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ORIGINAL ARTICLE

# Neighborhood Crime and School Climate as Predictors of Elementary School Academic Quality: A Cross-Lagged Panel Analysis

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**Abstract** Past research has found negative relationships between neighborhood structural disadvantage and students' academic outcomes. Comparatively little work has evaluated the associations between characteristics of neighborhoods and schools themselves. This study explored the longitudinal, reciprocal relationships between neighborhood crime and school-level academic achievement within 500 urban schools. Results revealed that higher neighborhood crime (and particularly violent crime) predicted decreases in school academic achievement across time. School climate emerged as one possible mechanism within this relationship, with higher neighborhood crime predicting decreases in socioemotional learning and safety, but not academic rigor. All three dimensions of school climate were predictive of changes in academic achievement. Although this research supports a primarily unidirectional hypothesis of neighborhoods' impacts on embedded settings, additional work is needed to understand these relationships using additional conceptualizations of neighborhood climate.

**Keywords** Crime · Neighborhoods · School climate · Social disorganization

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## Introduction

Past research has shown that students who are exposed to unsafe conditions in their school and neighborhood environments are at particularly heightened risk for academic failure (Bowen and Bowen 1999; Henrich et al. 2004; Margolin Gordis 2000). Unfortunately, exposure to violent crime is not uncommon within many areas of the United States, and may be particularly high within urban, low-income contexts. For example, a survey of 900 youth from low-income areas of New York City revealed that up to 98 % of respondents had witnessed at least one violent act (e.g., physical or sexual assault, homicide) and 87 % had been victimized (e.g., heard gunfire, been hit, threatened with harm, or chased) within their communities at some point during the course of their lives (Gershoff et al. 2004). This exposure to violent environments is thought to compromise students' academic achievement through its effects on individual processes, including mental health, behavioral dysregulation, physiological stress reactivity, and sleep disturbances (Buka et al. 2001; Schwartz and Gorman 2003).

Despite a large body of research that has found direct and indirect links between violent environments and student-level academic outcomes, relatively little work has examined the ways that community violence may influence the long-term functioning of the schools or other social institutions embedded within these neighborhood contexts (Leventhal and Brooks-Gunn 2000; Kubrin and Weitzer 2003). As places where children spend most of their out-of-home time, neighborhoods and schools are two of the most salient and influential contexts for students' development (Duncan and Raudenbush 1999). For this reason, these contexts have been increasingly utilized as the targets of intervention (e.g., Cappella et al. 2008; Spielman et al. 2006). Understanding

the reciprocal exchanges between neighborhood and school ecological contexts is therefore critical not only for informing ecological theory, but also for describing the ways these environments may independently or interdependently affect individual growth across time. The present study seeks to address an important empirical gap by examining the reciprocal relationships between the social and structural characteristics of schools, and the neighborhoods in which they are embedded. Specifically, this study will examine the ways that neighborhood crime, school climate, and school academic achievement relate to one another across time within a sample of predominantly low-income elementary schools in Chicago.

## Neighborhood Crime and Academic Outcomes

Social disorganization theory (Shaw and McKay 1942) provides a framework for conceptualizing neighborhood effects on individuals. This theory argues that neighborhood structural factors (e.g., poverty, residential instability, racial-ethnic heterogeneity) contribute to delinquency, crime, and other problem behaviors in poor urban neighborhoods through the breakdown of social ties and neighborhood organization. The presence of these neighborhood characteristics makes it difficult for residents to develop relationships with one another and exert collective control over norms. In turn, informal and formal institutions (e.g., families, schools) are unable to transmit proper rules of behavior to individuals within these contexts.

In more recent years, a large body of theoretical and empirical work has drawn on the social disorganization theoretical framework to understand links between neighborhood characteristics and students' academic outcomes. Various indicators of neighborhood socioeconomic status (SES) and community violence have been found to predict individuals' standardized test scores, grades, attendance, and school behavior (Aber et al. 1997; Bowen and Bowen 1999; Henrich et al. 2004; Leventhal and Brooks-Gunn 2000; Lord and Mahoney 2007). As would be predicted based on social disorganization theory, neighborhood characteristics are often non-independent; violent crime has been consistently found to be higher in more disadvantaged neighborhoods (Nikulina et al. 2011). Moreover, the observed relationship between neighborhood poverty on children's outcomes may partially operate through exposure to crime, and particularly via resulting increases in stress, fear and anxiety and/or the modeling of unhealthy and antisocial behavior (Lynch 2003).

## School Climate, Achievement, and Delinquency

Social disorganization theory also offers insight into the ways that schools may influence student behavior and outcomes. In addition to drawing direct links between neighborhood structural characteristics and individual outcomes, social disorganization theory includes the evaluation of the norms and social regularities that define a particular setting, and uses these social characteristics to explain relationships between structural dimensions and environmental outcomes (Cantillon et al. 2003; Kubrin and Weitzer 2003). Much of the research on norms in schools has highlighted school climate, or the "quality and character of school life." This literature has largely focused on three specific domains of social organization: safety (e.g., rules of physical and socioemotional safety), relationships (e.g., respect for diversity, school connectedness, student and adult social support, leadership), and teaching and learning (e.g., social, emotional, and civic learning, support for learning; Cohen and Grier 2010).The three dimensions of school climate that are the focus of this study parallel these previously identified areas. Specifically, we focus on ratings of schools' safe and respectful climate (SRC), socioemotional learning environment (SEL), and academic rigor (AR). Like prior conceptualizations of "safety," SRC captures students' perceptions of both physical and emotional safety within their school environments. Similar to the "relationships" dimension, SEL is a measure of how students interact with one another and navigate conflict when it arises. Finally, like "teaching and learning," AR reflects students' perceptions of support for academic performance and personal growth provided by adults.

Empirical work has found positive school climate, across various dimensions, to be robustly related to students' higher academic achievement (Bowen and Bowen 1999; Bryk et al. 2010; Mayer et al. 2000) and reduced aggression, violence, and bullying (Birkett et al. 2009; Goldstein et al. 2008). Moreover, research suggests that the protective influence of a positive school climate is strongest for students in high risk or high poverty schools (Battistich et al. 1995). Despite this evidence for school climate as an important predictor of child outcomes, recent research suggests that positive perceptions of school climate may be insufficient in protecting students from the negative socioemotional consequences of violence (Hardaway et al. 2012). In the larger context of social disorganization theory, collectively these findings suggest school climate as a potentially important—yet incompletely explored—social mechanism for explaining links between structural characteristics like violence, and outcomes like academic achievement.

## Intersections Between Neighborhoods and Schools

Given the broad array of studies finding direct relationships between neighborhood and school characteristics and individual academic outcomes, it is clear that these contexts are

independently salient for shaping students' growth (Duncan and Raudenbush 1999; Gershoff and Aber 2006). Recently, a growing interest has developed in understanding how neighborhoods and schools can jointly influence individual outcomes. In particular, researchers have shown that characteristics of schools (e.g., school safety and behavioral norms) may partially explain the effects of neighborhoods on adolescent risk behavior (Ennett et al. 1997; Teitler and Weiss 2000).

Although this work offers insight into how neighborhoods and schools may independently and interdependently influence students, relatively little research has focused on how these systems influence *each other* over time. Untangling the relationships between neighborhoods and schools is critical for improving the specificity and generalizability of a growing number of interventions and policies that are implemented within these "higher level" settings (Cappella et al. 2008; Spielman et al. 2006). Social disorganization theory suggests that neighborhood structural factors contribute to crime through the breakdown of social ties and institutional (school) functioning over time. Empirically, past work has shown that schools that are embedded in high-crime, disorganized neighborhoods are themselves more likely to be chaotic and/or violent (Menacker et al. 1990). In addition, neighborhood disadvantage has been found to be related to violence and crime within schools (Gottfredson and Gottfredson 1985; Welsh et al. 2000) and school-level suspension rates (Hellman and Beaton 1986). Moreover, neighborhood-level violence has been found to be positively related to school-level violence (Laub and Laurstein 1998) and negatively related to school-level achievement (Milam et al. 2010).

Understanding the specific relationship between neighborhood crime and school functioning, particularly in terms of directionality and development over time, is largely limited by the use of cross-sectional data. One assumption made in prior work is that the primary direction of these associations is drawn from neighborhoods to schools. Indeed, there are various ways that neighborhood crime may influence school-level achievement across time. For example, students' exposure to violence in the neighborhood may affect the climate of the school through shifts in norms surrounding the use of violence to solve disputes, increased aggressive behaviors in the school, or by weakening the collective control of teachers (Coie and Dodge 1998; Hellman and Beaton 1986; Pearson and Toby 1991; Welsh et al. 2000). In turn, these cultural shifts have been shown to influence students' achievement (Mayer et al. 2000).

Although the majority of past research has assumed a unidirectional hypothesis of neighborhoods' influence on schools, empirical and theoretical evidence also suggests that there may be pathways through which embedded institutions influence neighborhood crime (Peterson et al. 2000). First, school characteristics may drive changes in the demographic composition of the surrounding neighborhood. High-performing schools may attract higher income individuals to a neighborhood, therefore altering the level of neighborhood disadvantage and related levels of crime over time. Indeed, past research has shown that shifts in elementary schools' overall academic achievement may in fact cause changes in the surrounding neighborhoods' housing values (Weimer and Wolkoff, 2001). Alternatively, improvements in school achievement or climate may drive larger shifts in the collective attitudes, relationships, and "climate" of the neighborhood more broadly. These changes in social norms and values may in turn promote a safer community environment. Finally, it is also plausible that there is a reciprocal relationship between neighborhood crime and school achievement. For example, higher levels of neighborhood crime may lead to decreases in school climate and achievement. This breakdown in school achievement may further weaken social ties and the functioning of other neighborhood institutions, therefore contributing to even higher levels of neighborhood crime.

## The Present Study

The primary aim of the present study is to examine the bidirectional relationships between crime in the neighborhoods surrounding urban elementary schools, and school-level academic achievement. We chose to focus on the neighborhoods in which schools are located because of prior work that has shown the features of the community directly surrounding schools to be more predictive of school disorder than the characteristics of the communities from which students are drawn (Welsh et al. 2000). In addition to this general aim, this study also tests whether the relationships between neighborhood crime and school achievement can be explained by students' perceptions of school climate. In particular, three distinct school climate variables that parallel dimensions from prior work will be explored: reports of SRC, SEL, and AR. Although it is expected that all school climate variables will be predictive of school-level academic achievement across time, it is hypothesized that the climate variables related most closely to students' feelings of safety, security, and support—namely, SRC and SEL—will be more highly related to neighborhood crime than reports of AR.

In exploring the direct and indirect relationships between neighborhood crime and school climate and achievement, this study will address several major gaps in the literature. First, this study examines school and neighborhood characteristics at the level of the setting rather than at the individual level, and in doing so allows

for greater inference regarding relationships between these higher order systems. Second, the use of multiple time points allows for both better understanding of the stability of crime and school achievement across time, as well as for improved understanding of the transactional relationships between these variables. In particular, the inclusion of a lagged model mitigates some of the biases associated with unmeasured, time-invariant confounding variables (Berrington et al. 2006). This, in addition to the ability to compare the relative strength of bidirectional pathways, provides improvement in addressing problems of simultaneity bias relative to cross-sectional studies (Leventhal and Brooks-Gunn 2000). Third, this study combines objective reports of neighborhood crime and school achievement with students' collective views of the quality of their school environments. Such a multi-informant approach provides a more nuanced understanding of how specific structural aspects of school and neighborhood environments may shape groups of students' perceptions across time, and vice versa. The use of objective crime data is a particular strength of this study, as it reduces reporter biases that may result from exposure to traumatic events. Finally, this study includes a large sample of elementary schools from a particularly large urban school district, thereby increasing generalizability of claims within a mostly low-income, underrepresented context.

## Methods

### Sample and Procedure

The present sample of elementary schools was obtained from the publicly accessible Chicago Public Schools (CPS) Office of Performance research database. Elementary schools were defined for the purposes of this study as those schools within the CPS system serving at least one third-grade classroom. School data were obtained for 2007, 2008, and 2009. Of the 500 elementary schools included in this study, 77.80 % were categorized as neighborhood schools that primarily served students from the communities immediately surrounding the school, and the remainder were other types of schools (e.g., charter, magnet, special education) serving students without regard to attendance boundaries. Demographic information indicated that the majority of schools served primarily low-income, ethnic/racial minority students. In 2007, the average enrollment was 598.30 students per school (SD = 318.94), 78.50 % (SD = 18.71 %) of which were free/reduced price lunch (FRPL) eligible. On average, schools were comprised of 55.39 % Black, 31.34 % Hispanic, and 8.01 % non-Hispanic White students.

### Measures

#### *Neighborhood Crime*

In the present study, neighborhood crime data were collected over a 3 year period using the publicly available City of Chicago online Crime Data Portal. Spatial identifiers (i.e., latitude and longitude) for each individual crime were geocoded using ArcGIS software (version 10; ESRI 2011) and spatially aggregated within schools' Census tracts to form estimates of school neighborhood crime for 2007, 2008, and 2009. (See Table 1 for descriptive information on neighborhood crime in each year.) Specifically, each year's estimate included the total number of index crimes that had occurred in the 12 months preceding students' academic assessments, which occurred in the spring of the school year. Index crimes are defined by the Federal Bureau of Investigation, and include both violent crimes (homicide, criminal sexual assault, robbery, aggravated assault, and aggravated battery) and property crimes (burglary, larceny, motor vehicle theft, and arson). Neighborhood crime data were square root transformed for all multivariate analyses in order to reduce positive skew.

#### *School Climate*

Students' perceptions of school climate were taken from the publicly available Student Connection Survey (SCS), which was reported annually by CPS for each year of the present study. Items on the SCS were rated by 6–8th grade students within each school and aggregated to the school level to provide overall reports of SRC, SEL, AR, student support, and participation in extracurricular activities (Osher et al. 2008). Because 80 % of elementary schools in CPS serve either kindergarten or pre-kindergarten to 8th grade, the SCS data have been considered in past work to be reflective of the climate experienced by elementary school students (Lowenstein et al. 2012; Raver et al. 2013). The average response rate on the SCS for the present sample of schools in 2007 was 82.84 % (SD = 11.05 %). The 48 items on the SCS were reported on a Likert scale with four answer options that range from "Strongly Agree" to "Strongly Disagree." The measure was carefully validated by the original authors using item response theory and tests of predictive validity to create final aggregate scores representing the percent of students within each school whose responses indicate an "excellent" or "adequate" view of the particular school climate domain (see Osher et al. 2008).

The present study used the SRC, SEL, and AR aggregates to represent dimensions of school climate. Specifically, the SRC aggregate outlines how physically and

**Table 1** Sample descriptive characteristics for neighborhoods (n = 400) and schools (n = 500)

| | 2007 | | 2008 | | 2009 | |
|---|---|---|---|---|---|---|
| | Mean (SD) | 95 % CI | Mean (SD) | 95 % CI | Mean (SD) | 95 % CI |
| Neighborhood crime | 704.00 (530.34) | 677.48–730.52 | 694.26 (522.41) | 668.14–720.38 | 662.50 (489.89) | 638.01–686.99 |
| School climate (% adequate/excellent) | | | | | | |
| Safety and respect | 76.53 (13.49) | 75.93–77.13 | 79.47 (12.22) | 78.92–80.02 | 81.89 (11.40) | 81.38–82.40 |
| Socioemotional learning | 67.17 (10.32) | 66.71–67.63 | 78.04 (7.86) | 77.69–78.39 | 80.67 (7.84) | 80.32–81.02 |
| Academic rigor | 73.61 (8.80) | 73.22–74.00 | 80.05 (7.11) | 79.73–80.37 | 75.90 (8.51) | 75.52–76.28 |
| School academic performance (% meeting/exceeding standards on math and reading) | 62.92 (18.53) | 62.09–63.75 | 63.17 (16.85) | 62.42–63.92 | 64.62 (16.60) | 63.88–65.36 |
| Free/reduced price lunch (%) | 78.50 (18.71) | 77.66–79.34 | 83.69 (20.50) | 82.77–84.61 | 84.23 (20.11) | 83.33–85.13 |

emotionally safe students feel at school. Statements include content pertaining to physical safety such as "I worry about crime and violence in school," and emotional safety such as "Most students in my school don't really care about each other." The SEL aggregate measures students' perceptions of their classmates' social, emotional, and interpersonal skills, including specific questions regarding anger management, fighting, and conflict resolution. Items on the SEL aggregate include, "Most students in my school think it's OK to fight if someone insults them" and "Most students in my school stop and think before doing anything when they get angry." Finally, the AR aggregate represents the degree to which students feel that adults in the school encourage them to think, work hard, do their best, and connect academic material to life outside school. Examples of items on the AR aggregate include, "My teachers often require me to explain my answers" and "The topics we are studying are interesting and challenging."

*School-Level Academic Achievement*

School academic achievement was collected from the publicly available CPS Office of Performance research database. Specifically, school academic achievement was represented by a composite measure of the percentage of students that met or exceeded standards on Illinois Standards Achievement Tests (ISAT) in math and reading at each school for each academic year. The ISAT is a standard assessment of students' academic achievement. It is given annually to students in grades 3 through 8 to measure whether schools are making adequate yearly progress. Schools' ISAT scores, particularly in terms of the proportion of students who meet state standards, are used to inform decisions about allocation of funds, places to intervene, and school closings, and therefore are a particularly policy-relevant measure of academic achievement. In the current study, we use the percent of students who meet and exceed academic standards on the ISAT in both reading and math to capture academic achievement at the setting level.

*School Poverty*

The percentage of students who were eligible for free or reduced price lunch (FRPL) was collected from the CPS Office of Performance and was used as a proxy for school-level economic disadvantage (Gershoff and Aber 2006). Levels of and changes in school poverty have been found in past studies to relate highly to both neighborhood crime and school academic achievement (Aber 1994; Bickel et al. 2000; Wirt et al. 2004), as well as to other salient predictors of these variables, such as schools' physical resources, teachers' levels of experience, and parental involvement in school activities (Mayer et al. 2000; Wirt et al. 2004). Because of this, school-level FRPL status was used as a covariate and included on all analytic pathways in an attempt to disentangle the effects of neighborhood crime on school-level outcomes from those of school poverty. Prior to analyses, FRPL was reflected (all scores subtracted from 101, or the highest value +1) and square root transformed due to negative skew.

Analytic Plan

To understand the relationships between neighborhood crime, school climate, and school academic achievement, a set of cross-lagged panel analyses was conducted within a structural equation modeling (SEM) framework using Mplus (version 6; Muthén and Muthén 1998–2010). By drawing on panel data, a cross-lagged panel analysis models the relationship between variable X at time 1 and variable Y at time 2, while simultaneously modeling the relationship between variable Y at time 1 and variable X at time 2. In addition, auto-lagged paths are included that model relationships within variables over time (i.e., variable X at time 1 and variable X at time 2). This approach provides several important benefits over traditional regression with cross-sectional data. First, the inclusion of auto-lagged pathways allows for a better understanding of the stability of characteristics across time. In addition,

adjusting for levels of the outcome variable at a previous time point provides a more conservative estimate of residualized change in that variable across a two-year period, rather than providing a simple estimate of the level of the outcome at one time point. Such an approach is thought to reduce (but not eliminate) selection bias attributable to unobserved, time-invariant characteristics that would otherwise have affected observed values of the particular outcome. Second, the inclusion of cross-lagged pathways allows for comparison of the relative contribution of coefficients across time, allowing for exploration of bidirectional hypotheses. Third, the use of an SEM framework permits simultaneous testing of multiple outcome variables and also provides relative and overall model fit indices that allow for comparison of nested models and evaluation of goodness of fit. Finally, the use of such a model with three separate constructs of interest also allows for the explicit evaluation of both direct and indirect model pathways, including the direct relationships between all study variables, as well as the ways that school climate may mediate any observed relationships between neighborhood crime and school academic achievement.

Several analytic strategies were used to improve statistical validity and model fit of the cross-lagged approach. First, because schools were nested within 400 neighborhood Census tracts, standard errors were adjusted for clustering using the TYPE = COMPLEX command in Mplus. The default estimator for nested data—maximum likelihood with robust standard errors—was used for all analyses. It is important to note that we did not adjust for clustering within classrooms given the nature of the available data and the higher-level (i.e., school-level) focus of our analyses. Second, correlations between residuals of all variables within the same time period were added to examine the contribution of each phenomenon above and beyond the covariance shared with other variables at that time point. Third, the percentage of students receiving FRPL in the previous year—a proxy for school-level poverty, a potentially important time-varying confounding variable—was included as a covariate on all pathways in the model. Finally, a full information maximum likelihood (FIML) approach was utilized to account for missing data across time points and retain use of the full sample of schools/neighborhoods. In general, there was only a small amount of missing data across the three time points: none of the 400 neighborhoods were missing crime data across all years, and an average of 6.33 % of the 500 schools were missing data on academic achievement, 23.07 % on school climate, and 6.87 % on FRPL status across the three time points.

Several sets of models were estimated to achieve the aims of the present study. The first examined the within- and between-variable relationships for neighborhood crime and school-level academic achievement across the specified three-year period. The second set of models included the school climate variables to explore the direct and indirect pathways between neighborhood crime, school climate, and school academic achievement. Specifically, three additional subsets of models were specified in which SRC, SEL, and AR were each added to the original model. These models were run separately for each set of school climate variables in order to understand the unique relationships that each of these domains—independent of other aspects of school climate—had with both neighborhood crime and school academic achievement (thereby simplifying interpretation), as well as to retain as much statistical power as possible.

To establish the best fitting model within each set of analyses, all variables of interest were tested to determine whether their intercepts and/or residuals should be constrained to be equal across time. Constraining parameters to be equal across time improves model parsimony, allows for more degrees of freedom in analyses, and is consistent with the hypothesis that processes are stable across years. Only models whose parameters were consistent in magnitude and direction and whose overall fit was equal or superior were constrained. Once this basic model was established, auto-lagged pathways were included to establish the relationships within all variables across the three time points. Finally, cross-lagged pathways were included to test direct relationships between all study variables (i.e., crime and school climate, school climate and academic achievement, and crime and academic achievement) to understand transactional relationships across time, accounting for correlations between variables of interest within time points. Auto-lagged and/or cross-lagged pathways were also constrained to be equal across time when fit indices showed equal or better model fit. Finally, to test whether school climate variables served as statistical mediators of the relationships between neighborhood crime and school academic achievement, indirect pathways between crime and achievement were tested using the MODEL INDIRECT in Mplus.

The following criteria were used to indicate adequate overall model fit: (a) a relative $\chi^2$ value (the ratio of $\chi^2$ to degrees of freedom) of 3 or less (less than 2 was ideal); (b) a root mean square error of approximation (RMSEA) value of less than 0.08 (less than 0.06 was ideal); (c) a comparative fit index (CFI) of 0.90 or above (greater than 0.95 was ideal); and (d) a standardized root mean square residual (SRMR) of less than 0.09 (Hatcher 1994; Hu and Bentler 1999; Kline 1998). In addition, the $\chi^2$ difference statistic ($\chi^2\Delta$) was used to compare nested models (Kline 1998). Due to the exploratory nature of the present study and the relatively conservative specifications used in models, marginally significant findings (i.e., those with $p < .10$) were reported in addition to those whose $p$ values were less than 0.05.

## Results

### Neighborhood Crime and School Academic Achievement

Several models were estimated to understand the relationships among and between neighborhood crime and school academic achievement across time. A model with freely estimated auto-lagged pathways and constrained cross-lagged pathways was found to have marginally better model fit than a model with only auto-lagged pathways, $\chi^2\Delta(3) = 7.079$, $p < .10$ (see Table 2 for fit statistics across models). Within this model, neighborhood crime was significantly and positively related across the three time points, as was schools' academic achievement, indicating relatively high—but not complete—stability in these phenomena over time. In addition, higher earlier levels of neighborhood crime were found to significantly predict decreases in school academic achievement across time, $b = -0.090$, SE = 0.045, $p < .05$. Within this model, school academic achievement was not found to significantly predict changes in neighborhood crime. Correlations between residuals were also non-significant. (See Fig. 1 for full model.)

### Relationships with School Climate

To test whether the relationship between neighborhood crime and school achievement may be partially explained by students' reports of school climate, three additional sets of models were tested. First, a set of models examining the direct relationships between crime, students' reports of school-level SRC, and school academic achievement were compared. A cross-lagged model with constrained cross-lagged pathways and a constrained auto-lagged path for SRC was found to have the best model fit relative to the others tested, including a model only estimating auto-lagged pathways, $\chi^2\Delta(9) = 46.911$, $p < .01$. Within this model, higher neighborhood crime was found to predict reductions in SRC at the trend level, $b = -0.051$, SE = 0.030, $p < .10$. In addition, significant reciprocal relationships between school climate and achievement were found. Specifically, higher levels of SRC were found to predict increases in academic achievement, $b = 0.161$, SE = 0.036, $p < .01$, and higher academic achievement was found to predict increases in SRC, $b = 0.083$, SE = 0.021, $p < .01$. Comparison of standardized coefficients across these two pathways indicated that relationships were equal in magnitude, at $\beta = 0.122$ for both. In this model, school climate and achievement did not predict changes in neighborhood crime, and crime did not predict school achievement directly. All correlations between residuals were non-significant. Finally, an additional test of the indirect pathway from neighborhood crime to school academic achievement via SRC was non-significant. (See Fig. 2.)

An additional set of models examined students' reports of school-level SEL in place of SRC. Once again, a cross-lagged model with constrained cross-lagged pathways and a constrained auto-lagged path for SEL was found to have better fit than a model with only auto-lagged pathways, $\chi^2\Delta(9) = 21.384$, $p < .05$. In this model, higher neighborhood crime was significantly related to reductions in SEL across time, $b = -0.053$, SE = 0.023, $p < .05$. In turn, lower SEL was predictive of decreases in school achievement, $b = 0.106$, SE = 0.041, $p < .01$. No other pathways were statistically significant within this model, nor were the residual correlations. A test of the indirect pathway from neighborhood crime to school achievement via SEL was significant at the trend level, $b = -0.006$, SE = 0.003, $p = .08$, indicating preliminary but inconclusive evidence for SEL as a mediator in this relationship. (See Fig. 3.)

Next, a set of models exploring students' reports of school-level AR was explored. A cross-lagged model with constrained cross-lagged paths was found to be a better fit than an auto-lagged only model, $\chi^2\Delta(9) = 38.505$, $p < .01$. In this model, higher neighborhood crime was marginally predictive of decreases in academic achievement, $b = -0.080$, SE = 0.045, $p < .01$, but not related to AR. Higher levels of AR, on the other hand, were marginally predictive of decreases in neighborhood crime, $b = -0.013$, SE = 0.007, $p < .10$, and significantly predictive of increases in academic achievement, $b = 0.181$, SE = 0.049, $p < .01$. Residual correlations between AR and school academic achievement were significant, $b = 12.858$, SE = 3.897,

**Table 2** Fit statistics for SEM models predicting school academic achievement

| | Auto-lagged only | | | | Auto-lagged and cross-lagged | | | |
|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ (*df*) | RMSEA | CFI | SRMR | $\chi^2$ (*df*) | RMSEA | CFI | SRMR |
| Neigh crime and academic achievement | 69.693 (18) | 0.076 | 0.982 | 0.033 | 62.614 (15) | 0.080 | 0.983 | 0.024 |
| With safe and respectful climate | 138.860 (38) | 0.073 | 0.974 | 0.054 | 91.949 (29) | 0.066 | 0.984 | 0.020 |
| With socioemotional learning | 126.941 (38) | 0.068 | 0.976 | 0.055 | 105.557 (29) | 0.073 | 0.980 | 0.038 |
| With academic rigor | 122.186 (37) | 0.068 | 0.977 | 0.074 | 83.601 (28) | 0.063 | 0.985 | 0.054 |

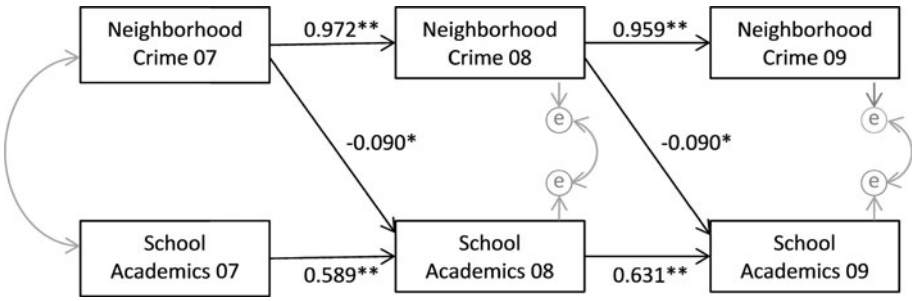


**Fig. 1** Direct relationships between neighborhood crime and school-level academic achievement across 3 years. *Notes* For ease of presentation, covariates, non-significant pathways, and correlations between within-year variable residuals not shown. All parameters unstandardized. Neighborhood crime square root transformed. $^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$

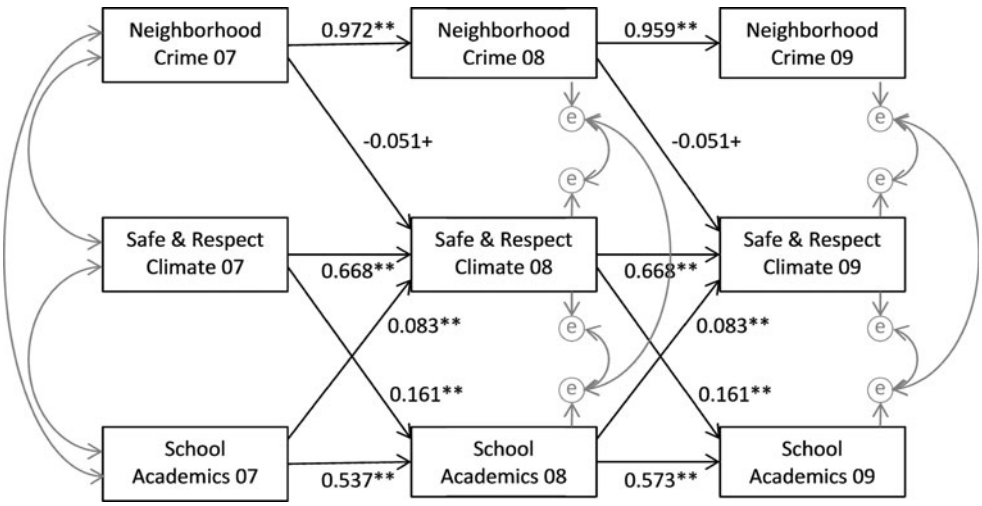


**Fig. 2** Transactional relationships between neighborhood crime, safe and respectful school climate, and school-level academic achievement across 3 years. *Notes* For ease of presentation, covariates, indirect pathways, non-significant direct pathways, and correlations between within-year variable residuals not shown. All parameters unstandardized. Neighborhood crime square root transformed. $^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$

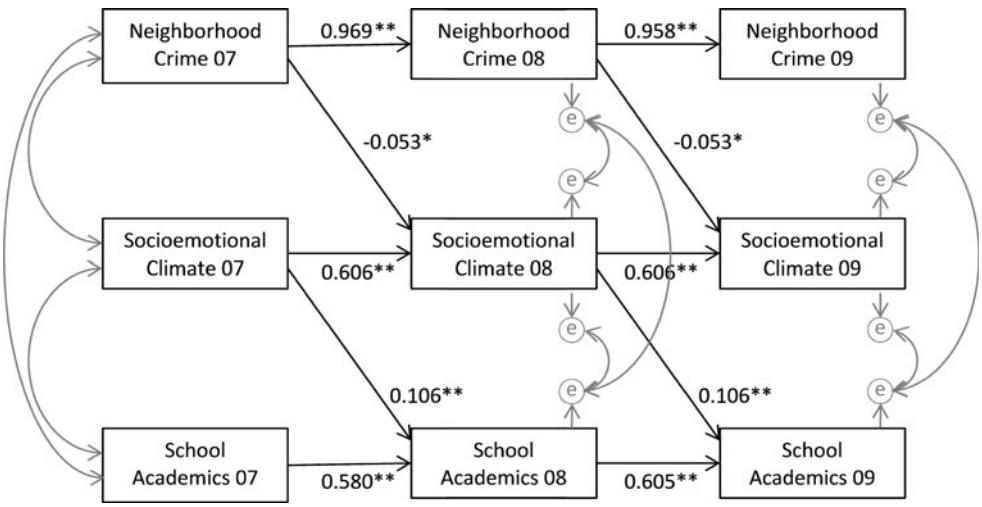


**Fig. 3** Transactional relationships between neighborhood crime, socioemotional learning climate, and school-level academic achievement across 3 years. *Notes* For ease of presentation, covariates, indirect pathways, non-significant direct pathways, and correlations between within-year variable residuals not shown. All parameters unstandardized. Neighborhood crime square root transformed. $^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$

$p < .01$ for 2008 and $b = 9.462$, SE $= 3.753$, $p < .01$ for 2009. All other residual correlations were non-significant. In addition, the indirect pathway between neighborhood crime and school achievement via AR was nonsignificant (see Fig. 4).

## Robustness Checks

Several strategies were used to test the robustness of results to changes in model specification. First, analyses were conducted using listwise deletion of cases with missing data

instead of a FIML approach. This approach was taken to improve confidence that findings were not related to non-random patterns of missingness in the sample (e.g., that findings were not different when schools with response rates on the SCS too low to report were excluded from the sample). Second, an additional set of models was tested that included separate analyses of math and reading outcomes to test whether patterns of results might differ based upon the specific subtype of academic achievement. Third, the original set of models was tested with an additional covariate for type of school (neighborhood school vs. all others). Results of all sets of models were largely consistent in both magnitude and direction of coefficients compared to those presented above.

In addition to testing the primary models' robustness to changes in these particular model specifications, an additional set of tests was conducted to understand whether relationships were different based on the type of crime being analyzed. In particular, separate analyses were re-run using (1) only violent crimes and (2) only property crimes. Results of both of these sets of analyses were largely consistent in magnitude and direction with findings from the primary models evaluating all index crimes; however, several notable differences did emerge. First, the overall, direct relationship between neighborhood crime and achievement was only significant for violent crime predicting decreases in academic achievement, and not for property crime. Second, the indirect pathways between crime and school achievement via schools' socio-emotional learning climate were significant at $p < .05$ for both violent crime and property crime when conceptualized separately. Third, there was no evidence for any relationship between property crime and changes in schools' climate of safety and respect. There was, however, important evidence to suggest a bidirectional relationship between violent crime and school achievement via an indirect pathway through school SRC. In particular, violent crime was found to directly predict decreases in school SRC, school SRC was found to directly predict increases in school achievement, and tests of indirect effects revealed that violent crime was found to indirectly predict changes in school achievement via school SRC. In addition, the opposite pattern was found, where school achievement was found to predict increases in school SRC, school SRC was found to predict decreases in neighborhood violent crime, and school achievement was found to indirectly predict marginally ($p < .10$) significant changes in neighborhood violent crime (See Appendix for summary of direct paths between violence, SRC, and achievement; For full results of any of these robustness checks, please contact the first author.)

## Discussion

The present study explored the longitudinal, multi-directional relationships between objective reports of neighborhood crime, multiple dimensions of school climate (safety and respect, socioemotional learning, and academic rigor), and school-level academic achievement for a sample of 500 primarily low-income public elementary schools in Chicago. Exploring these setting-level processes using a cross-lagged framework allowed for a better understanding of the multi-directional relationships that occur between urban schools and the neighborhood environments in which they are embedded. From a conceptual perspective, this study contributes important evidence to the school and neighborhood process literature on the ways that structural dimensions of neighborhoods relate to schools' social norms and academic success.

Results of this study revealed that high levels of crime—and particularly violent crime—within school neighborhoods are directly predictive of decreases in school-level academic achievement across time, net of the socioeconomic conditions faced by students in the schools. This finding is

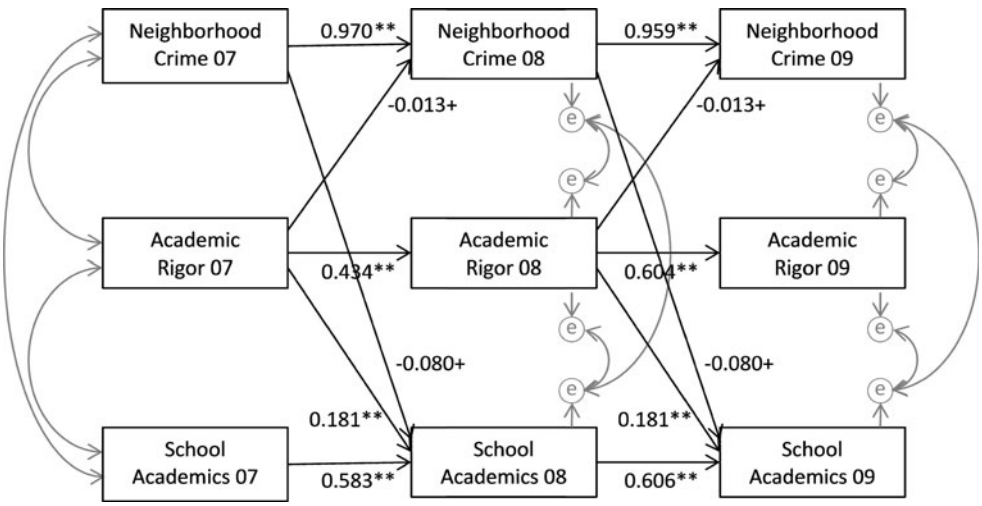


**Fig. 4** Transactional relationships between neighborhood crime, school climate of academic rigor, and school-level academic achievement across 3 years. *Notes* For ease of presentation, covariates, indirect pathways, non-significant direct pathways, and correlations between within-year variable residuals not shown. All parameters unstandardized. Neighborhood crime square root transformed. $^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$

consistent with the conceptualization of community crime as a primary exosystemic force that shapes both informal and formal institutions (like schools) within neighborhood boundaries (Bowen and Bowen 1999). Importantly, less evidence was available to support the reverse relationship, as schools' overall academic achievement was not significantly predictive of direct changes in neighborhood index crime across time. One possible explanation for this phenomenon is that given the high number of additional structural and social challenges faced by low-income, urban communities (e.g., unequal policing practices, lack of collective efficacy; Sampson et al. 1997, 2002), improvements in overall academic achievement may not be sufficient to elicit more widespread changes in surrounding neighborhood characteristics.

Alternatively, the broad measure of neighborhood index crime utilized in this study may have masked the relationship between specific types of crime and school-level achievement. For example, it may be that crimes committed by particular groups (e.g., juveniles) or specific subtypes of crimes may be more likely to be influenced by school-level achievement than overall types of crime. There is some evidence to support this theory in the robustness checks evaluating models using only violent crime, where direct and indirect pathways showed evidence for bidirectional relationships between neighborhood violent crime and school academic achievement through changes in schools' climates of safety and respect. Moreover, in this study we focus on one dimension of neighborhood climate: crime. It may be that other neighborhood dimensions such as community efficacy or support are more directly affected by shifts in school-level academic achievement than the relatively distal outcome of crime. Although these findings provide important preliminary evidence for a primarily unidirectional relationship between neighborhood crime and school achievement, additional work is needed to consider whether alternative measures of crime and neighborhood climate are influenced by shifts in school-level academic achievement.

In addition to testing the direct pathways between neighborhood crime and school academic achievement, this study also evaluated the potential role that school climate may play in contributing to both of these phenomena across time, over and above levels of poverty within the school. Results revealed that levels of index crimes in school neighborhoods are either marginally or significantly related to changes in students' perceptions of safety/respect and socioemotional learning within the school environment, where higher levels of crime are associated with decreases in these dimensions of school climate across time. Lower levels of safe and respectful climate and socioemotional learning were found to be, in turn, strongly predictive of decreases in school academic achievement. In addition to these direct relationships, the indirect pathway between neighborhood crime and school achievement via school socioemotional learning was found to be statistically significant for both violent and property crime, suggesting that socioemotional learning may partially mediate the relationships between these different types of crime and achievement. Furthermore, the direct relationships between safe and respectful school climate and school achievement appear to be bidirectional, with levels of academic achievement shown to be equally predictive of changes in perceptions of school safety/respect.

These results suggest not only that schools' levels of safety, respect, and socioemotional competence are important predictors of schools' academic growth across time, but also that these aspects of perceived safety may be directly influenced by the neighborhoods in which schools are embedded. In particular, this study found that the level of crime in the community—a potential marker of neighborhood chaos, disorganization, or lack of safety—is closely associated with how students relate to one another within the school environment, the degree to which they feel safe in their schools, and the ways that they handle conflict. Importantly, no direct relationship between neighborhood crime and school academic achievement was seen within a 1-year period when dimensions of school climate were included in the models, suggesting that the impact of neighborhood crime on school achievement may in fact be operating through changes in school climate or other higher order social processes.

When placed into the context of past research linking contextual influences and individual child functioning, these results are not surprising. Research has shown that individuals exposed to violent community contexts are at greater risk for perceiving threat in their environments, employing violence for the purposes of problem solving, and viewing aggression as an appropriate response to challenge (Coie and Dodge 1998; Guerra et al. 2003). At the school level, the psychological and behavioral reactions of individual students may coalesce to reshape school community values and social regularities around problem solving, conflict, and respect, which in turn have important implications for schools' outcomes (Bowen and Bowen 1999; Mayer and Leone, 1999). However, given inconsistent meditational evidence from tests of indirect effects of neighborhood crime on school achievement via socioemotional learning and safety/respect, additional research is needed to fully understand the multiple mechanisms and specific conceptualizations of neighborhood climate that may explain these larger community-school processes.

In addition to testing the role of social and relational aspects of school climate, this study also examined schools' climates of academic rigor as they relate to neighborhood crime and school academic achievement. As hypothesized, neighborhood crime was not directly predictive of changes in academic rigor, nor did academic

rigor mediate the relationship between crime and school achievement; however, higher levels of AR were directly and strongly predictive of increases in school-level academic achievement across time. In addition, a marginally significant pathway was seen directly between neighborhood crime and changes in academic achievement. These results, particularly when viewed in comparison to models examining social aspects of school climate, are not especially surprising. Although theories of social disorganization and social information processing would suggest direct relationships between crime and the norms within schools around conflict and relationships more generally, there is comparatively little empirical or theoretical evidence to suggest that crime might directly impact the academic standards to which students are held.

Interestingly, in addition to the observed relationship between school-level academic rigor and academic outcomes, a trend-level pathway was also seen between levels of academic rigor and later changes in neighborhood index crime. In particular, communities containing schools with high levels of academic rigor saw marginally fewer reports of crime across time. Furthermore, results of robustness checks indicated evidence to suggest that higher levels of safety and respect in schools also predict reductions in violent crime over time. Despite their preliminary nature (and, in the case of academic rigor and index crime, statistical weakness), these findings represents an especially important area for future research, particularly given recent attention placed on a culture of academic rigor, accountability, and respect in urban charter schools (e.g., KIPP), which tend to be disproportionately located within disadvantaged neighborhoods (Angrist et al. 2010; Hoxby et al. 2009). Understanding whether these schools may impact their surrounding environments in addition to their individual students—or, alternatively, whether perceived school climate is driving changes in the demographic composition of surrounding neighborhoods—is a critical area of needed research.

## Limitations and Future Directions

Although this study has numerous strengths—including its use of multiple time points, exploration of transactional processes, and inclusion of both objective reports and perceptions of setting-level phenomena—there are several limitations that constrain the inferences that can be drawn from these findings. First, this study makes use of data reported by middle-school aged students to represent the overall climate of the entire school. Although it is likely that older students' perceptions of their school environments correspond directly with the experiences of younger students within the same school buildings, it is possible that this is not true for all environments and that some error may be included in the measures of school climate. Additionally, although helpful in understanding the climate of the school itself, these measures are unable to appropriately capture the breakdown of social ties of the neighborhood itself, which is a key component of social disorganization theory.

Second, the outcome of school academic achievement was operationalized using a measure of the percentage of students who met or exceeded the state standard on Illinois' standardized achievement test. Although this measure is relevant for policy decisions and provides sufficient variability for analyses, it could also be considered a more course estimation of school academic achievement than actual mean test scores, for example. Unfortunately, due to limitations of data availability, we were unable to replicate results across various conceptualizations of school-level academic achievement, which is an area of needed research.

Third, it is likely that unobserved characteristics of either the school or community may account for some of the observed relationships between neighborhood crime and school-level functioning. These concerns are somewhat mitigated by the inclusion of the percentage of students at each school who received free or reduced price lunch (a proxy for school-level poverty), as well as the use of a residualized change model (which reduces some bias in the outcome associated with time-invariant characteristics). However, small observed differences in the magnitude of coefficients across the full sample of schools versus the sample of schools with complete data suggest that unobserved characteristics related to missing data may be driving some of the relationships. Future research should explore the degree to which selection bias might be a problem in order to improve the confidence of causal claims.

Fourth, although prior work has demonstrated that classroom-level influences (e.g., teacher characteristics, classroom quality) are important predictors of our outcomes of interest (Koth et al. 2008; Wayne and Young 2003), these classroom characteristics were not included in our study. As such, it is impossible to disentangle the individual influences of classrooms, or to adjust for nesting of students in classrooms within the present study. Future work should consider reciprocal relationships between neighborhood and classroom characteristics in addition to exploring relationships with school-level outcomes. Finally, these results must also be replicated in other regions to better understand generalizability beyond this urban, predominantly low-income setting.

## Appendix

See Fig. 5.

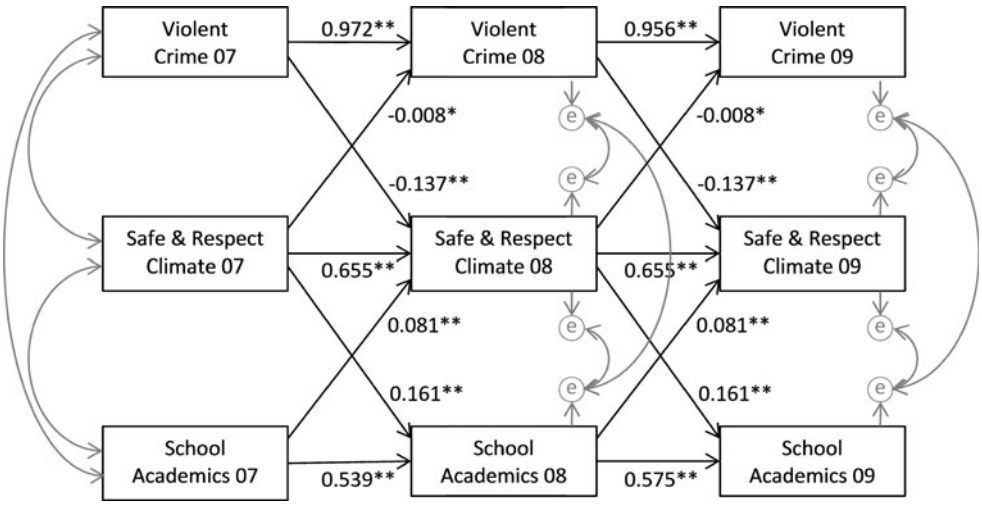


**Fig. 5** Transactional relationships between neighborhood violent crime, school climate of safety and respect, and school-level academic achievement across 3 years. *Notes* For ease of presentation, covariates, indirect pathways, non-significant direct pathways, and correlations between within-year variable residuals not shown. All parameters unstandardized. Neighborhood violent crime square root transformed. $^{+}p < .10$, $*p < .05$, $**p < .01$

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