with a negative effect of more than 1.5 points (.5 standard deviations) in the days immediately following the homicide. The effect declines and reaches zero roughly nine days following a homicide in the block group, and fluctuates around or just above zero thereafter. At the census tract level (gray dashed line), the negative effect of local homicides is smaller in the days immediately following a homicide and also appears to

dissipate in a roughly linear pattern. A similar pattern is present at the neighborhood cluster level (dotted black line).

The same set of plots is shown for WRAT3 scores in Figure S6. At the block group level, the temporal pattern is less smooth but still suggests a linear decline in the acute effect of local homicides. In the days following a homicide in the block group the negative effect is roughly one half standard deviation (7.5 points), and the effect declines to zero after roughly nine days. The relationship between time since a homicide in the census tract or the neighborhood cluster and WRAT3 scores is unclear from the plots shown in Figure S6, which fluctuate around zero over the full range of the data. This is consistent with the absence of any effect of local homicides at the census tract level or nieghborhood cluster level on WRAT3 scores, as displayed in Figure 2 of the main text.

Local linear regressions were estimated also for Woodcock-Johnson assessments in the Three City Study Chicago sample (Figures S7 and S8). In general, there is more fluctuation in the smoothed regression lines than in the PHDCN sample, reflecting the small sample of the Three City Chicago sample and the resulting imprecision of estimates. The relationship between time since homicide and Letter-Word scores (Figure S7) approximates the relationship found when analyzing WISC-R scores in the PHDCN—in the immediate aftermath of a homicide there is a strong negative effect on Letter-Word scores, which declines and approaches zero as the duration of time since the homicide expands (although the effect persists for a longer period of time in the Three City Study sample). The effect is particularly large for homicides occurring within the census tract, and is smallest for homicides within the neighborhood cluster.

Temporal patterns are less clear for Applied Problems scores (Figure S8). This is in part due to two outliers who scored roughly four standard deviations above the mean on the Applied Problems subtest and were assessed 14 days following a local homicide in the block group. The relationship between time since homicide in the census tract and Applied Problems scores more closely resembles that found for the other assessments (see Figure S8, dashed gray line).

Overall, the local linear regression analyses support the conclusion that the acute effect of a local homicide on cognitive performance declines in an approximately linear manner as the time between the homicide and the assessment widens, and the effect tends to disappear after roughly nine days. This is the most common pattern found in the data, although there are exceptions to the pattern—for instance, results shown in Figure S7 suggest an effect of homicides in the census tract on Letter-Word scores that persists for a longer period.

References

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Table S1. Descriptive statistics from the PHDCN and Three City Study samples.

	PHDCN		Three City Study Chicago Sample	
	African Americans	Hispanics	African Americans	Hispanics
Sample size	1,162 (35%)	1,546 (47%)	391 (52%)	320 (42%)
WISC-R (sd)	7.81 (2.92)	7.20 (2.87)	95.29 (16.72)	101.06 (20.22)
WRAT3 (sd)	94.09 (18.44)	94.57 (20.20)	90.86 (17.30)	95.34 (17.17)

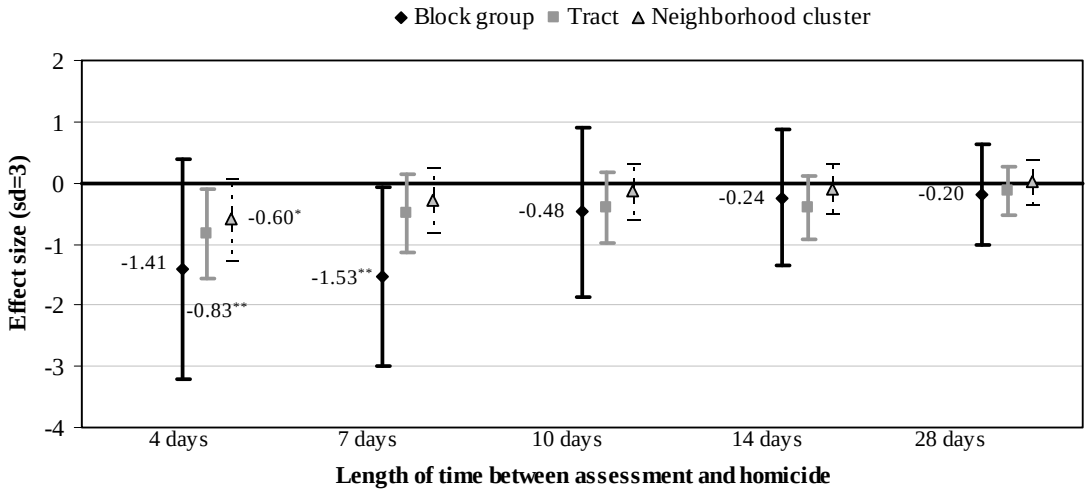

Figure S1. Weighted results, WISC-R. Effect on WISC-R scores of a recent homicide occurring within the block group, census tract, or neighborhood cluster, respectively, among African-Americans in the PHDCN. ** = p<.05; * = p<.10. Coefficient values are shown for all block group estimates and for significant estimates at all levels. Sample sizes: block group estimates are based on 2,255 assessments among 1,082 respondents, census tract estimates are based on 2,328 assessments among 1,106 respondents, neighborhood cluster estimates are based on 2,340 assessments among 1,111 respondents.

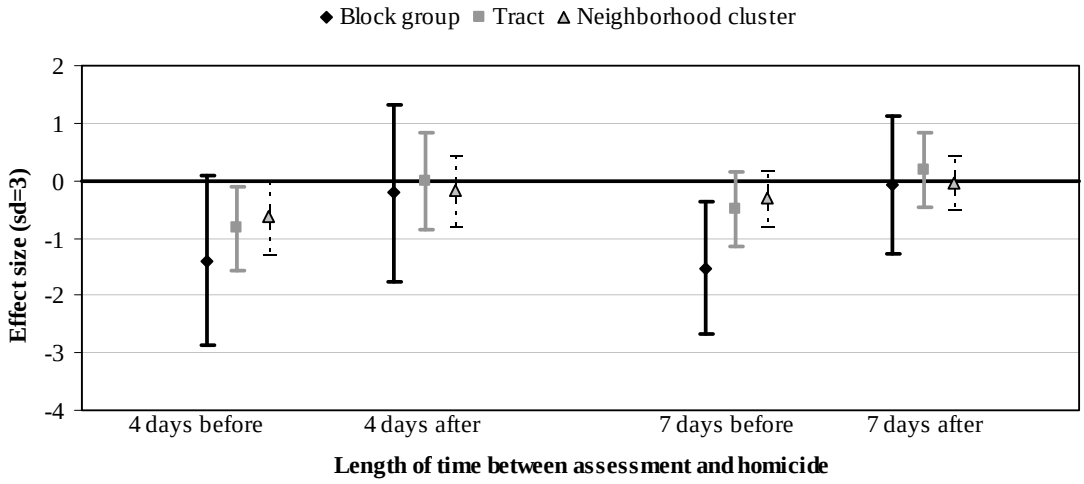

Figure S2. Homicide effects before and after WISC-R assessments. Effect on WISC-R scores of a recent homicide occurring during the specified period *before* or *after* the cognitive assessment, shown for homicides occurring within the block group, census tract, or neighborhood cluster, respectively, among African-Americans in the PHDCN. Sample sizes: block group estimates are based on 2,294 assessments among 1,082 respondents, census tract estimates are based on 2,381 assessments among 1,106 respondents, neighborhood cluster estimates are based on 2,393 assessments among 1,111 respondents.

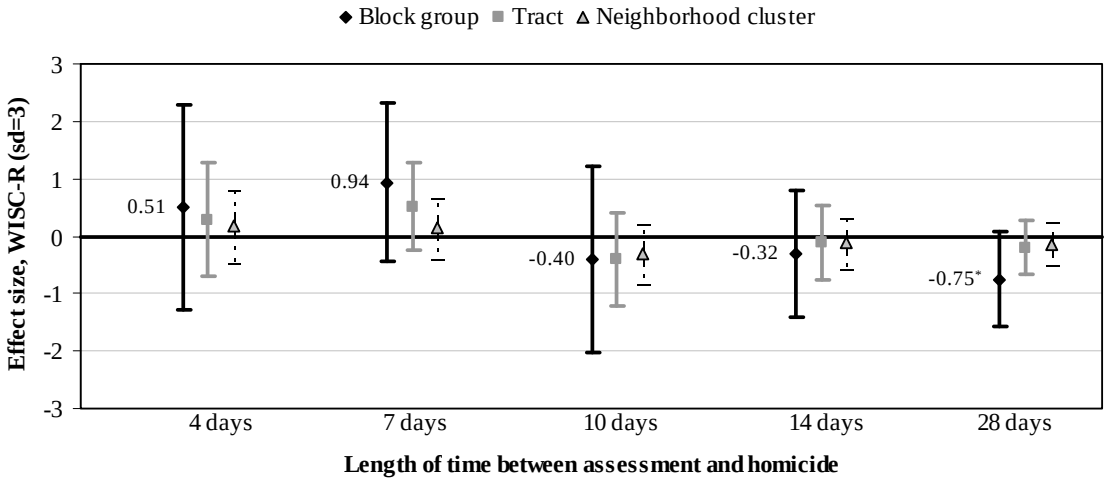

Figure S3. Hispanics results, WISC-R. Effect on WISC-R scores of a recent homicide occurring within the block group, census tract, or neighborhood cluster, respectively, among Hispanics in the PHDCN. * = p<.10. Coefficient values are shown for all block group estimates and for significant estimates at all levels. Sample sizes: block group estimates are based on 2,851 assessments among 1,315 respondents, census tract estimates are based on 3,174 assessments among 1,438 respondents, neighborhood cluster estimates are based on 3,198 assessments among 1,446 respondents.

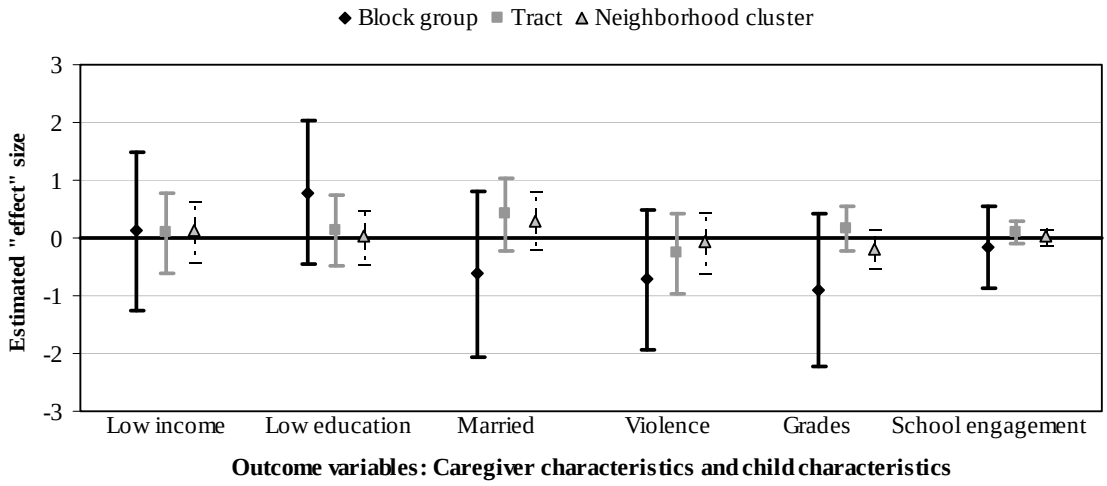

Figure S4. Heterogeneity among African-American children and families exposed and not exposed to a local homicide within four days of the assessment. Effects on caregiver characteristics and child violence of a homicide occurring with four days of the interview assessment. Results shown for homicides occurring within the block group, census tract, or neighborhood cluster, respectively, among African-Americans in the PHDCN. No coefficients are significant at $p<.10$.

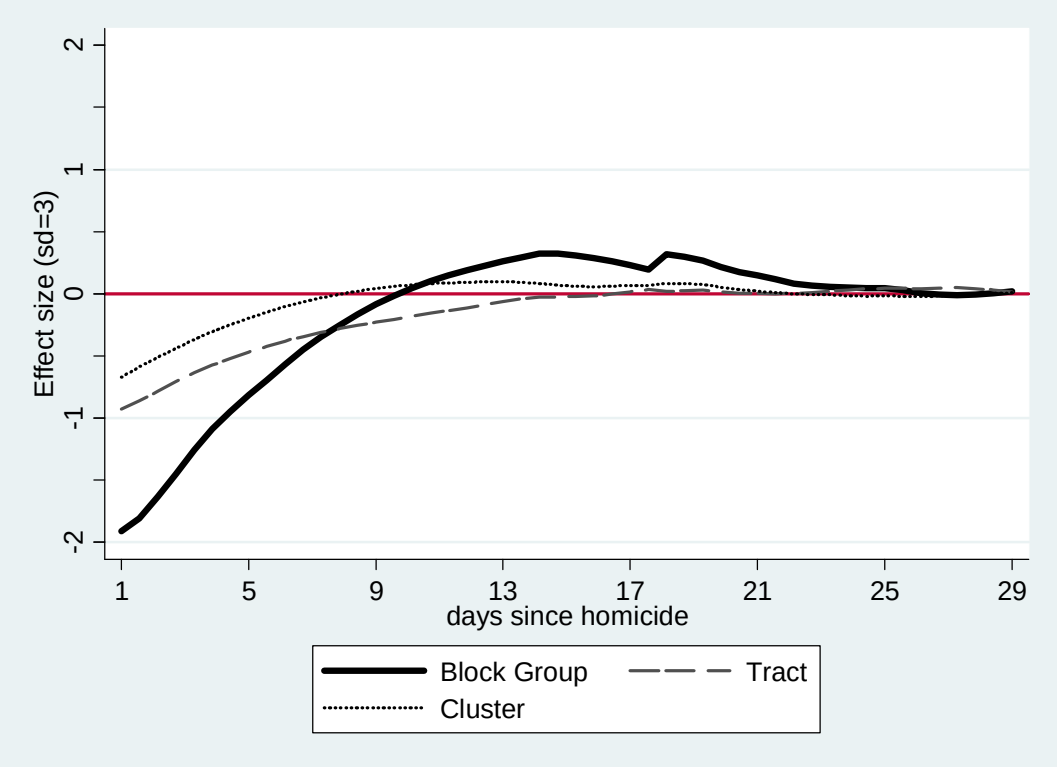

Figure S5. Kernel weighted local linear regression results, PHDCN WISC-R assessment. Local linear regression estimates of the effect of a homicide occurring at the block-group, census tract, and neighborhood cluster level, respectively. Epanechnikov kernel function, bandwidth of 5 days.

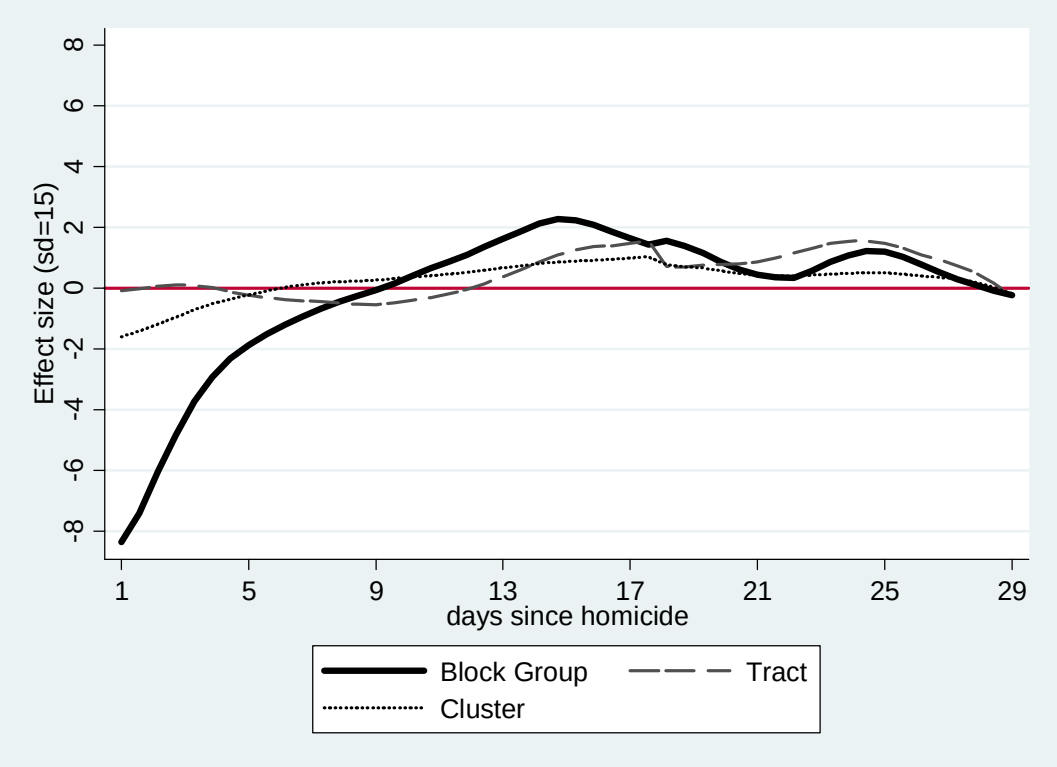

Figure S6. Kernel weighted local linear regression results, PHDCN WRAT3 assessment. Local linear regression estimates of the effect of a homicide occurring at the block-group, census tract, and neighborhood cluster level, respectively. Epanechnikov kernel function, bandwidth of 5 days.

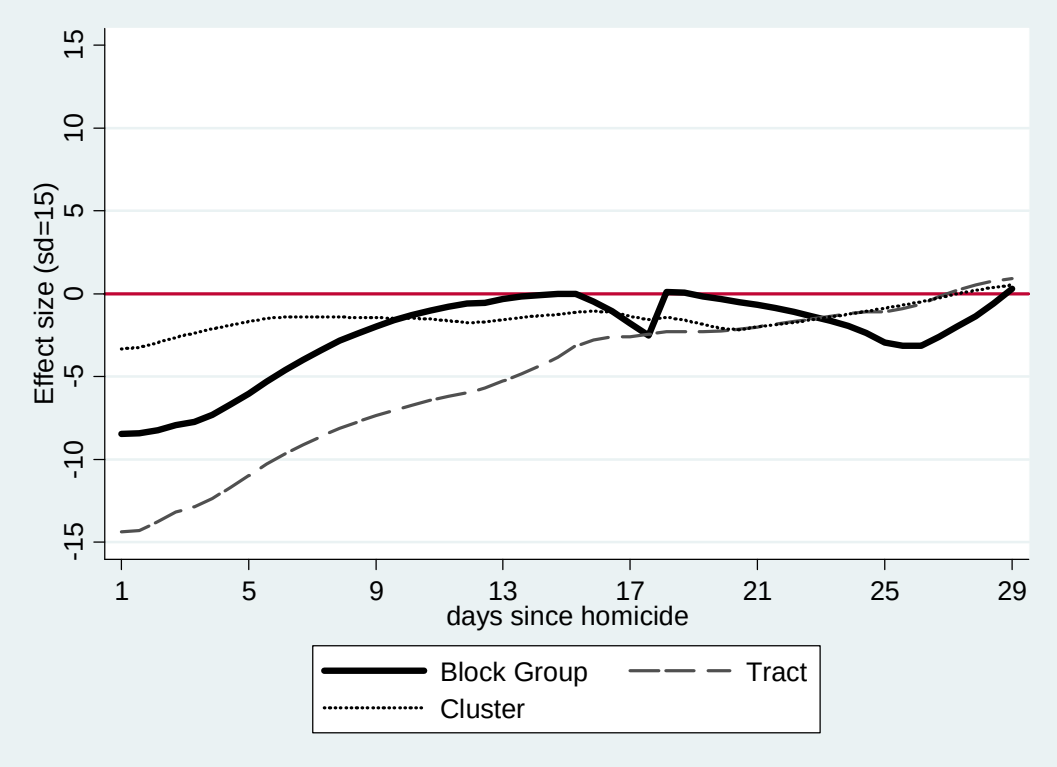

Figure S7. Kernel weighted local linear regression results, Three City Study Woodcock-Johnson Letter-Word assessment. Local linear regression estimates of the effect of a homicide occurring at the block-group, census tract, and neighborhood cluster level, respectively. Epanechnikov kernel function, bandwidth of 5 days.

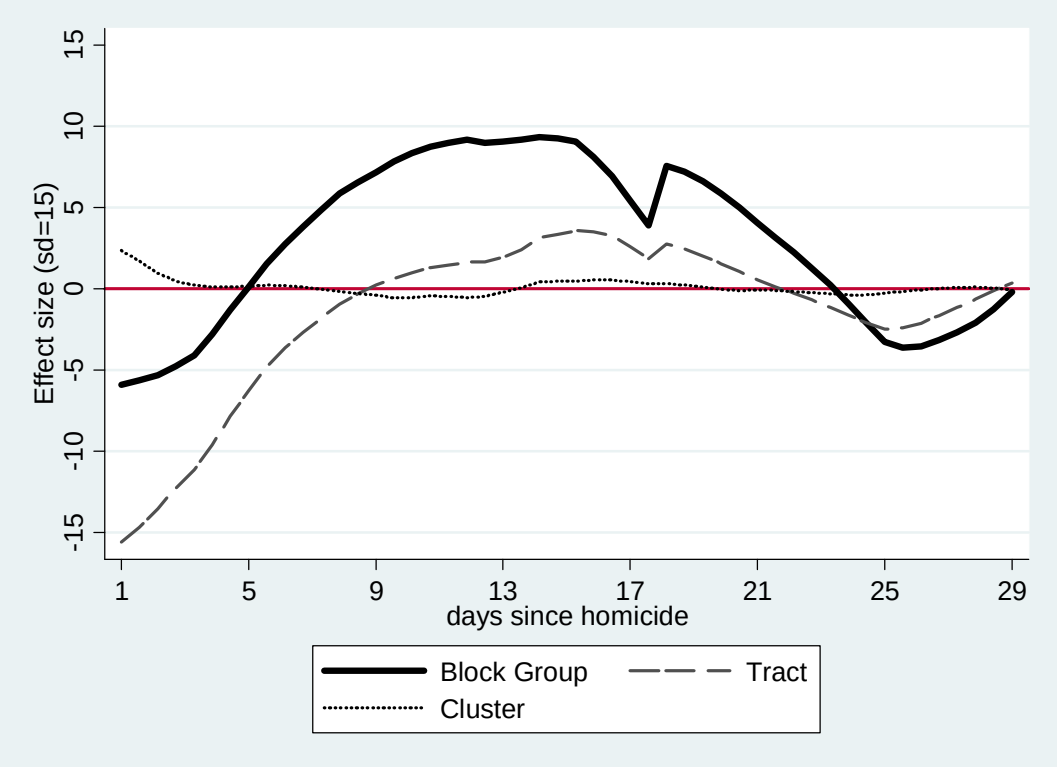

Figure S8. Kernel weighted local linear regression results, Three City Study Woodcock-Johnson Applied Problems assessment. Local linear regression estimates of the effect of a homicide occurring at the block-group, census tract, and neighborhood cluster level, respectively. Epanechnikov kernel function, bandwidth of 5 days.