Childhood Risk Factors Associated with Adolescent Gun Carrying among Black and White Males: An Examination of Self-protection, Social Influence, and Antisocial Propensity Explanations

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Abstract

Adolescent gun violence is a serious public health issue that disproportionately affects young Black males. Although it has been postulated that differential exposure to childhood risk factors might account for racial differences in adolescent gun carrying, no longitudinal studies have directly examined this issue. We examined whether childhood risk factors indexing neighborhood crime, peer delinquency, and conduct problems predicted the initiation of adolescent gun carrying among a community sample of Black and White boys. Analyses then examined whether racial differences in risk factors accounted for racial differences in gun carrying. Data came from a sample of 485 Black and White boys who were repeatedly assessed from 2nd grade until age 18. Multi-informant data collected across the first three years of the study were used to assess neighborhood crime, peer delinquency, and conduct problems. Illegal gun carrying was assessed annually from 5th grade through age 18. Growth curve analyses indicated that children with higher initial levels of conduct problems and delinquent peer involvement, as well as those who increased in conduct problems across childhood, were more likely to carry a gun prior to age 18. Black boys were also more likely to carry guns than Whites. Racial differences were greatly reduced, but not eliminated, after controlling for initial levels of conduct problems and delinquent peer involvement. Findings suggest that early prevention programs designed to reduce adolescent gun violence (including racial disparities in gun violence) should target boys with severe conduct problems and those who affiliate with delinquent peers during elementary school.

Keywords

adolescent gun carrying; racial disparities; self-protection; social influence; antisocial predisposition

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Gun violence is a serious public health problem that disproportionately affects young Black males living in impoverished urban communities. In order to effectively prevent adolescent

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gun violence, it is critical to understand what risk factors in early childhood are most strongly associated with carrying a gun during later adolescence (Centers for Disease Control, 1992; Hammond, Whitaker, Lutzker, Mercy, & Chin, 2006; Spano, 2012). To date, studies examining risk factors for adolescent gun carrying have focused on self-protection, social influence, and antisocial predisposition explanations (Yun & Hwang, 2011). Self-protection models posit that youth who live in high crime neighborhoods where victimization is common are more likely to carry guns to protect themselves from potential attackers. In contrast, social influence explanations hypothesize that gun carrying is learned and reinforced through social interactions with delinquent peers. Antisocial lifestyle explanations suggest that children exhibiting early emerging conduct problems may begin carrying guns during adolescence to establish dominance and achieve broader antisocial goals.

Although each of these explanatory models is intuitively appealing, prospective longitudinal studies testing these competing theories are lacking. Further, no longitudinal studies have examined whether childhood risk factors associated with these three explanatory models may help to explain racial disparities in gun carrying among boys living in urban communities. The current study addresses these issues by examining: 1) the extent to which childhood risk factors associated with self-protection (i.e., neighborhood crime), social influence (i.e., peer delinquency), and antisocial predisposition (i.e., conduct problems) models prospectively predict the initiation of adolescent gun carrying, and 2) whether race differences in these childhood risk factors accounts for differences in adolescent gun carrying among a community sample of Black and White males.

Background Research

Explanatory Models of Adolescent Gun Carrying

Self-Protection—Self-protection hypotheses suggest that adolescents who live in high crime neighborhoods where victimization is common tend to carry guns for self-defense (Kleck & Gertz, 1998; Rich & Grey, 2005; Sheley & Wright, 1993; Spano & Bolland, 2013; Spano, Rivera, & Bolland, 2010). Consistent with this model, cross-sectional studies have found the highest rates of gun carrying and violence among adolescent boys who live in poor neighborhoods with high levels of crime, and among boys who report high levels of exposure to violence (Margolin & Gordis, 2000; Molnar, Miller, Azrael, & Buka, 2004; Spano, 2012). Furthermore, a limited number of longitudinal studies have found that adolescents who report high exposure to violence are more likely than their non-victimized peers to carry guns in later adolescence (Spano & Bolland, 2013; Spano & Bolland, 2011; Spano, Pridemore, & Bolland, 2012) and early adulthood (Wallace, 2017). However, no prospective longitudinal studies have examined whether boys who live in high crime neighborhoods during childhood are at increased risk for initiating gun carrying during later adolescence. Moreover, longitudinal studies have not sufficiently controlled for childhood risk factors associated with other explanatory models of gun carrying, such as early conduct problems and delinquent peer group affiliation.

Social Influence

According to social influence models, youth who affiliate with delinquent peers are more likely to begin carrying guns during adolescence in part because the group members model, encourage and/or reinforce engagement in criminal behaviors such as gun carrying. In addition, youth who affiliate with delinquent peer groups are believed to be at risk for carrying because they have greater access to illegal gun markets. Consistent with social influence models, several longitudinal studies have found that deviant peer group affiliation is one of the most robust predictors of adolescent criminal behavior, including serious violence (Dodge, Dishion, & Lansford, 2006; Vitaro, Brendgen, & Lacourse, 2015). In addition, several studies have found that adolescents who report illegally carrying a firearm are also more likely to affiliate with gang members and delinquent peers (Cao, Zhang, & He, 2008; Lizotte, Tesoriero, Thornberry, & Krohn, 1994). However, these studies examined concurrent associations, making it unclear whether affiliating with deviant peers prospectively predicts gun carrying during later adolescence (i.e., temporal ordering). One of the few longitudinal studies to examine this issue found that boys who reported being in a gang during adolescence (~ages 14–15) were more likely to report carrying a gun six months later, even after controlling for prior carrying, drug dealing, and other covariates (Lizotte, Krohn, Howell, Tobin, & Howard, 2000). Although these findings lend support to social influence models of gun carrying, this study focused on gang membership--which typically onsets after age 12 (R. Loeber, Farrington, Stouthamer-Loeber, and White, 2008)--as a proximal predictor of gun carrying during adolescence. Therefore, it is unclear whether affiliating with delinquent peers during childhood (i.e., before age 12) has a more distal impact on the initiation of adolescent gun carrying.

Antisocial Predisposition

Perhaps one of the most common explanatory models of adolescent gun carrying posits that this behavior is primarily exhibited by youth who have a general predisposition to engage in deviant behaviors. Some researchers have referred to this as a "stepping stone model of youth gun carrying" (Le Blanc & Loeber, 1998; Spano et al., 2012), theorizing that conduct problems (e.g., fighting) in childhood serve as "stepping stones" for more serious delinquency during adolescence, including gun carrying and firearm violence (Le Blanc & Loeber, 1998; Spano et al., 2012). According to this model, boys with a pre-existing propensity to engage in antisocial behavior view guns as "tools of the trade" that can be used in pursuit of antisocial goals, such as selling or obtaining drugs, stealing property, and/or intimidating others (Spano & Bolland, 2013; Wright & Rossi, 1986). In support of this model, cross-sectional studies with community-based and juvenile justice samples have found that gun carrying typically co-occurs with other severe forms of criminal behavior, particularly drug dealing and violence (R. Loeber et al., 2008; Sheley & Wright, 1993). Moreover, one longitudinal study found that adolescents from high-poverty neighborhoods who reported engaging in violence were more likely than non-violent youth to initiate gun carrying at a one-year follow-up, and this effect remained significant after controlling for co-occurring exposure to violence and gang membership (Spano et al., 2012). However, this study suffered from high levels of participant dropout and included a developmentally heterogeneous group of youth (i.e., ages 9–19). We are unaware of any longitudinal studies that have prospectively examined whether boys exhibiting severe and persistent conduct

problems during childhood are at heightened risk for initiating gun carrying during adolescence.

Race Difference in Adolescent Gun Carrying

Gun violence perpetration and victimization disproportionately affect Black adolescents living in impoverished urban neighborhoods (Blumstein, Rivara, & Rosenfeld, 2000; Centers for Disease Control, 2012; Lizotte et al., 2000; R. Loeber et al., 2005; Nielsen, Martinez, & Rosenfeld, 2005). For example, the Youth Risk Behavior Survey in 2011 indicated that among sampled high school students, 10% of Black males reported carrying a gun in the past month, compared to 7% of White males (Centers for Disease Control, 2012). In addition, a study using the National Incident Based Reporting System (NIBRS) indicated that guns are involved in about 30% of incidents involving young black men, compared to 5% of incidents involving young white men (Felson & Painter-Davis, 2012).

However, factors accounting for these racial inequalities have not been thoroughly examined. Researchers have traditionally attempted to explain racial disparities in gun violence using differential exposure models. These models posit that Black youth living in impoverished urban communities begin accumulating a greater number of risk factors associated with the development of delinquent behavior during childhood (e.g., exposure to crime; deviant peers) than White boys (Fite, Wynn, & Pardini, 2009; Haynie & Payne, 2006; R. Loeber & Farrington, 2011; McNulty & Bellair, 2003). Although there is some evidence that a greater accumulation of risk factors helps to account for racial differences in violence and theft (Fite et al., 2009), few longitudinal studies have examined illegal gun carrying as an outcome. One of the only studies to examine this issue found that higher rates of gun carrying among Black/Hispanic youth relative to Whites could only be partially accounted for by disproportionate involvement with drug dealing, gang membership, and affiliating with criminal peers (Lizotte et al., 2000).

Some have suggested that the higher prevalence of gun carrying among Black youth compared to Whites may also be driven by a differential sensitivity to early risk factors (Fite et al., 2009). Differential sensitivity models posit that certain risk factors may be more strongly related to gun carrying and other forms of criminal behavior in Black youth relative to Whites (Fite et al., 2009). The few studies that have tested differential sensitivity models have produced contradictory or null findings. For example, some studies have found that living in a disadvantaged/high crime neighborhood is associated with later weapon carrying (including guns) in Whites but not Black/Hispanic youth (Haegerich, Oman, Vesely, Aspy, & Tolma, 2013; Miller & Bank, 2013). However, others have failed to find evidence of race differences in the linkage between neighborhood disadvantage/crime and later offending (Fite et al., 2009; Sampson, Morenoff, & Raudenbush, 2005). Studies further examining how the linkages between childhood risk factors and later gun carrying differ between Black and White boys can help to inform the creation of culturally sensitive gun violence prevention programs for Black children living in impoverished urban neighborhoods.

Limitations in Prior Work

It is evident that published studies examining risk factors that may influence adolescent gun carrying are limited in several respects. First, no published longitudinal study has simultaneously examined whether childhood risk factors associated with the self-protection, social influence, and antisocial predisposition explanatory models are all uniquely associated with the initiation of gun carrying. Simultaneously testing components of all three models can help to identify the explanatory risk factors that are most robustly related to adolescent gun carrying. Second, no studies have examined whether risk factors assessed in early childhood (well before the onset of gun carrying) can help characterize boys who will go on to carry guns during later adolescence. For this reason, researchers and public officials have called for more longitudinal studies examining the early antecedents to gun carrying as a way to inform the creation of empirically-informed early interventions designed to prevent gun carrying and firearm violence (Ash, Kellermann, Fuqua-Whitley, & Johnson, 1996; Brennan & Moore, 2009; Wilkinson & Fagan, 2001). Third, studies examining the predictors of gun carrying have typically measured static risk factors at a single time point during adolescence, which overlooks the possibility that chronic exposure to early risk factors may be a particularly strong predictor of adolescent gun carrying. Finally, no studies have examined whether childhood risk factors associated with adolescent gun carrying differ between Black and White boys, or whether disproportionate exposure to early risk factors helps to explain racial discrepancies in adolescent gun carrying.

Present Study

Overcoming some of the major limitations in prior work, the present study used data from a community sample of Black and White boys to examine the extent to which childhood risk factors associated with three common explanations for gun carrying were prospectively associated with initiation of gun carrying during adolescence. Specifically, measures of neighborhood crime, affiliation with delinquent peers, and early conduct problems were collected semiannually from multiple informants across a 3-year period (grades 2–4) prior to the initiation of gun carrying. The initiation of adolescent gun carrying was assessed via self-report using annual assessments conducted from approximately age 10 to 17; a developmental period where carrying a concealed gun is both dangerous and illegal (Spano, 2012). A major strength of this approach is the ability to examine whether initial levels and/or changes in the targeted risk factors during childhood may have a long-term influence on adolescent gun carrying. Analyses also examined whether the early childhood risk factors associated with adolescent gun carrying differed for White and Black adolescents, and examined whether differential exposure to early risk factors could help explain racial differences in adolescent gun carrying.

Methods

Participants

The current study used data collected on boys in the youngest cohort of the Pittsburgh Youth Study. Participants included 503 boys (55.7% Black, 40.6%% White, 3.7% Other) who were initially recruited from a roster of 1st grade students enrolled in Pittsburgh public schools. From this roster, a random sample of 849 boys was selected to undergo a multi-informant

(parents, teachers, self-report) screening to assess current and prior conduct problems (e.g., fighting, stealing). A random sample of ~250 boys who scored in the upper 40th percentile on the risk screen (N=256) and a roughly equal number of boys who scored below the 40th percentile (N=247) were selected for the longitudinal follow-up study. Boys in the follow-up sample were similar to those from the screening sample in terms of race, family composition, parental education, and parental employment (R. Loeber et al., 2008). The sample was predominately Black (55.7%; N=280) or White (40.6% N=205), and less than half were living with both biological parents (40.2%; N=202). Because the aim of the study was to examine whether the antecedents of adolescent gun carrying varied for Black and White adolescent boys, the 18 boys who identified as another race were excluded.

Following screening, the boys, primary caretakers, and teachers were interviewed separately every six months for three years from the 2nd to 4th grade. The predictors for the current study were measured using data collected across these six assessments (hereafter referred to as Time 1–6) prior to the onset of gun carrying. After these six assessments, boys participated in two additional bi-annual assessments, followed by nine annual assessments (from 5th grade until approximately age 18). The initiation of gun carrying was measured using a self-report instrument administered at each of these assessments. The current study focused on any gun carrying reported prior to age 18, because it is illegal for a minor to carry a concealed firearm.

Participation rates were high across the assessments used in the current study. Retention rated never dropped below 82.3% (mean=91.1%) for the 17 youth assessments, 95.2% (mean=96.2%) for the six primary caretaker assessments, and 87.9% (mean=90.6%) for the six teacher assessments. All data collection procedures were reviewed and approved by the University of Pittsburgh Institutional Review Board.

Measures

Demographics—Information regarding the boy's race and date of birth (used to calculate age) was collected from the primary caretaker as part of the screening assessment.

Adolescent gun carrying—At each assessment from 5th grade to age 17, boys self-reported whether they had carried a gun since the previous time-point using the Self-Reported Delinquency Scale (Elliott, Huizinga, & Ageton, 1985). Specifically, boys were asked whether they had carried a hidden weapon, and if so, a follow up question asked youth to state the most dangerous weapon they had carried (with a gun being the most dangerous). For each participant, the initiation of gun carrying was determined using only those assessments that occurred prior to age 18 (0=never reported carrying a gun; 1=reported carrying a gun at least once). This developmental period was chosen because gun carrying as a minor is illegal and particularly risky.

Neighborhood crime—We used a subscale from the Neighborhood Impressions Questionnaire as an indicator of neighborhood crime (R. Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998). Specifically, primary caretakers provided reports of the level of crime in the family's neighborhood at Time 1 (mean age=7.5), Time 3 (mean age=8.5), and Time 5 (mean age=9.5). Caretakers were asked to rate whether 10 different

types of crimes (e.g., gangs, drugs, vandalism, prostitution) were a problem in their neighborhood using a scale ranging from 1 ("not a problem") to 3 ("big problem"). The 10 items were summed so higher scores represented greater levels of neighborhood crime (αs ranged from .929 to .938).

Peer delinquency—Peer delinquency was assessed via youth self-report at each assessment from Time 1 to Time 6 using the Peer Delinquency Scale (R. Loeber et al., 1998). At each interview, boys were asked to rate the proportion of their friends who had engaged in seven different types of delinquent behaviors (e.g., damaged property, hit other kids/got into physical fight, stolen something) using a scale that ranged from 0 ("none of them") to 4 ("all of them"). Ratings on the seven items were summed so higher scores represented higher levels of peer delinquency (αs ranged from .741 to .785).

Conduct problems—Early conduct problems were assessed using parent and teacher ratings on eight items from the Child Behavior Checklist and Teacher Report Form (respectively) from Time 1 to Time 6 (Pardini, Obradovic, & Loeber, 2006). Specifically, both parents and teachers rated the extent to which the target child engaged in behaviors consistent with symptoms of conduct disorder (e.g., gets into fights, physically attacks people, stealing, property damage) using a scale ranging from 0 ("not true") to 2 ("very true"). Consistent with prior studies, the higher of the two informant ratings was calculated for each item and then the 8 items were summed to form a multi-informant conduct problems score (Pardini et al., 2006). Higher scores are indicative of more conduct problems (αs ranged from .868 to .915).

Data Analysis Plan

The research aims were addressed in multiple steps. The first step involved modeling individual differences in risk factors indexing neighborhood crime, peer delinquency, and conduct problems from Time 1–6, including any systematic changes in these risk factors that occurred across this developmental period. This was done using latent growth curve modeling within Mplus 7.2 (Muthén & Muthén, 2012). Specifically, latent growth curve models were specified to delineate between-individual differences in the initial levels and rates of change in each risk factor over time (Bollen & Curran, 2006). Because the risk factors used in this study were negatively skewed, analyses were conducted using maximum likelihood estimation with standard errors and a chi-square statistic that was robust to non-normality. Initially, unconditional growth curve models were specified separately for each risk factor (i.e., neighborhood crime, peer delinquency, conduct problems). Each model included a latent intercept indexing between-individual differences in the estimated level of each risk factor at the first assessment (Time 1) and a linear slope to estimate between-individual differences in the rate of change in the risk factor from Time 1–6. A Satorra-Bentler Chi-Square test for nested models was used to determine whether adding a quadratic growth factor helped to improve the fit of the model (results available by request). The overall fit of each model was assessed using the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA). Conventional cutoffs for the CFI and TLI include values greater than .90 for acceptable fit and values greater than .95 for good fit (Hu & Bentler, 1999; McDonald & Ho, 2002). For

the RMSEA, values between .05 and .08 indicate acceptable fit and values less than .05 indicate good fit (Browne & Cudeck, 1992; McDonald & Ho, 2002).

After the unconditional growth curves for each risk factor were established, adolescent gun carrying was regressed separately and then simultaneously on the risk factor intercepts and slopes. Models were then run to test the differential exposure hypothesis. First, we examined the bivariate associations between race and each of the risk factors and gun carrying. Then a model was run examining whether the association between race and gun carrying was eliminated after controlling for growth indicators of neighborhood crime, peer delinquency, and early conduct problems. To determine whether a risk factor accounted for a statistically significant portion of the race differences in adolescent gun carrying, an indirect effects model (i.e., race→neighborhood crime→adolescent gun carrying) was run. When a statistically significant indirect effect was found, the proportion of the race effect that was attributable to differences in the risk factor was calculated by dividing the estimated indirect effect by the regression parameter representing the unadjusted association between race and adolescent gun carrying (Fite et al., 2009).

To aid the interpretation of findings from the growth curve models, we used latent class growth models (LCGM) to identify latent subgroups of youth who exhibited similar patterns of change in each risk factors over time (Muthén, 2004). Although these models have methodological limitations (Bauer & Curran, 2003), they can be helpful for visualizing patterns of change and associations that occur for subpopulations of youth (e.g., stable high, stable low, increasing, decreasing). The optimal number of classes was determined by a number of recommended criteria, including the Sample Size Adjusted Bayesian Information Criteria, Vuong-Lo-Mendell-Rubin Likelihood Ratio Test, Bootstrapped Likelihood Ratio Test, classification accuracy, parsimony, interpretability, and sample size (>5% in each class) (Muthén, 2004; Nylund, Asparouhov, & Muthén, 2008). After groups were established, we regressed adolescent gun carrying on the groups for each risk factor. All analyses were conducted in Mplus 7.2 using maximum likelihood with robust standard errors (Muthén & Muthén, 2012).

As final set of analyses tested the differential sensitivity hypothesis using a multi-group latent growth curve model. The base multi-group model allowed the means of the growth indicators for each risk factor and their association with gun carrying to differ for Blacks and Whites. A series of Wald chi-square tests were then used to examine whether the estimated regression parameter between the intercept and slope of each risk factor and gun carrying significantly differed between Blacks and Whites (Fite et al., 2009; Muthén & Muthén, 2012). A significant Wald chi-square text indicates that the magnitude of the association between the risk factor and gun carrying is not equivalent between Blacks and Whites (i.e., moderation by race).

Missing Data

As mentioned previously, sample retention in the present study was high (greater than 82% at all assessments). Missing data were handled using full-information maximum likelihood estimates, which uses all available data to generate parameter estimates rather than resorting

to listwise deletion. This method for handling missing data provides unbiased and efficient parameter estimates under the assumption the data are missing at random.

Results

Descriptive Statistics

Approximately 27% of Black boys reported carrying a gun prior to age 18 ($N = 75$) and 12% of White boys reported carrying a gun prior to age 18 ($N = 27$). Among youth who reported carrying a gun, there was no difference in the number of years that youth carried a gun at least once between Black (1–6; $M = 1.83$, $SD = 1.08$) and White (1–5; $M = 1.57$, $SD = 1.02$) youth. See Table 1 for descriptive statistics regarding childhood risk factors.

Unconditional Growth Curve Models

Results of the unconditional growth models for neighborhood crime indicated that the best functional form included an intercept and a linear slope. This model indicated that there was significant between-individual variability in the initial level of neighborhood crime, and the average level of neighborhood crime tended to decrease only slightly over time (see Table 2). The variance of the linear slope was non-significant, indicating that between-individual differences in neighborhood crime remained stable across the developmental period examined. For this reason, only the intercept of neighborhood crime was used as a predictor in subsequent analyses.

Results from the unconditional growth models for peer delinquency and conduct problems both indicated that a model consisting of an intercept and a linear slope fit the data well. On average, there was a slight decrease in boys' self-reported peer delinquency from Time 1–6, whereas conduct problems showed a slight increase across the same time period. The variance of the intercept and slope values for both conduct problems and peer delinquency were statistically significant. This indicates there was significant between-individual variability in the initial levels and rates of change in conduct problems and peer delinquency from Time 1–6 (see Table 2).

A final unconditional model was run to examine the associations between the latent intercept and slope values among the three predictors (see Table 3). This combined model fit the data well when run using the whole sample (CFI=.98; TLI=.98; RMSEA=.03), as well as when the model was run separately for White (CFI=.96; TLI=.95; RMSEA=.04) and Black (CFI=.97; TLI=.96; RMSEA=.04) participants. The intra-correlations between the intercepts for the three predictors were statistically significant and small to moderate in magnitude (rs from .20–.32; See Table 3). The slopes of the conduct problem and peer delinquency latent growth factors were not significantly correlated (see Table 3).[1]

Predicting Adolescent Gun Carrying—All growth factors indexing child risk factors were associated with higher odds of gun carrying when each growth factor was examined separately, except for the slope of peer delinquency, which was not significant (see Table 4).

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[1]We did not estimate correlations with the slope for neighborhood crime because this growth factor did not demonstrate any between-individual variability.

When adolescent gun carrying was regressed on all latent growth factors together, results demonstrated that individuals who started higher on peer delinquency and conduct problems (intercepts) had significantly higher odds of carrying a gun in adolescence (see Table 4, Model 1). Additionally, boys who experienced greater increases in conduct problems throughout childhood also demonstrated higher odds of carrying a gun in adolescence (see Table 4, Model 1). In contrast, the association between initial levels of neighborhood crime and adolescent gun carrying was non-significant.

Differential exposure—Analyses indicated that Black youth were significantly more likely to carry a gun in adolescence than White youth without adjusting for covariates (OR = 3.25, $p < .001$; see Table 4). Consistent with the differential exposure hypothesis, Black youth also had significantly higher intercepts on all three risk factors (i.e., neighborhood crime, peer delinquency, conduct problems) and a more rapid increase in conduct problems across time compared to Whites (rs from .11–.55; see Table 3).

To determine whether race differences in gun carrying could be accounted for by differences in the early risk factors, a model was run regressing adolescent gun carrying onto race and all the childhood risk factors. In this model, the intercept of peer delinquency and intercept and slope of conduct problems significantly predicted gun carrying (see Table 4, Model 2). Although race remained a significant predictor of later gun carrying after controlling for the risk factors, the magnitude of the association was attenuated (see Table 4, Model 2). Indirect effects analysis indicated that approximately 36% of the race effect on gun carrying was attributable to differences in initial levels of peer delinquency ($p = .006$), and approximately 24% of the race effect on carrying was attributable to differences in initial levels of conduct problems ($p = .002$). Together, these two indirect paths accounted for approximately 60% of the effect of race.

Latent Class Growth Models (LCGM)—To help illustrate the patterns of change over time in the risk factors and the associations between the growth factors and adolescent gun carrying, we conducted LCGMs for each of the risk factors and examined the associations between the LCGM groups and adolescent gun carrying. Results indicated that 4-group solutions were best for neighborhood crime and conduct problems but a 3-group solution was best for peer delinquency (see Supplemental Table 1 and Supplemental Figures 1–3). For neighborhood crime and peer delinquency, there was very little change over time for any of the groups. Indeed, the groups demonstrated significant differences at the initial assessment, and these group differences were maintained for the rest of the study period (see Supplemental Figures 1 and 2). For conduct problems, the four groups differed in their pattern of change over time: Group 1 started low but demonstrated substantial increases over time (but never caught up to the highest group); Group 2 started low, remained the lowest group, and demonstrated very little change over time; Group 3 started high and continued to increase over the study (maintaining the highest group level at all time-points), and Group 4 started nearly as high as the highest group but decreased during the study period (see Supplemental Figure 3).

Additionally, results indicated that the groups differed significantly in their likelihood of carrying a gun in adolescence (see Supplemental Table 2). For neighborhood crime and peer

delinquency, the two highest groups were significantly more likely to carry a gun in adolescence than the lowest groups (see Supplemental Table 2). For conduct problems, the high-increasing group was significantly more likely to carry a gun than all other groups (see Supplemental Table 2). Additionally, the high-decreasing group and the low-increasing group were significantly more likely to carry a gun than the consistently low group (see Supplemental Table 2).

Differential sensitivity hypothesis—A multiple group model was then run that allowed the means of the growth factors and their associations with gun carrying to differ for Blacks and Whites. A series of Wald chi-squares were calculated to test whether the regression parameter between the intercept and slope of each risk factor and gun carrying significantly differed between Blacks and Whites. None of these chi-square tests were statistically significant (all ps > .33), indicating that the associations between the risk factors and gun carrying did not significantly vary as a function of race.

Discussion

The present study followed Black and White boys from early childhood to late adolescence to examine the extent to which childhood risk factors associated with self-protection (neighborhood crime), social influence (peer delinquency), and antisocial predisposition (conduct problems) models prospectively predicted the initiation of adolescent gun carrying, and whether race differences in these childhood risk factors accounted for racial disparities in adolescent gun carrying.

Lending some support to the social influence and antisocial predisposition pathways, results demonstrated that boys who consistently affiliated with delinquent peers and exhibited high or increasing conduct problems during elementary school years were at highest risk for carrying a gun during adolescence. It was interesting that there was very little within-individual change in peer delinquency, although there were significant differences in where individuals started, which were maintained over the subsequent three-year period. Early affiliation with delinquent peer groups might entrench young boys in delinquent social networks where gun carrying and other serious violence is modeled and reinforced. This suggests that affiliation with delinquent peers throughout childhood might have long lasting consequences in terms of young boys' beliefs and values about delinquency—which can lead to gun carrying. It also suggests that gun carrying might emerge simply because of opportunity and exposure.

The significant associations between initial level and change in childhood conduct problems with adolescent gun carrying also provide support for the antisocial predisposition hypothesis. This suggests that gun carrying represents an adolescent behavioral manifestation of an early-emerging predisposition toward deviant behavior that is observable in early childhood. Consistent with the antisocial predisposition hypothesis, gun carrying might be the culmination of a gradual escalation of conduct problems, with gun carrying merely serving as a means to achieve broader antisocial goals in adolescence, such as intimidating or controlling victims (Spano & Bolland, 2013; Wright & Rossi, 1986).

Although neighborhood crime was significantly associated with later gun carrying in the bivariate analysis, this effect was reduced to non-significance after controlling for risk factors associated with conduct problems and peer delinquency. This suggests that exposure to neighborhood crime in early childhood is associated with later gun carrying to some extent. However, because neighborhood crime was not associated with adolescent gun carrying when controlling for the other two risk factors, the effect of neighborhood crime might be accounted for by the type of peers to which young people are exposed. It is also possible that our measure of neighborhood crime was too general and that a measure of neighborhood violence would have had more predictive utility. The measure is also limited in that it asks parents to rate how much of a problem various crimes are in their neighborhood. This involves making a subjective judgment about what level of crime constitutes a problem rather than having parents report on the amount of crime in their neighborhood.

It is important to note that initial between-individual differences in neighborhood crime were extremely stable across the initial three-year follow-up. In fact, there was no significant between-person variability in terms of changes in parent-reported neighborhood crime over time. This suggests that most boys did not change neighborhoods or that they moved into neighborhoods with equivalent levels of crime, which is not surprising given that most families have limited social mobility over such as short period of time.

Racial Disparities in Gun Carrying

Consistent with prior research, we also found that gun carrying in adolescence is much more common among Black boys than White boys (Blumstein et al., 2000; Centers for Disease Control, 2012; Lizotte et al., 2000; R. Loeber et al., 2005; Nielsen et al., 2005). Although this finding is not particularly novel, this is the first empirical study that has attempted to identify what early risk factors may account for this difference. Specifically, analyses examined whether racial disparities in gun violence were due to Black boys being more likely to experience certain risk factors (i.e., differential exposure models) or whether race differences were due to Black boys being more vulnerable to the negative effects of certain risk factors (i.e., differential sensitivity models). These are two completely different ways of examining potential racial disparities. One hypothesis assumes that racial differences emerge because minorities are more likely to experience certain risk factors than Whites (i.e., differential exposure models). The other hypothesis assumes that racial differences emerge because certain risk factors—risk factors that minorities and Whites are equally exposed to —have stronger influences on gun carrying for minorities than Whites (i.e., differential sensitivity models).

Consistent with differential exposure models, over half of the observed racial disparities in gun carrying was attributable to Black boys having higher initial levels of early risk factors for gun carrying than Whites, namely childhood conduct problems and peer delinquency. It is important to note that the higher rates of conduct problems and delinquent peer involvement among Black boys is likely the result of a cascading array of early environmental risks that impact families living in impoverished minority communities. The present study provided some evidence in support of this, given that parents of Black boys

reported significantly more neighborhood crime in early childhood than parents of White boys. Taken together, results suggest that the foundation for racial disparities in firearm violence starts in early childhood.

Contrary to differential sensitivity models, there was no evidence that the associations between the risk factors and gun carrying differed between Black and White boys, which was consistent with a prior study examining racial differences in juvenile arrests (Fite et al., 2009). Although sensitivity models (i.e., moderation analyses) are overwhelmingly the most common way to test for racial differences in social science research, our data suggest that an examination of differential exposure, instead of whether associations vary for different subgroups, yields substantially more information. Nonetheless, future studies should test both hypotheses when looking for potential explanations for racial disparities.

Limitations

The study is not without limitations. The sample only included Black and White boys and future research should examine these associations with more racially/ethnically diverse samples and with girls. Additionally, peer delinquency was assessed using participants' perceptions of their friends' behavior rather than friends' own self-report, which is subject to projection biases. Moreover, the measure of neighborhood crime was assessed via parent-report. Future research should incorporate measures of youth-reported personally experienced crime and victimization to determine whether personally experienced victimization is more strongly associated with later gun carrying. Furthermore, the present study only examined the predictors of gun carrying, not firearm violence. Future research should examine the risk factors that distinguish youth who actually use a firearm to cause harm to another person. It is also important to note that the present study only examined the long-term, prospective associations between childhood risk factors and adolescent gun carrying. It is likely that there are more proximal factors that mediate the associations studied here (e.g., drug dealing). Finally, it is important to consider that only 28% of Black adolescents and only 10% of White adolescents carried a gun during the study period. The relatively small sample size may have limited our ability to detect group differences in the predictors of gun carrying.

Conclusion/Clinical Implications

This study clearly indicates that boys with higher conduct problems and peer delinquency in early childhood are at a heightened risk of carrying a gun in adolescence. The long-term predictive utility of these two risk factors was particularly striking. In addition, the results from this study suggest Black boys tend to have higher levels of conduct problems and more delinquent peers in early childhood than White boys, and this discrepancy helps to account for later racial differences in adolescent gun carrying. Prevention programs designed to prevent firearm violence, and racial disparities in firearm violence, should target children who affiliate with deviant peers and exhibit early conduct problems during elementary school.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Public Significance

Boys who exhibit early conduct problems and affiliate with delinquent peers in childhood are more likely to carry a gun during adolescence. Racial differences in these childhood risk factors may help to explain (in part) why Black boys are more likely than Whites to carry a gun during adolescence. These results suggest that prevention programs designed to reduce racial disparities in gun violence should begin in early childhood.

Table 1

Descriptive Statistics for Childhood Risk Factors by Race

	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Black (N = 280)						
Neighborhood crime	16.25 (5.78)		15.98 (6.08)		15.45 (5.59)	
Peer delinquency	4.21 (3.51)	4.42 (3.37)	3.90 (3.66)	3.97 (3.59)	3.71 (3.60)	3.65 (3.54)
Conduct problems	3.53 (3.70)	4.34 (4.33)	3.70 (4.09)	4.43 (4.54)	4.11 (4.21)	5.20 (4.57)
White (N = 205)						
Neighborhood crime	11.93 (3.21)		11.64 (2.94)		11.57 (3.25)	
Peer delinquency	2.58 (3.14)	2.94 (3.22)	2.54 (2.88)	2.36 (2.66)	1.93 (2.42)	1.96 (2.54)
Conduct problems	2.47 (2.90)	2.53 (3.13)	2.25 (3.23)	2.97 (3.58)	2.60 (3.20)	3.23 (3.91)

Notes. M=mean. SD=standard deviation

Table 2

Model Fit and Descriptive Statistics for Univariate Growth Curve Models (N=485)

	MODEL FIT			Mean		Variance	
	CFI	TLI	RMSEA	Intercept	Slope	Intercept	Slope
Neighborhood crime	1.00	1.02	0.00	14.44 ***	−0.32 **	14.55 ***	1.11
Peer delinquency	0.99	0.99	0.02	3.68 ***	−0.15 ***	6.54 ***	0.32 ***
Conduct problems	0.96	0.96	0.07	3.07 ***	0.19 ***	9.25 ***	0.35 ***

***
$p < .001$;

**
$p < .01$;

*
$p < .05$

Table 3

Intra-correlations Between Risk Factor Growth Curves and Race

	1	2	3	4	5
1. Intercept neighborhood crime					
2. Intercept peer delinquency	0.20 **				
3. Slope peer delinquency	0.06	−0.56 ***			
4. Intercept conduct problems	0.25 ***	0.32 ***	−0.14 *		
5. Slope conduct problems	0.04	0.09	0.09	−0.28 ***	
6. Race (0=White, 1=Black)	0.55 ***	0.29 ***	0.04	0.19 ***	0.11 *

Notes. Slope of neighborhood crime was not included because it had no significant between-individual variability.

***
$p < .001$;

**
$p < .01$;

*
$p < .05$

Table 4

Associations Between Childhood Risk Factors, Race, and Adolescent Gun Carrying (N=485)

		95% CI	
	Std. Est	**UL**	**LL**
Bivariate associations with gun carrying			
Intercept neighborhood crime	0.17*	0.04	0.30
Intercept peer delinquency	0.45***	0.31	0.58
Slope peer delinquency	0.15	−0.03	0.32
Intercept conduct problems	0.43***	0.31	0.54
Slope conduct problems	0.30***	0.16	0.43
Black	0.31***	0.18	0.43
Model 1			
Intercept neighborhood crime	0.02	−0.14	0.18
Intercept peer delinquency	0.28***	0.13	0.44
Slope peer delinquency	0.08	−0.09	0.25
Intercept conduct problems	0.33***	0.20	0.47
Slope conduct problems	0.23**	0.08	0.37
Model 2			
Intercept neighborhood crime	−0.06	−0.23	0.11
Intercept peer delinquency	0.25**	0.09	0.42
Slope peer delinquency	0.06	−0.11	0.23
Intercept conduct problems	0.33***	0.20	0.46
Slope conduct problems	0.21**	0.07	0.36
Black	0.18*	0.03	0.33

Notes. Std. Est=Standardized Estimate. CI = confidence interval. LL = lower limit. UL = upper limit. Linear slope for neighborhood crime not included because there was no between-subject variability, which caused model convergence problems.

***
p<.001;

**
p<.01;

*
p<.05