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## Examining How Neighborhood Disadvantage Influences Trajectories of Adolescent Violence: A Look at Social Bonding and Psychological Distress

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### Abstract

**Background**—To understand how neighborhoods influence the development of youth violence, we investigated intrapersonal mediators of the relationship between neighborhood disadvantage and youth violence trajectories between ages 11 and 18. The hypothesized mediators included indicators of social bonding (belief in conventional values, involvement in school activities, religious engagement, and commitment to traditional goals) and psychological distress.

**Methods**—The sample (N=5,118) was 50% female and 52% Caucasian. Data from a 5-wave panel study spanning ages 11 to 18 were analyzed using sex-stratified multilevel growth curves.

**Results**—Neighborhood disadvantage was associated with higher levels of violence perpetrated by girls, lower belief in conventional values for both girls and boys, less commitment to traditional goals by girls, and higher levels of psychological distress reported by girls. Sobel tests identified three significant mediators of the effects of neighborhood disadvantage on girls' violence trajectories: belief in conventional values, commitment to traditional goals and psychological distress. The only significant mediator of the relationship between neighborhood disadvantage and boys' violence trajectories was belief in conventional values. The effects of neighborhood disadvantage on violence trajectories were not fully mediated; in fact, results suggested suppression effects, or inconsistent mediation, may exist.

**Conclusions**—The results emphasize the importance of both contextual and intrapersonal attributes in understanding the development of violence among school-age youth. Early school-based and community-level prevention initiatives that promote social bonding and address mental health needs may help reduce the impact of youth violence, particularly for girls.

## Keywords

violence; community health; child & adolescent health

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## INTRODUCTION

Neighborhoods affect many health-risk behaviors during adolescence, including violence,<sup>1-2</sup> substance use<sup>3</sup> and school dropout.<sup>4</sup> Many studies of neighborhood effects on school-age youth focus on neighborhood socioeconomic disadvantage, which is a construct central to theories of relative deprivation and social exclusion.<sup>5-6</sup> These theories posit that some negative effects of disadvantage may appear due to weakened social bonds and active disengagement of young residents. In disadvantaged neighborhoods, social norms contrasting with more conventional aspects of society may promote deviant behavior as a means of attaining goals impeded by the lack of socioeconomic resources.<sup>5-7</sup> Alternatively, other effects of disadvantage may result from negative psychological consequences of exposure to chronic stress and strain,<sup>8</sup> which may represent a somewhat hidden mechanism of neighborhood influence. Few studies have examined intrapersonal processes by which neighborhoods influence development, especially for youth living in rural areas. Using data collected in three predominantly rural counties in the southeastern United States (U.S.), we examined the intrapersonal factors of bonding to conventional aspects of society and psychological distress to determine whether they mediated associations between neighborhood disadvantage and violence trajectories during adolescence. Understanding how neighborhood disadvantage influences violence can help school personnel and community practitioners develop preventive interventions for at-risk youth.

The degree to which an individual bonds to conventional aspects of society has been associated with pathological patterns of adolescent development, such as engagement in violence and delinquency.<sup>6,9</sup> Hirschi's control theory<sup>10</sup> specifies that delinquency is less likely among those who are attached to non-deviant others, believe in the basic rules governing society, are involved in traditional activities such as school and religion, and are committed to attaining goals through conventional means. Exposure to neighborhood socioeconomic disadvantage may weaken adolescents' commitment to traditional activities and goals and lessen their belief in conventional values and rules that govern behavior as they see less benefit resulting from such social bonds.<sup>6</sup>

Several empirical studies suggest indirect neighborhood effects on youth violence functioning through adolescents' bonds to conventional aspects of society. A national study found that the relationship between neighborhood disadvantage and delinquency was partially mediated by commitment to school.<sup>11</sup> A Seattle study suggested the effect of neighborhood disorder on youth violence was mediated by lower belief in conventional rules of society.<sup>12</sup> Studies also have shown that neighborhoods are related to adolescents' engagement in conventional activities<sup>13</sup> and that involvement in conventional activities is negatively associated with delinquency for both girls and boys.<sup>9,14</sup> No published study using longitudinal data from both girls and boys has formally tested the mediating role of multiple aspects of social bonding to link neighborhood socioeconomic disadvantage with violence trajectories, as done in the current study.

Another pathway by which neighborhoods may influence youth is through negative psychological consequences of chronic exposure to stress and strain associated with living in a disadvantaged neighborhood. The psychosocial resources model suggests that chronic stressors, such as neighborhood socioeconomic disadvantage, adversely impact health by depleting coping resources.<sup>8</sup> Increasing levels of neighborhood disadvantage are associated

with childhood<sup>15</sup> and adolescent<sup>16–18</sup> depression, as well as with youth violence.<sup>17, 19–20</sup> An innovation of the current study is formal testing of psychological distress as a potential mediator through which neighborhood disadvantage may influence trajectories of youth violence.

As shown in Figure 1, we hypothesized neighborhood disadvantage would be negatively associated with trajectories of social bonding (including belief in conventional values, involvement in school activities, religious engagement, and commitment to traditional goals), which in turn would be negatively associated with trajectories of violence perpetration. In contrast, we expected neighborhood disadvantage to be positively associated with trajectories of psychological distress, which in turn would be positively associated with trajectories of violence perpetration. We used multilevel growth curve models to test our hypotheses. Due to gender differences in violence perpetration during adolescence,<sup>21–22</sup> and because some studies suggest that risk factors for violence differ by sex,<sup>2, 23</sup> we examined mediation effects separately for girls and boys.

## METHODS

Data were from the Context of Adolescent Substance Use Study<sup>24</sup> and included youth-report data on violence from in-school surveys conducted in three predominantly rural counties in the southeastern U.S. linked with U.S. Census data on socioeconomic disadvantage. Adolescents completed five waves of questionnaires in schools every 6 months between spring 2002 and spring 2004, beginning when students were in 6<sup>th</sup>–8<sup>th</sup> grade and ending when they were in 8<sup>th</sup>–10<sup>th</sup> grade. At each wave, all adolescents in public schools were eligible for participation, except those who could not complete the questionnaire in English or who were in special education programs. Response rates ranged from 88.4% for Wave 1 to 76.0% for Wave 5 (average was 81.1%). We defined neighborhoods using U.S. Census block group boundaries linked with students' geocoded addresses. The geocoding process has been described elsewhere.<sup>20</sup>

### Subjects

The analysis sample (N=5,118) includes adolescents who were between ages 11 and 16 at Wave 1 and who lived in a neighborhood containing at least two survey respondents (j=128). The age restriction was imposed to limit the number of students who were out of the typical age range for their grade (less than 1% of sample), and we limited analyses to neighborhoods containing more than one student (almost 99% of sample) to increase stability of estimates. Follow-up rates ranged from 86.6% at Wave 2 to 79.5% at Wave 5; 56.0% of students participated in the study at all five waves, 15.6% participated in only four waves, 15.1% in only three waves, 5.3% in only two waves and 8.0% only at Wave 1.

Most students (95.6%) were between ages 11 and 14 (mean=13.1 years) at Wave 1. Half (50.1%) were girls, 52.0% were White, 38.3% were Black or African-American and 3.8% were Hispanic/Latino. Most (80.0%) indicated that they lived with two parents, and 73.0% had at least one parent with post-high school education. Almost all (88.9%) of the students lived in the same neighborhood at all five waves.

The three study counties had greater proportions of African-Americans (average of 27.8%) than the general United States population (12.2%). The median household income (\$36,600 on average) and median housing value (\$89,400 on average) were lower than the national medians (\$42,000 and \$111,800, respectively<sup>25</sup>).

## Instruments

The violence scale assessed how many times in the past three months the respondent had hit or slapped another kid, been in a fight in which someone was hit, threatened a teacher, and threatened someone with a weapon.<sup>26</sup> Responses ranged from *none* (0) to *10 or more times* (4) and were summed and log-transformed. Cronbach's alpha ranged from .68 at Wave 1 (scale mean=1.27, *SD*=2.03) to .86 at Wave 5 (scale mean=1.36, *SD*=2.94). At Wave 1, 45.6% of girls and 51.8% of boys had perpetrated violence in the past 3 months.

Neighborhood socioeconomic disadvantage was calculated using U.S. Census data<sup>25</sup> on education (percentage of people aged 25 and older with less than a high school education), employment (percentage of people aged 16 or older in labor force who were unemployed and percentage of people aged 16 or older who held working-class or blue-collar jobs) and economic resources (percentage of people living below federally-defined poverty threshold, percentage of households without access to a car, and percentage of renter-occupied housing units). An average composite score was calculated for each neighborhood at Wave 1 (Cronbach's alpha=.88, mean=25.34, *SD*=8.52), with higher scores indicating higher levels of neighborhood disadvantage. Each student was assigned their neighborhood average, which was grand-mean centered.<sup>27</sup> Because we used sex-stratified data, grand means were calculated separately for girls and boys.

Social bonding was conceptualized as a time-varying predictor, so scores were calculated for each wave. Belief in conventional values included: "it is good to be honest;" "people should not cheat on tests;" and "in general, police deserve respect." Responses ranged from 0 (*strongly disagree*) to 4 (*strongly agree*). Items were averaged (Cronbach's alpha=.71, mean=3.40, *SD*=0.84 at Wave 1; alpha=.74, mean=3.10, *SD*=0.95 at Wave 5). Students indicated whether or not they had participated in (or planned to participate in) traditional school activities during the current school year, including sports, service or interest clubs, performance groups, school newspaper or yearbook, honor societies, or anti-drug groups. A total count indicated degree of involvement in traditional school activities (observed range=0–2; mean=0.76, *SD*=0.66 at Wave 1; mean=0.58, *SD*=0.59 at Wave 5). Two questions assessed religious engagement: how important religion is to them (responses ranging from 0=*not at all important* to 3=*very important*) and how much their religious beliefs influence what they do (responses ranging from 0=*not at all* to 3=*very much*). Items were averaged ( $r=.73$ , mean=2.21, *SD*=0.78 at Wave 1;  $r=.80$ , mean=2.15, *SD*=0.86 at Wave 5). Four items assessed importance of traditional goals: finishing high school, going to college, having a happy family life, and having a close group of friends. Responses ranged from 0 (*not at all important*) to 3 (*very important*). Items were averaged (alpha=.68, mean=2.84, *SD*=0.34 at Wave 1; alpha=.82, mean=2.74, *SD*=0.52 at Wave 5).

Psychological distress included three items from the Short Mood and Feelings Questionnaire<sup>28</sup> and seven items from the Revised Children's Manifest Anxiety Scale.<sup>29</sup> Responses on all items ranged from 0 (*strongly disagree*) to 4 (*strongly agree*). A factor analysis suggested that a single-factor structure was appropriate in this sample, so items were averaged, with high scores indicating greater distress (alpha=.88, mean=1.43, *SD*=1.00 at Wave 1; alpha=.93, mean=1.59, *SD*=1.14 at Wave 5).

Control variables were based on all available data. Race/ethnicity was represented by three variables (Black/African-American, Hispanic/Latino, other race/ethnicity) with White as reference. Parent education was measured by the highest level of education attained by either parent (0, *less than a high school education*; 5, *graduate or professional school after college*). Family structure indicated a single-parent household at any time during the study. Two geocoding control variables adjusted for type of address and degree of precision of

geocode. Analyses also controlled for the number of times the student moved to a different neighborhood.

## Data Analysis

We used multilevel growth curves to model violence trajectories as a function of chronological age, centered at age 11. We verified there was no interaction of age with cohort (data not shown) to justify combining data from the three cohorts to take advantage of the accelerated longitudinal design<sup>30</sup> to model trajectories between ages 11 and 18 using the five survey waves. Thus, data from the 6<sup>th</sup> grade cohort primarily represented ages 12–14, data from the 7<sup>th</sup> grade cohort primarily represented ages 13–15, and data from the 8<sup>th</sup> grade cohort primarily represented ages 14–16. Younger or older ages were represented by the fewest number of individual cases.

Missing values were replaced using multiple imputation,<sup>31</sup> with a missingness equation including the dependent variables at all five waves, variables highly correlated with the outcomes from all five waves (including the independent variables), variables containing special information about the sample and other variables thought to be associated with missingness.<sup>32–33</sup> Most students (86%) had data from three or more waves that were used for the imputation. All analyses were conducted using PROC MIXED in SAS version 9.1<sup>34</sup> using restricted maximum likelihoods and the Kenward-Roger adjustment and data stratified by sex. All models had relative efficiencies greater than .95, which suggests that ten imputations were sufficient.<sup>33</sup>

The mediators were hypothesized to act as intervening variables between neighborhood disadvantage and violence trajectories. We calculated bivariate correlation coefficients between time-varying values of violence, time-varying values of the proposed mediators and the neighborhood variables at Wave 1 (see Table 1). We used the formulas provided by Rubin and Schafer<sup>35</sup> to combine the correlation coefficients across the ten imputed datasets. Then, we used a series of regression equations to generate coefficients required for testing significance of mediated effects in a multilevel context.<sup>36–37</sup> The first step was to regress violence on neighborhood disadvantage. We specified a multilevel, random intercept model to include a quadratic function for age based on studies indicating that youth violence follows a curvilinear trajectory.<sup>38–39</sup> The effect of neighborhood disadvantage was fixed, and based on preliminary analyses assessing the significance of random neighborhood intercepts and slopes (not shown), we included a random neighborhood intercept for girls, but not for boys. Prior analyses<sup>20</sup> indicated that neighborhood disadvantage was associated with the intercepts, not the slopes, of the violence trajectories; thus, our models did not include any interactions of disadvantage with age or age-squared. This indicates that any effects of disadvantage on initial levels of violence (centered at age 11) are consistent at all ages in the trajectory. We calculated unadjusted multilevel growth curve models to assess bivariate relationships between disadvantage and violence and multivariate models to adjust for relevant control variables.

Next, we regressed each proposed time-varying mediator on neighborhood disadvantage using multilevel models specified as a quadratic function of age. We included the quadratic term to allow the mediator trajectories to take the same form as the violence trajectories; most models were simplified by removal of non-significant age-squared terms. Based on preliminary analyses (not shown), we included a random neighborhood intercept for both girls and boys in models for involvement in school activities and religious engagement. As with the violence models, neighborhood disadvantage was specified as a predictor of the intercepts in the mediator trajectory models. This indicates that any effects of disadvantage on initial levels of social bonding and distress are consistent at all ages in the trajectory.

The third step was to regress violence on neighborhood disadvantage and time-varying values of the proposed mediators to generate mediated parameter estimates for disadvantage. These multilevel random intercept models included a quadratic function of age, and they also provided the regression parameter estimates for each mediator's relationship with the violence trajectories. Because neighborhood disadvantage affected initial levels of violence, we specified the mediators as predictors of the intercepts as well. As in the other models, any effects of disadvantage or the mediators on initial levels of violence were consistent at all ages in the trajectory. Finally, given our guiding theoretical framework, we tested all mediators simultaneously to account for the possibility that effects of the mediators were inter-related.

In the final step, we determined whether mediated effects were statistically significant using the product of coefficients approach,<sup>37</sup> which tests the joint significance of the two effects constituting the mediated effect: (1) the effect of the predictor on the mediator and (2) the effect of the mediator on the outcome.<sup>40</sup> This approach is particularly powerful for detecting small mediated effects,<sup>36</sup> and it is recommended in the multilevel context. In a multiple-mediator context, the product of coefficients analysis assesses the influence of one mediator above and beyond the effects of all other mediators in the model.<sup>36</sup> For those proposed mediators that had been significantly predicted by neighborhood disadvantage, we calculated Sobel tests using the Aroian formula for the standard error of the mediation effects.<sup>40–41</sup> These calculations result in a *z*-statistic that can be compared to the standard normal distribution.<sup>40</sup>

## RESULTS

As indicated by the significant positive coefficients for age and negative coefficients for age-squared presented in Table 2, violence followed a curvilinear trajectory for both boys and girls. In the adjusted models, neighborhood disadvantage was a significant predictor of initial levels of violence perpetrated by girls in both uncontrolled models and in models that included the demographic control variables (see Table 2). As levels of disadvantage increased, the amount of violence perpetrated at age 11 also increased; this increased level of violence in disadvantaged neighborhoods was consistently maintained at all ages in the girls' trajectory. In the most disadvantaged neighborhoods, the peak of the girls' trajectories reached a level of violence comparable to that of the boys' highest violence levels (that is, one to two acts of violence committed in the prior 3 months). Neighborhood disadvantage was associated with boys' violence trajectories in uncontrolled models, but that association decreased to marginal significance when controlling for individual-level demographic variables (see Table 2).

As shown in Table 3, for both girls and boys, belief in conventional values followed a negative curvilinear trajectory over time, with decreasing endorsement of conventional beliefs from age 11 that slowed around age 15. Involvement in school activities and religious engagement each followed negative linear trajectories for both girls and boys, with school and religious activities each decreasing over time. Commitment to traditional goals followed a flat trajectory for girls (very little change over time) and a negative linear trajectory for boys. Psychological distress followed a positive linear trajectory for girls (increasing over time) and a flat trajectory for boys.

Neighborhood disadvantage was a significant predictor of many of the proposed mediator trajectories (Table 3). In the multivariate models, neighborhood disadvantage was negatively associated with belief in conventional values at age 11, with girls and boys both reporting lower belief in conventional values as disadvantage increased. In contrast, neighborhood disadvantage was not associated with girls' or boys' involvement in school activities or



religious engagement in the multivariate models. Neighborhood disadvantage was negatively associated with girls' commitment to traditional goals at age 11, with girls reporting lower commitment to traditional goals as disadvantage increased, but there was no relationship between disadvantage and boys' trajectories of commitment to traditional goals in the multivariate models. Finally, neighborhood disadvantage was positively associated with girls' reports of psychological distress at age 11, but there was no relationship between disadvantage and boys' trajectories of psychological distress in the multivariate models.

Table 4 provides information about two components of the hypothesized mediated effects: the relationship between the proposed mediators and violence trajectories, and the relationship between neighborhood disadvantage and violence trajectories after accounting for effects of the mediators. As hypothesized, belief in conventional values and commitment to traditional goals were negatively associated with girls' and boys' violence trajectories, with lower belief in conventional values and lower commitment to traditional goals associated with higher levels of violence. Religious engagement also was negatively associated with girls' violence trajectories, but it was not significantly related to boys' violence trajectories. Counter to our expectations, involvement in school activities was positively associated with the violence trajectories. As hypothesized, psychological distress also was positively associated with violence trajectories for both girls and boys. This pattern of results was replicated in single-mediator models (see below), although the coefficients for each mediator generally were larger when the other mediators were not included.

The Sobel tests identified three significant mediators of neighborhood disadvantage for girls: belief in conventional values ( $z=2.52, p < .01$ ), commitment to traditional goals ( $z=2.44, p < .01$ ) and psychological distress ( $z=3.06, p < .01$ ). The only significant mediator of the relationship between neighborhood disadvantage and the violence trajectories for boys was belief in conventional values ( $z=1.94, p < .05$ ). Mediation effects of involvement in school activities and religious engagement were not tested, since these trajectories were not significantly predicted by neighborhood disadvantage.

Multivariate models also showed that relationships between disadvantage and the violence trajectories were not fully mediated by the social bonding and psychological health variables, because neighborhood disadvantage remained a significant predictor of violence trajectories for both girls and boys when the mediators were included in the model. In fact, rather than diminishing the relationship between neighborhood disadvantage and the violence trajectories—as would be expected in the case of full mediation—inclusion of the mediators to the multivariate model slightly strengthened the relationship between disadvantage and violence (coefficients increased by 0.001 for both girls and boys), which could indicate a case of suppression, or inconsistent mediation.<sup>42</sup> A series of post-hoc analyses included single-mediator models to examine the coefficients for neighborhood disadvantage in the presence of only one mediator at a time. These models revealed the small suppression effect in the presence of either conventional values or traditional goals for both boys and girls (results available upon request).

## DISCUSSION

Effects of neighborhood socioeconomic disadvantage on trajectories of youth violence were partially mediated. For girls, neighborhood disadvantage operated through belief in conventional values, commitment to traditional goals and psychological distress. For boys, neighborhood disadvantage worked primarily through belief in conventional values. Thus, elements of the social bonding hypothesis were supported for the girls and boys in our sample, and the stress hypothesis only was supported for girls. The mediated effect was small but significant, and suggested possible inconsistent mediation effects as the

relationship between neighborhood disadvantage and the violence trajectories appeared to be slightly strengthened upon addition of the mediators to the model. Our post-hoc analyses suggested that this effect was maintained in simplified mediation models containing only conventional values or traditional goals.

The strengthening of effects of neighborhood disadvantage in the presence of the hypothesized mediators was unlikely to be because social bonding and psychological distress confounded the relationship of neighborhood disadvantage with the violence trajectories.<sup>42</sup> The Sobel tests and models presented in Tables 3 and 4 support the contention that belief in conventional values, commitment to traditional goals and psychological distress are indeed mediators: Neighborhood disadvantage was significantly associated with the mediator trajectories, and there were significant relationships between these mediators and the violence trajectories. Thus, the relationships are consistent with elements of social bonding and psychological distress being on the causal pathway(s) between neighborhood disadvantage and violence perpetration in this sample of adolescents, although effects varied by gender. This conceptualization distinguishes these mediators from other confounders of neighborhood effects on youth.<sup>42</sup> That the effects of neighborhood disadvantage remained significant in the multiple mediation models suggests that the theoretical framework was incomplete, however, and that there are other mediating variables that should be considered in future studies.<sup>43</sup>

Although no studies have examined the exact mediation mechanisms that were the focus of our study, the results from our rural sample are similar to those from more urban and suburban samples. As seen in other studies,<sup>12</sup> we found that affirmation of both conventional values and traditional goals were important deterrents to violence, and that they each were negatively associated with neighborhood disadvantage. As in our results, other studies show that neighborhood disadvantaged predicts girls' psychological distress over time.<sup>15–18</sup> Our study extends findings from prior work by putting the pieces together to examine how social bonding and psychological distress may differentially mediate the effects of neighborhood disadvantage on school-aged girls' and boys' violence trajectories.

Examination of parameter estimates from the mediation model provides important information about where expected causal relationships were not upheld.<sup>37</sup> Some constructs did not qualify as mediators because there was not a significant association between neighborhood socioeconomic disadvantage and trajectories of the hypothesized mediator over time. For example, neighborhood disadvantage was not a significant predictor of trajectories of commitment to traditional goals or psychological distress for the boys in our sample, which is counter to some prior studies.<sup>19</sup> There was an impact of each of these variables on the boys' violence trajectories, however, and commitment to traditional goals and psychological distress each were significant mediators for girls. Furthermore, neighborhood disadvantage was not a significant predictor of involvement in school activities or religious engagement for either girls or boys in our sample. In contrast, Cook et al.<sup>13</sup> found that neighborhood disadvantage is negatively related to adolescents' engagement in conventional activities and others have found that such engagement is, in turn, negatively associated with violence and delinquency.<sup>9, 14</sup> We observed that trajectories of religious engagement were negatively related to the violence trajectories for girls, but not for boys. Johnson and colleagues<sup>9</sup> found that religious engagement predicted less involvement in delinquent behavior over time, but gender differences in this relationship were not examined.

We also noted that trajectories of involvement in school activities were positively associated with the violence trajectories for both girls and boys in our sample. This is opposite the direction of the associations we hypothesized, and it is counter the protective effect of



involvement in school extracurricular activities on more serious acts of delinquency documented for girls and boys in a predominantly rural mining community in the southwestern U.S.<sup>14</sup> The positive relationship between school activities and violence noted in our sample may have resulted from a high involvement in school sports or clubs that provide opportunities to interact with peers in a competitive context, which may foster violent interaction in some cases. The finding also could be due to the measure of involvement in traditional activities that was available for this secondary data analysis. If this finding is replicated in other datasets with more comprehensive indicators of students' activities (such as measures of the frequency and extent of involvement in different activities), violence prevention interventions targeting competitive teams may be helpful for reducing adolescent violence inside and outside of the school context.

## Limitations

This study has several strengths, as well as some limitations that deserve mention. Strengths include the large sample from a census of adolescents from three counties who completed five waves of questionnaires, which allowed us to model violence trajectories over time. The response rates for the in-school surveys were high, and the adolescent sample was demographically diverse. There also were a wide variety of neighborhoods represented that varied by income and racial characteristics. The reliability of the neighborhood measure was very high, using U.S. Census data to describe the neighborhood context avoids same-source bias,<sup>2, 44</sup> and there were enough respondents in each neighborhood to enable us to use multilevel analysis techniques to estimate the neighborhood effects. We also used multiple imputation procedures that used many established predictors of youth violence to replace missing values, which minimizes the effect of attrition in this longitudinal study.

Limitations include the generalizability of these results, which may be limited to similar rural contexts, particularly those with large populations of African-Americans or with lower median incomes than the national levels. Because we used trajectories of social bonding and psychological distress modeled using time-varying values, the mediators and the outcomes were assessed contemporaneously. It is possible that perpetration of violence prompts some youth to disengage from conventional society or to become depressed or anxious, but this was not assessed in our analyses. There also may be relationships between psychological distress and social bonding that are not accounted for in our model. A further consideration is that our models did not account for violence victimization, which is likely to be associated with neighborhood disadvantage, social bonding and psychological health. Finally, as noted above, the measurement of some constructs was limited by the items available in the existing dataset to assess each of the variables in our conceptual model.

## Conclusions

The results from our analysis emphasize both contextual and intrapersonal attributes in predicting youth violence, but effects of neighborhood disadvantage were not fully explained by the social bonding and psychological health mediators. There may be other important individual-level characteristics, such as attitudes about the social acceptability of violence among peers in the neighborhood,<sup>45</sup> that would further explain the processes by which neighborhood disadvantage impacts youth violence. In addition, family characteristics such as the presence of family conflict and violence<sup>21</sup> also may be important mediators. We did note evidence suggestive of a suppression effect, or inconsistent mediation,<sup>42</sup> as the relationship between neighborhood disadvantage and the violence trajectories was slightly strengthened upon addition of the social bonding and psychological health variables to the models. These inconsistent mediation effects imply that effects of neighborhood disadvantage on youth violence potentially could be underestimated in models that do not account for variables such as social bonding and psychological distress.

## IMPLICATIONS FOR SCHOOL HEALTH

This study has important implications for school personnel and community public health practitioners. In accordance with socioecological models,<sup>46</sup> neighborhood or community-based interventions to reduce disadvantage may help prevent violence. In addition, by providing services to support youth in at-risk neighborhoods, such as school-based mental health services or career and educational counseling, we may be able to decrease psychological distress and increase bonding to conventional aspects of society and thereby reduce youth violence. These interventions may be particularly important for rural girls living in disadvantaged neighborhoods. The early effects (as evidenced by associations of neighborhood disadvantage with initial levels of violence, social bonding and distress) also suggest that intervention with elementary school students may be warranted.

### Human Subjects Approval Statement

The Public Health Institutional Review Board at The University of North Carolina at Chapel Hill approved all study protocols.

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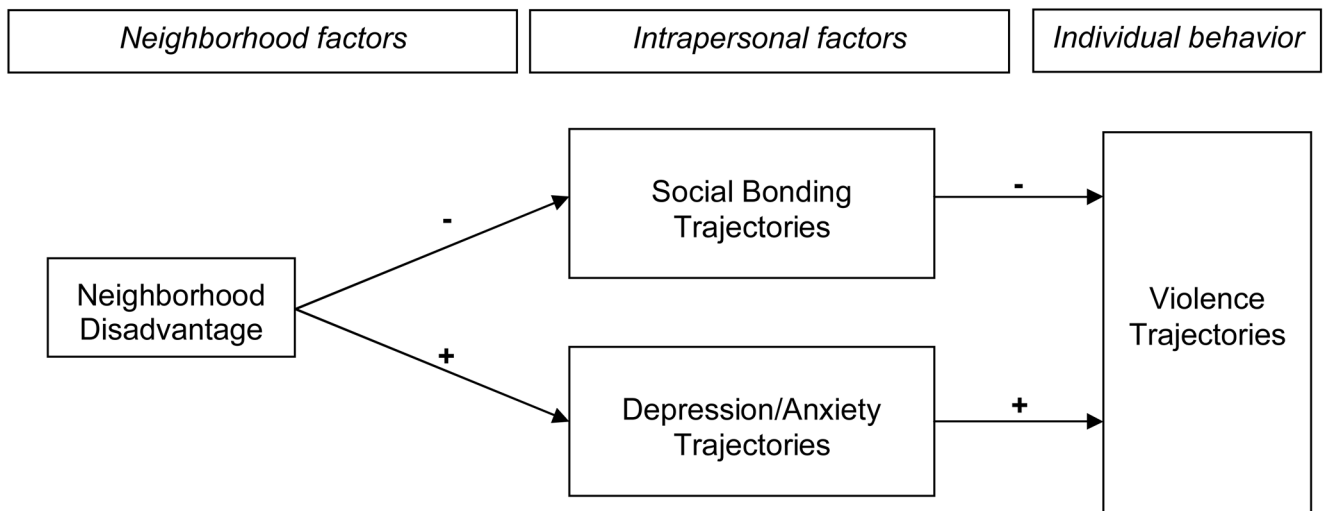
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**Figure 1.**  
Conceptual model.

**Table 1**  
 Bivariate correlations between neighborhood disadvantage, proposed mediators and violence.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Violence	---	.05**	-.38**	.04**	-.13**	-.33**	.24**
(2) Neighborhood disadvantage	.12**	---	-.07**	.00	.00	-.04**	.04**
(3) Conventional values	-.32**	-.10**	---	.14**	.28**	.34**	-.16**
(4) School activities	-.03**	-.06**	.09**	---	.13**	.12**	.01
(5) Religious engagement	-.14**	-.01	.27**	.15**	---	.23**	-.12**
(6) Traditional goals	-.26**	-.11**	.29**	.14**	.23**	---	-.14**
(7) Depression/anxiety	.23**	.07**	-.17**	-.06**	-.14**	-.14**	---

Note. Boys above diagonal (N=2,553); girls below (N=2,565).

\*  $p < .05$ .

\*\*  $p < .01$ .



**Table 2**

Neighborhood disadvantage predicting trajectories of violence between ages 11 and 18.

Unadjusted Models				
Predictor	Girls		Boys	
	B	95% CI	B	95% CI
Intercept	0.305**	(0.233, 0.378)	0.449**	(0.367, 0.532)
Age	0.150**	(0.105, 0.195)	0.135**	(0.080, 0.190)
Age-squared	-0.021**	(-0.028, -0.014)	-0.016**	(-0.025, -0.007)
Neighborhood disadvantage	0.012**	(0.009, 0.015)	0.006**	(0.004, 0.009)
Adjusted Models <sup>a</sup>				
Predictor	Girls		Boys	
	B	95% CI	B	95% CI
Intercept	0.301**	(0.131, 0.471)	0.330**	(0.145, 0.516)
Age	0.138**	(0.088, 0.189)	0.103**	(0.032, 0.174)
Age-squared	-0.021**	(-0.027, -0.014)	-0.017**	(-0.026, -0.008)
Neighborhood disadvantage	0.005**	(0.003, 0.008)	0.003 <sup>†</sup>	(0.000, 0.006)

Note. CI=confidence interval.

<sup>a</sup>Adjusted models controlled for race/ethnicity, parent education, family structure, the number of times the student moved during the five waves of data collection, the type of address geocoded and the precision of the geocode.

\*  $p < .05$ .

\*\*  $p < .01$ .

<sup>†</sup>  $p < .10$ .

**Table 3**

Neighborhood disadvantage predicting trajectories of the proposed mediators.

Belief in Conventional Values				
	Girls		Boys	
Predictor	B	95% CI	B	95% CI
Intercept	4.105**	(3.888, 4.322)	3.982**	(3.723, 4.241)
Age	-0.349**	(-0.424, -0.274)	-0.367**	(-0.443, -0.29)
Age-squared	0.032**	(0.021, 0.042)	0.036**	(0.026, 0.045)
Neighborhood disadvantage	-0.004*	(-0.007, -0.001)	-0.004*	(-0.008, 0.000)
Involvement in School Activities				
	Girls		Boys	
Predictor	B	95% CI	B	95% CI
Intercept	0.743**	(0.591, 0.895)	0.835**	(0.667, 1.003)
Age	-0.114**	(-0.144, -0.085)	-0.106**	(-0.138, -0.074)
Neighborhood disadvantage	0.000	(-0.003, 0.003)	-0.001	(-0.004, 0.002)
Religious Engagement				
	Girls		Boys	
Predictor	B	95% CI	B	95% CI
Intercept	2.271**	(2.061, 2.480)	1.933**	(1.697, 2.169)
Age	-0.072*	(-0.109, -0.035)	-0.079**	(-0.124, -0.033)
Neighborhood disadvantage	-0.001	(-0.005, 0.003)	-0.002	(-0.006, 0.003)
Commitment to Traditional Goals				
	Girls		Boys	
Predictor	B	95% CI	B	95% CI
Intercept	2.930**	(2.845, 3.014)	2.842**	(2.728, 2.956)
Age	-0.050**	(-0.071, -0.028)	-0.054**	(-0.075, -0.032)
Neighborhood disadvantage	-0.002**	(-0.003, 0.000)	-0.001	(-0.003, 0.002)
Psychological Distress				
	Girls		Boys	
Predictor	B	95% CI	B	95% CI
Intercept	1.366**	(1.096, 1.636)	1.268**	(1.013, 1.523)
Age	0.156**	(0.097, 0.215)	0.050*	(0.079, 0.380)
Neighborhood disadvantage	0.007**	(0.003, 0.012)	0.003	(-0.002, 0.008)

*Note.* CI=confidence interval. Analyses controlled for race/ethnicity, parent education, family structure, the number of times the student moved during the five waves of data collection, the type of address geocoded and the precision of the geocode.

\*  
 $p < .05.$

\*\*  
 $p < .01.$

†  
 $p < .10.$

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**Table 4**

Neighborhood disadvantage and multiple mediators predicting trajectories of violence.

Predictor	Girls		Boys	
	B	95% CI	B	95% CI
Intercept	0.381**	(0.224, 0.539)	0.405**	(0.238, 0.573)
Age	0.101**	(0.054, 0.149)	0.060 <sup>†</sup>	(-0.009, 0.128)
Age-squared	-0.017**	(-0.024, -0.011)	-0.011*	(-0.02, -0.002)
<b>Conventional values<sup>a,b</sup></b>	<b>-0.142**</b>	<b>(-0.159, -0.125)</b>	<b>-0.176**</b>	<b>(-0.193, -0.158)</b>
School activities	0.033**	(0.014, 0.052)	0.064**	(0.037, 0.091)
Religious engagement	-0.040**	(-0.057, -0.023)	-0.015	(-0.034, 0.004)
<b>Traditional goals<sup>a</sup></b>	<b>-0.192**</b>	<b>(-0.228, -0.157)</b>	<b>-0.248**</b>	<b>(-0.282, -0.214)</b>
<b>Psychological distress<sup>a</sup></b>	<b>0.099**</b>	<b>(0.086, 0.111)</b>	<b>0.109**</b>	<b>(0.095, 0.122)</b>
Neighborhood disadvantage	0.006**	(0.004, 0.009)	0.004**	(0.002, 0.007)

Note. CI=confidence interval. Analyses controlled for race/ethnicity, parent education, family structure, the number of times the student moved during the five waves of data collection, the type of address geocoded and the precision of the geocode.

<sup>a</sup>Significant mediator of the relationship between neighborhood disadvantage and average girls' violence trajectory.

<sup>b</sup>Significant mediator for boys.

\* p < .05.

\*\* p < .01.

<sup>†</sup> p < .10.