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Pathways and Predictors of Antisocial Behaviors in African American Adolescents from Poor Neighborhoods

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Abstract

Antisocial behavior among youth remains a serious personal and social problem in the United States. The purposes of this study were to (1) identify the shape and number of developmental trajectories of antisocial behavior in a sample of poor, inner-city African American youth, and (2) test predictors of group membership and the developmental course of antisocial behaviors. Using growth mixture modeling, we examined predictors of antisocial behavior pathways and the likelihood of arrest in a sample of 566 poor, urban African American adolescents (ages 11 to 16). Three distinct trajectory classes of antisocial behavior were identified over a period of six years: one low-risk group (*low steady*) and two high-risk groups (*incremental* and *high starter*). The conditional probabilities for being arrested during ages 14–16 were 0.18 for the low steady class, 0.68 for the incremental class, and 0.31 for high starter class. Prevention strategies for adolescents at high risk are discussed.

Keywords

antisocial behavior; violence; African American adolescents; pathways; poverty; longitudinal analysis

Antisocial behavior, often interchangeably used with delinquency, violent behavior, conduct problem, and deviant behavior, is one of the most serious behavioral problems in the United States and incurs costs to individuals, families, and the society as a whole. Antisocial behavior is defined in this paper as behavior that violates social norms or the rights of fellow human beings. Because of its significance, a number of efforts exists to understand how antisocial behavior develops over the life course and to comprehend the predictors and consequences (e.g., Schaeffer, Petras, Jalongo, Poduska, & Kellam, 2003). Although a general tendency of decreasing rates of antisocial behavior is reported as youth reach adulthood, research also

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indicates a strong link between childhood antisocial behavior and subsequent chronic offenses during adulthood (Bongers, Koot, van der Ende, & Verhulst, 2008; Huesmann, Eron, & Dubow, 2002). In particular, minority youth in urban, poor neighborhoods have high risks of being exposed early to violence and of developing antisocial behavior (Spano, Rivera, & Bolland, 2006; Tolan, Gorman-Smith, & Henry, 2003; Walker, Maxson, & Newcomb, 2007). Thus, it seems paramount to develop effective prevention and intervention efforts for minority youth to reduce the chances of subsequent criminal behaviors.

Research indicates that biology and personal attributes such as social maladjustment and value orientation play an important role in predicting antisocial behavior of youth (Moffitt, 1993), yet attention has also been placed on contextual characteristics that shape the environment for the youth. An ecological perspective indicates that an environment surrounding individuals (e.g., family, school) can have a profound influence on adolescents' antisocial behavior (Gorman-Smith, Tolan, & Henry, 2000; Seidman et al., 1998). Nevertheless, neither developmental perspectives nor environmental characteristics alone may account for trajectories of antisocial behavior. The developmental-ecological perspective argues that individual development is influenced by the ongoing qualities of the social settings in which the child lives and interacts with outer world (Gorman-Smith et al., 1998, 2000; Le Blanc & Kaspy, 1998). That is, personal characteristics and environmental settings may collectively contribute to the formation and development of the trajectories of antisocial behavior.

Multiple Trajectories of Antisocial Behavior during Adolescence

The importance of identifying and preventing antisocial behavior has given rise to testing patterns of antisocial behavior and trajectory modeling. In such effort, Moffitt (1993) proposed two distinct trajectories: a persistent, long-lasting trajectory of antisocial behavior (life-course persistent) and temporary or situational trajectory during adolescence (adolescence-limited). A life-course persistent pathway may be characterized by an early onset trajectory of antisocial behaviors linked with chronic offending as an adult (Piquero & Chung, 2001). In contrast, adolescence-limited antisocial behavior, which peaks during adolescence, shows little continuity over the life course. This life-course persistent vs. adolescence-limited differentiation, however, is only capable of explaining two distinct developmental trajectories, while evidence suggests that there may be multiple pathways of antisocial behavior.

Earlier, Loeber and colleagues (1991) classified juvenile offenders based on the offense level over two years in a panel study that included three age groups of boys (ages of 6, 10, and 13 years) from Pittsburgh Public schools. They identified seven groups based on the involvement of offending: nondelinquent, starters, stable, moderately serious offenders, escalators, stable, highly serious offenders, de-escalators, and desistors. Similarly, Gorman-Smith and colleagues (1998) followed a sample of urban minority boys over a three-year period. The sample consisted of African-American and Latino boys, between the ages of 11 and 15 at the first interview, from economically disadvantaged neighborhoods. The authors identified four patterns that characterized delinquency involvement over time: no offenders, chronic minor offenders, escalators, and serious chronic offenders.

Le Blanc and Kaspy (1998) also identified four different pathways based on the frequency and types of delinquent behaviors, namely moderate delinquency, intermediate delinquency, persistent delinquency, and serious persistent delinquency. Recently, Park and colleagues (2008) examined longitudinal patterns of antisocial behavior among minority adolescents (ages 12 through 15) residing in inner-city, poor neighborhoods. They identified three distinct developmental trajectories of antisocial behavior: high starters, incremental group, and steady group.

Although aforementioned studies demonstrate multiple trajectories of antisocial behavior, it is often difficult to compare the trajectories across different studies because they differ with respect to age spans, definitions of antisocial behavior, or methods to examine trajectories. Some studies may not fully address the dynamic process of antisocial behavior methodologically. This is so for a number of reasons. For example, in some work, antisocial behavior trajectories were assigned to conceptually “pre” determined categories rather than deriving classes of trajectories through an analytical process (e.g., Loeber et al., 1991). Other studies derived patterns of antisocial behavior using clustering methods; these might be better suited for cross-sectional data (e.g., Gorman-Smith et al., 1998; Le Blanc & Kaspy, 1998). Although the study by Park et al. (2008) is one of the few studies to date that utilized the dynamic classification method of growth mixture modeling (GMM), their study is limited in that the whole purpose of the study was to classify developmental trajectories of antisocial behavior and that class profiles were examined descriptively afterwards. In addition, these studies cover a short period of follow-ups (about three years) or use different age groups rather than following individuals over time.

In consideration of these limitations, the present study aims to classify antisocial behavior trajectories during a longer period of adolescence (ages 11 through 16) using GMM modeling. The study also aims to test and include both theoretically and empirically important predictors as well as an important outcome variable, namely the probability of arrest.

Environmental and Individual Characteristics Influencing Antisocial Behavior

Family characteristics and school factors—Family characteristics have been consistently identified as one of the strongest predictors of antisocial behavior in children and adolescents (Dekovic, Janssens, & Van As, 2003; DuRant, Cadenhead, Pendergrast, Slavens & Linder, 1994). A large body of literature suggests that lack of parental monitoring and poor disciplines are related to adolescents' involvement in antisocial behavior (Patterson, DeBaryshe, & Ramsey, 1989; Spano, Rivera, Vazsonyi, & Bolland, 2008; Walker et al., 2007). Laird and his colleagues (2008) found that greater parental monitoring knowledge was associated with less antisocial behavior involvement.

Involvement in school discipline (e.g., school suspension and expulsion) is an important outcome of violent behaviors and predicts more serious developmental outcomes later. Out-of-school suspension is among the most common consequences for disciplinary infractions (Bowditch, 1993; Raffaele Mendez, Knoff, & Ferron, 2002). Fights and physical aggression among students are consistently found to be among the most common reasons for suspension (Costenbader & Markson, 1998; Raffaele Mendez et al., 2002). In contrast to suspension, school expulsion tends to be used relatively infrequently (Sinclair, 1999). Morrison and colleagues (1997) report that expulsion appears to be reserved for incidents of moderate to high severity of troublesome or dangerous behaviors. A limited number of studies have focused on the associations between involvement in school discipline and the antisocial behavior trajectory. One study by Walker and Sprague (1999) found that the number of discipline contacts during the school year for a child was a prominent predictor of arrest status during later school years.

Substance use involvement—Evidence suggests that substance use and antisocial behavior are highly linked (Clark, Vanyukov, & Cornelius, 2002; Friedman, 1998; Rainone, Schmeidler, Frank, & Smith, 2006; Wiesner, Silbereisen, & Weichold, 2008). For example, Strand (2002) reported that alcoholism was 21 times more likely to occur among individuals with antisocial behavior disorder than those without it. Farrell et al. (2005) used latent growth curve analysis to examine the structure and interrelations among aggression, drug use, and delinquent behavior during early adolescence among both urban and rural groups of youth, and

found positive relations among all three behaviors. Although it is difficult to sort out the sequential order between substance use and antisocial behavior, it is likely that substance involvement at early ages affects the trajectory of antisocial behavior.

Self concepts and hopelessness—The close relation between self concepts and antisocial behavior has also been documented. It is generally reported that antisocial children tend to hold negative self concepts. In a study across three ethnic groups of adolescents, Guerra and colleagues (1995) suggested that stress and poor self concepts contributed significantly to the prediction of aggression for all ethnic groups. It is frequently reported that there is a wide sense of hopelessness shared by many inner-city children at risk (Guerra et al., 1995). DuRant et al. (1994) found that self-reported use of violence was associated with hopelessness among 225 teenagers living in urban housing projects. Bolland and colleagues (2001) indicated that hopelessness was a strong predictor of violent behavior for both girls and boys from inner-city poor neighborhoods, and this finding was validated on a larger sample of inner-city adolescents in later work (Bolland, 2003).

Purpose of the Study

A number of studies have reported on different trajectories of antisocial behavior during adolescence (Gorman-Smith et al., 1998; Loeber et al., 1991, 1993); however, most have focused on indentifying the number of trajectories as opposed to predictive models of trajectories based on theoretical and empirical evidence. In addition, few studies have examined ethnic minority youth exclusively. The purposes of this study were to: (1) identify the shape and number of developmental trajectories in a sample of poor, inner-city African American youth; (2) to test predictors of group membership and the developmental course of antisocial behaviors; and (3) to calculate the probability of arrest in each of the identified groups. We expected to find distinct classes of antisocial behavior trajectories and that these different trajectories would be associated with class-specific predictors and arrest. In examining multiple trajectories of antisocial behavior, we used GMM procedures, which can efficiently identify the unique trajectory of each class and incorporate predictors and outcomes simultaneously (Muthén, 2001; Muthén & Muthén, 2000). GMM is a versatile estimation method, which includes features of latent class growth models and which is capable of incorporating complex models.

Method

Study Sites

Data for this study were based on the Mobile Youth Survey (MYS), a multiple cohort longitudinal study that was designed to identify the life course trajectories of adolescents in the 13 Mobile-Prichard inner-city, poor neighborhoods in Alabama (Bolland, 2004). The 13 neighborhoods were relatively homogeneous with regard to poverty rates and the community composition. According to the US Census Bureau (2002), the poverty rate for those aged under 17 in the area was 27.1%, which was considerably higher than those of Alabama (21.6%) and the nation (16.7%). The median poverty rate of the 13 neighborhoods in 2000 was approximately 57%, with 30.5% of residents living in extreme poverty; and the median household income was less than \$12,000. Ninety-five percent of residents in these neighborhoods were African American. Seven of the neighborhoods were public housing developments and six were non-public housing (Bolland, Bryant, Lian, McCallum, Vazsonyi, & Barth, 2007).

Participants

The sample was derived from the ongoing MYS study, which collected data annually between 1998 and 2005. Because we were interested in longitudinal trajectories of antisocial behavior

during adolescence, we selected children who were 11 years old at baseline and those who were followed over next six years. This resulted in a total of 566 African American participants (ages 11 through 16) from the cohorts of 1998-2000. Among 566 African American youth, 273 were male (48.2%) and 293 were female (51.8%).

Procedures

The MYS study used a multiple cohort design in that new cohorts of youth were added each year and tracked thereafter during 1998 through 2005. The MYS sampled adolescents from 13 neighborhoods representing 27 different block groups in 14 census tracts (Bolland, 2004). Within the neighborhoods, the MYS research team identified homes where records indicated that youth between the ages of 10 and 18 lived. Once the sampling pool was generated, the investigators attempted to make contact with each of these targeted homes. The youth and his or her adult caregiver were informed about the purpose of the survey and the youth was invited to participate in the survey.

When the youth and his or her caregiver agreed to participate, a group administration of the survey was scheduled in a nearby church, community center, or other quiet facility. The groups consisted of around 20 to 30 adolescents. The questions were read aloud to the participants, and they were asked to mark their answer to each question in the survey booklet. Those who commanded individual attention were assisted one-on-one, while most participants completed the survey independently. The whole procedure took about an hour. Each participant received \$10 as compensation.

Measures

Antisocial behavior—Antisocial behavior was constructed in our study through the additive score of eight items that measured the involvement in the behavior during past 3 to 12 months: physical fighting, getting other kids to fight each other, carrying a knife or razor, carrying a gun, pulling a knife or a gun on someone else, cutting or stabbing someone else, shooting a gun at someone else, and hanging out with members of a gang. The questions were answered using three choices (0 = no; 1 = yes, just once; 2 = yes, more than once) except gang involvement, which was coded in two choices (0 = no; 1 = yes). Thus, total additive score could range from 0 to 15, with higher score indicating more involvement in the antisocial behavior. The simple sum of antisocial frequencies was used in other studies (Gordon et al., 2004). Cronbach's alpha coefficients of the eight antisocial activities were 0.70, 0.68, 0.73, 0.73, 0.76, and 0.74 over the course of the six-assessments period.

Arrest—Arrest was measured with one item: During the past year, were you arrested? (0 = no; 1 = yes). If participants answered yes to the question at any point of ages 14-16, the variable was coded as 1; otherwise, it was coded as 0. This measured being arrested during middle adolescence.

Covariates—In terms of family characteristics, we measured parental behavioral control (what children were allowed to do) as a proxy for family monitoring. Parental behavioral control involved four items related to expectations about certain behavior such as staying out as late as you want on school nights (or on weekend nights) and staying out after dark on school nights (or on weekend nights). Each item was coded dichotomously (0 = no; 1 = yes) and the additive score of four items was used with higher scores indicating less parental behavioral control. Cronbach's alpha for the four items was 0.59. The school variables included two separate questions: (1) have you ever been suspended from school? (0 = no; 1 = yes); and (2) have you ever been expelled from school? (0 = no; 1 = yes).

Substance involvement was measured with two separate questions: (1) have you ever smoked a cigarette? (0 = no; 1 = yes); and (2) have you ever gotten drunk on alcohol or high on drugs? (0 = no; 1 = yes). Self-worth or self concepts was measured with nine items. For example, statements include: I am usually unhappy with myself (0) or I am usually happy with myself (1). The additive score of the nine items was used, where higher scores indicating higher levels of self-worth. Cronbach's alpha for the construct was 0.58. Hopelessness was measured with six items. Participants were asked if they agree or disagree with each statement; for example, all I see ahead of me are bad things, not good things (0 = disagree; 1 = agree). The summative score of the six items was used as an index of hopelessness with higher scores indicating higher level of hopelessness. Cronbach's alpha for the scale was 0.69.

Data Analysis

GMM was used to examine pathways of antisocial behavior over time. The GMM approach allows for unobserved heterogeneity in the sample; that is, different classes of individuals have class-specific population distributions (Muthén, 2001). GMM takes an approach of finite mixture models, which assume that the population of interest consists of unobserved heterogeneous subpopulations (Nagin, 1999). The GMM procedure classifies the entire population into several distinct subpopulation-specific trajectories based on the principle of a maximum likelihood technique using the expectation maximization algorithm (Hipp & Bauer, 2006; Muthén & Shedden, 1999). Our model setting of GMM with predictors and a distal outcome is shown in Figure 1.

We started with a one cluster solution (i.e., under the assumption that the population is homogeneous) and increased the number of classes up to five. The best cluster solutions may be achieved with low Bayesian information criterion (BIC) values, and high entropy across clusters (Muthén & Muthén, 1998-2007; Muthén & Muthén, 2000). The entropy measure provides an index of the classification quality. Entropy values range from zero to one; clear classification is obtained as they become closer to one.

In selecting the number of classes, we also used the bootstrap likelihood ratio test (BLRT), which compares the current model (the alternative hypothesis) and the model with one less class (the null hypothesis). Nylund et al. (2007) shows the superior performance of BLRT to other methods in a simulation study. Another consideration for determining the number of clusters was to evaluate the classification quality through examining the posterior probabilities (Muthén & Muthén, 2000). The matrix of average posterior probabilities (range from zero to one) summarizes information on the conditional probabilities for cases to be in their respective class. Classification quality is good when diagonal values are high and off-diagonal values are low. The GMM procedure to find optimal solutions was done using Mplus 5.2. Logistic regression was used to test for predictor effects on class membership.

Missing values—In testing GMM models, the Mplus software program uses full-information maximum-likelihood estimation under the assumption that the data were missing at random (i.e., the probabilities of the missing values can be predicted by variables that are not missing, but not by variables that are missing). That is, the procedure estimated the parameters using all observations available at each time point. In following antisocial behavior overtime, 21.0 % of the participants had no missing values; 26.1% had missing 1 time; 23.5% had missing 2 times, 18.6% had missing 3 times; and 10.8% had missing 4 times. We examined the covariance coverage matrix in Mplus output to decide whether the data provided adequate information. The coverage ranged from 0.41 to 0.92 in our study which exceeded the minimum coverage of 0.10 necessary for models to converge (Muthén & Muthén, 1998-2007).

Results

Figure 2 shows the observed pooled means of antisocial behavior over time. The figure suggests that over the six years, antisocial behavior remained steady; this assumes that everyone follows one population distribution. Since this approach does not allow for subgroup differences in the population, we classified the entire group into multiple classes using GMM.

To decide the optimal number of classes, the linear models of one class through five classes were estimated. Table 1 presents the results based on the model-selection criteria. The three-class model had the lowest BIC value whereas the four-class model provided the highest entropy (0.91) followed by the three-class model (0.88). BLRT favored the three-class model over the two-class model and the four-class model over the three-class model. However, the four-class model included a class with a very small number of members (21), which does not provide distinct class characteristics. In consideration of the parsimony of modeling and overall model quality based on evaluation criteria, the three-class model was selected as the final model. Also, the matrix of average conditional probabilities for cases to be in their respective classes in the three-class model had high diagonal values of 0.93, 0.90, and 0.96, indicating good classification quality by this solution.

Figure 3 presents the means weighted by estimated class probabilities of three classes over six years. Three distinct groups were identified considering their trajectories of antisocial behavior. The majority of the adolescents fell into the *low steady* group ($n = 435$, 77%), which maintained antisocial behavior at low levels over six years. The *incremental* group ($n = 86$, 15%) consisted of adolescents whose antisocial behavior was low at age 11 but kept increasing thereafter. Finally, the *high starter* group ($n = 45$, 8%) followed the trajectory that started high at age 11 but decreased to a similar level of the *low steady* group by age 16.

To further understand the profiles of each class obtained, logistic regressions were completed to examine the effects by each predictor on class membership. Considering the high amount of collinearity among predictors, a separate model for each predictor was tested, where the *low steady* group was used as the reference group. Table 2 presents odds ratios and confidence intervals. Membership in the *incremental* group over the *low steady* group was associated with being suspended from school, smoking, and using alcohol/drugs at age 11, even though involvement of antisocial behavior was quite comparable between the two groups. The membership of the *high starter* group compared to the *low steady* group was related to poorer parental behavioral control, school suspensions, smoking, use of alcohol and drugs, and greater feelings of hopelessness at baseline.

To check the predictability of the identified trajectories for later antisocial behavior, the odds ratios of being arrested were obtained using the *low steady* group as the reference group. The odds ratios of being arrested was 9.77 ($p = 0.001$) for the *incremental* group and 2.14 ($p = 0.015$) for the *high starter* group. That is, the *incremental* group had the highest chance of being arrested later, followed by the *high starter* group, and the *low steady* group had the lowest chance of being arrested.

Discussion

The primary aim of the study was to derive developmental pathways of antisocial behavior in a sample of African American adolescents residing in disadvantaged neighborhoods over the course of six years. The second aim of the study was to identify predictors of different antisocial behavior pathways; finally, the study also examined how these pathways were associated with the probability of arrest. This study contributes to understanding trajectories of antisocial behavior among African American adolescents in high risk inner-city neighborhoods. This study examined the developmental trajectories of antisocial behavior using GMM techniques,

which assign class memberships based on patterns in antisocial behavior, predictors, and outcomes.

Patterns of Antisocial Trajectories

We identified three distinctive developmental pathways of antisocial behavior and related these pathways to arrest during middle adolescence (ages 14-16 years). The majority of the participants (77%) in the study belonged to the *low steady* group. This group had a substantially lower risk of being arrested at later ages compared to both *incremental* and *high starter* groups. The *low steady* group resembles the steady group identified by Park et al. (2008); it is also similar to chronic minor offenders or non-offenders described by Gorman-Smith et al. (1998, 2000). Parallel to our findings, previous studies have also found associations between low levels of aggression during the developmental process and low rates of later antisocial involvement (e.g., Broidy et al., 2003; Schaeffer et al., 2003).

The *incremental* group (15%) we identified consisted of adolescents whose antisocial behavior was slightly higher than that of youth in the *low steady* group at age 11, but the rate of antisocial behavior accelerated over next five years compared to the *low steady* group which remained stable. Participants in the *incremental* group had the highest chance of being arrested; the chance of being arrested for the *incremental* group over the *low steady* group was almost ten times higher. The *incremental* group appears to correspond to escalators described by Gorman-Smith et al. (1998, 2000) and by Loeber et al. (1991). Schaeffer et al. (2003) also identified the increasing group in aggressive behavior among children from kindergarten to 7th grades and described them as the life-course-persistent group, the child-onset type (Loeber & Stouthamer-Loeber, 1998). However, children in Schaeffer et al.'s study showed aggressive behavior at much earlier ages throughout elementary and middle schools. Thus, it is plausible that participants of the incremental group follow later starters or adolescent onset patterns as identified by Moffitt (1993) and Patterson et al. (1998). Nevertheless, the *incremental* group appears to be the high-risk group and to benefit most from potential prevention efforts.

The *high starter* group consisted of a small number of participants (8%) and was characterized by strong involvement in antisocial behavior at age 11 and by a decreasing trend thereafter. At age 16, the level of antisocial involvement of the *high starter* group was equivalent to that of *low steady* group. The probability of being arrested for the *high starter* group was significantly lower than that of the *incremental* group; however, adolescents in the *high starter* group were twice as likely to get arrested as youth in the *low steady* group. The *high starter* group resembles desistors or de-escalators identified by Loeber et al. (1991) and a high-but-desisting aggression group found in studies on high risk children by Broidy et al. (2003).

There was no evidence in this study of chronic high or moderate groups (cf., Broidy et al., 2003; Gorman-Smith et al., 1998; Loeber et al., 1991; Schaeffer et al., 2003). A possible explanation is that the current study measures more severe forms of delinquent or antisocial behaviors as compared to other studies. Thus, parts of the largest group in our study, *low steady*, might be differentiated into a moderate group using measures of less serious forms of antisocial behavior. In addition, the *incremental* group might include chronic high offenders if we could expand the age span beyond age 16.

Risk Factors

Various risk factors were associated with class memberships. Adolescents in the *incremental* group were twice as likely to have been suspended from school and to have smoked at age 11 compared to youth in the *low steady* group. In addition, the *incremental* group was at high risk of involvement in alcohol and drug use. Other studies suggest that correlates of escalation of antisocial behavior included low educational achievement and low school motivation (Loeber

et al., 1991) and that use of alcohol or other substances was associated with a long-term pattern of delinquent behavior (Farrell et al., 2005). It is noteworthy that parental behavioral control and individual factors such as self concepts and hopelessness did not influence the differentiation of the *incremental* group from the *low steady* group. Although family characteristics and individual factors have been valid predictors of antisocial behavior, the evidence also suggests that adolescents who are seriously involved in antisocial behavior are very vulnerable to the influences by deviant peers (Patterson et al., 1998; Schaeffer et al. 2003; Tolan et al., 2003). Risk factors such as suspension from school and substance use are likely to accelerate associations with deviant peers. It is important to note, however, that this interpretation is tentative because variables on peer relations were not included in our model.

The *high starter* group was highly associated with most of the risk factors, including poor parental behavioral control, suspension from school, smoking behavior, use of alcohol and drugs, and feeling of hopelessness at age 11. The results resonate with previous research findings in terms of strong associations of antisocial behavior with family monitoring (Dekovic et al., 2003; Gorman-Smith et al., 2000; Patterson et al., 1989), substance involvement (Clark et al., 2002; Friedman, 1998; Rainone et al., 2006), school involvement (Walker & Sprague, 1999), and individual factors such as poor self concept and hopelessness (Bolland et al., 2003; Guerra et al., 1995). Although these constellations of risk factors were linked to unusually high level of antisocial involvement at age 11, frequency of antisocial behavior for the *high starter* group significantly decreased over six years. It is difficult to comprehend how adolescents with various risk factors in the *high starter* group leveled to those youth in the *low steady* group at age 16. A possible explanation is that adolescents in the *high starter* group might have been engaged in early-onset, antisocial behavior in childhood and gradually desist from antisocial involvement during the adolescence period; this phenomenon has been observed in other studies (Broidy et al., 2003; Loeber et al., 1991).

Limitations of the Study and Future Research

This study has several limitations to be considered in interpreting findings. First, self-reports used in the survey may question response validity. Although research staff have been trained to assure accurate responses from the participants, we cannot rule out the possibility of response biases such as social desirability bias. For example, participants might have underreported antisocial behaviors that would be considered socially undesirable behavior possibly causing an inflation of the *low steady* group. Second, internal consistencies of some predictor variables are undesirably low. Third, because this study examined adolescents between the ages 11 and 16, the antisocial behavior trajectories before and after the time periods are largely unknown. This limitation presents a problem in identifying trajectories that can span from childhood through young adulthood (e.g., adolescence-limited and life-course-persistent patterns). Fourth, our study includes African American youth who come from economically distressed inner-city neighborhoods. Although findings of this study provide insights on understanding developmental trajectories of high risk samples, results may not be generalizable to the general youth population. Finally, although we have not explicitly explored in this study, what may be considered antisocial behaviors in some contexts may be adaptive behaviors in other contexts. The jury is still out on whether adolescents carry weapons for offensive purposes (e.g., Webster, Gainer, & Champion, 1993), for defensive purposes (e.g., Arria, Borges, & Anthony, 1997; Molnar, Gortmaker, Bull, & Buka, 2004), or for both purposes (e.g., Hemenway, Prothrow-Stith, Bergstein, Ander, & Kennedy, 1996). But in the MYS neighborhoods, where approximately 20% of adolescents report that they had carried a weapon at least one time during the previous week, the potential for weapon carrying as a defensive behavior must at least be considered. Moreover, Anderson (1999) argues that the "code of the streets" demands that youth in underclass neighborhoods engage in violent behavior as a way of minimizing their risk of future victimization.

To fully test theoretical and statistical modeling of pathways in antisocial behavior, more studies that span a wide range of ages are needed. For example, Patterson et al. (1998) followed children at ages 9-10 through age 18 years old to describe an early-onset trajectory of antisocial behavior. However, the start age could be as early as 17 months to observe a full spectrum of development in antisocial behavior (Patterson & Yoerger, 2002). To examine late-onset trajectory of antisocial behavior, children may be followed from late childhood through adulthood. With a wider age range, the pathways of antisocial behavior, especially the *incremental* and *high starter* groups, in our study could have a more explanatory power.

Future research also needs to examine pathways in antisocial behavior across diverse racial and gender groups. For example, we had a substantial proportion of girls in our study. Although there was no gender difference in the patterns of antisocial behavior trajectories in our study and this finding was consistent with finding from other studies, there are studies that demonstrate gender differences especially in terms of onset and severity of antisocial behavior (Gorman-Smith & Loeber, 2005; Silverthorn & Frick, 1999). With a larger sample size, gender differences may be tested systematically.

As described earlier, adolescents in the incremental group need some special attention in preventing them from being involved with antisocial behavior and possible criminal activity. The group has increased their antisocial behaviors steadily over six years and had the highest rate of being arrested. The risk factors such as school suspension and substance use may be incorporated in screening adolescents at risk as early as when children are in elementary school. Associations with the deviant peer group may be included in future research in examining antisocial behavior trajectories and in the prevention efforts.

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References

- Anderson, E. Code of the street: Decency, violence, and the moral life of the inner. Norton; city. New York: 1999.
- Arria A, Borges G, Anthony JC. Fears and other suspected risk factors for carrying lethal weapons among urban youths of middle-school age. Archives of Pediatrics & Adolescent Medicine 1997;151(6):555–560. [PubMed: 9193237]
- Bolland JM. Hopelessness and risk behavior among adolescents living in high-poverty inner-city neighborhoods. Journal of Adolescence 2003;26:145–158. [PubMed: 12581723]
- Bolland, JM. Overview of the Mobile Youth Study. The University of Alabama, Institute for Social Science Research; Tuscaloosa, AL: 2004.
- Bolland JM, Bryant CM, Lian BE, McCallum DM, Vazsonyi AT, Barth JM. Development and risk behavior among African American, Caucasian, and mixed-race adolescents living in high poverty inner-city neighborhoods. American Journal of Community Psychology 2007;40(34):230–249. [PubMed: 17932741]
- Bolland JM, MaCallum DM, Lian B, Bailey CJ, Rowan P. Hopelessness and violence among inner-city youths. Maternal and Child Health Journal 2001;5(4):237–244. [PubMed: 11822525]
- Bongers IL, Koot HM, van der Ende J, Verhulst FC. Predicting young adult social functioning from developmental trajectories of externalizing behaviour. Psychological Medicine 2008;38(7):989–999. [PubMed: 18047767]
- Bowditch C. Getting rid of troublemakers: High school disciplinary procedures and the production of dropouts. Social Problems 1993;40:493–507.

- Broidy LM, Nagin DS, Tremblay RE, Bates JE, Brame B, Dodge KA, et al. Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: A six-site, cross-national study. *Developmental Psychology* 2003;39(2):222–245. [PubMed: 12661883]
- Clark DB, Vanyukov M, Cornelius J. Childhood antisocial behavior and adolescent alcohol use disorders. *Alcohol Research and Health* 2002;26(2):109–116.
- Costenbader V, Markson S. School suspension: A study with secondary school students. *Journal of School Psychology* 1998;36(1):59–82.
- Dekovic M, Janssens JM, Van As NM. Family predictors of antisocial behavior in adolescence. *Family Process* 2003;42(2):223–235. [PubMed: 12879595]
- DuRant RH, Cadenhead C, Pendergrast RA, Slavens G, Linder CW. Factors associated with the use of violence among urban black adolescents. *American Journal of Public Health* 1994;84(4):612–617. [PubMed: 8154565]
- Farrell AD, Sullivan TN, Esposito LE, Meyer AL, Valois RF. A latent growth curve analysis of the structure of aggression, drug use, and delinquent behaviors and their interrelations over time in urban and rural adolescents. *Journal of Research on Adolescence* 2005;15(2):179–204.
- Friedman AS. Substance use/abuse as a predictor to illegal and violent behavior: A review of the relevant literature. *Aggression and Violent Behavior* 1998;3(4):339–355.
- Gordon RA, Lahey BB, Kawai E, Loeber R, Stouthamer-Loeber M, Farrington DP. Antisocial behavior and youth gang membership: Selection and socialization. *Criminology* 2004;42(1):55–87.
- Gorman-Smith D, Loeber R. Are developmental pathways in disruptive behaviors the same for girls and boys? *Journal of Child and Family Studies* 2005;14(1):15–27.
- Gorman-Smith D, Tolan PH, Loeber R, Henry DB. The relation of family problems to patterns of delinquent involvement among urban youth. *Journal of Abnormal Child Psychology* 1998;26(5):319–333. [PubMed: 9826291]
- Gorman-Smith D, Tolan PH, Henry DB. A developmental-ecological model of the relation of family functioning to patterns of delinquency. *Journal of Quantitative Criminology* 2000;16(2):169–198.
- Guerra ND, Huesmann LR, Tolan PH, Van Acker R, Eron LD. Stressful events and individual beliefs as correlates of economic disadvantage and aggression among urban children. *Journal of Consulting and Clinical Psychology* 1995;63(4):518–528. [PubMed: 7673529]
- Hemenway D, Prothrow-Stith D, Bergstein JM, Ander R, Kennedy BP. Gun Carrying among Adolescents. *Law and Contemporary Problems* 1996;59(1):39–53.
- Huesmann LR, Eron LD, Dubow EF. Childhood predictors of adult criminality: Are all risk factors reflected in childhood aggressiveness? *Criminal Behaviour and Mental Health* 2002;12:185–208. [PubMed: 12830312]
- Hipp JR, Bauer DJ. Local solutions in the estimation of growth mixture models. *Psychological Methods* 2006;11:36–53. [PubMed: 16594766]
- Laird RD, Criss MM, Pettit GS, Dodge KA, Bates JE. Parents' monitoring knowledge attenuates the link between antisocial friends and adolescent delinquent behavior. *Journal of Abnormal Child Psychology* 2008;36(3):299–310. [PubMed: 17874291]
- Le Blanc M, Kaspy N. Trajectories of delinquency and problem behavior: Comparison of social and personal control characteristics of adjudicated boys on synchronous and nonsynchronous paths. *Journal of Quantitative Criminology* 1998;14(2):181–214.
- Loeber R, Stouthamer-Loeber M. Development of juvenile aggression and violence: Some common misconceptions and controversies. *American Psychologist* 1998;53:242–259. [PubMed: 9491750]
- Loeber R, Stouthamer-Loeber M, Van Kammen WB, Farrington DP. Initiation, escalation and desistance in juvenile offending and their correlates. *The Journal of Criminal Law & Criminology* 1991;82(1):36–82.
- Loeber R, Wung P, Keenan K, Girsou B, Stouthamer-Loeber M, Van Kammen WB, et al. Developmental pathways in disruptive child behavior. *Development and Psychopathology* 1993;5:103–133.
- Moffitt T. Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review* 1993;100(4):674–701. [PubMed: 8255953]
- Molnar BE, Gortmaker SL, Bull FC, Buka SL. Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. *American Journal of Health Promotion* 2004;18(5):378–386. [PubMed: 15163139]

- Morrison GM, D'Incau B, Couto E, Loose S. Understanding pathways to student expulsion: Consideration of individual and system indicators. *California School Psychologist* 1997;2:53–61.
- Muthén, BO. Latent variable mixture modeling. In: Marcoulides, GA.; Schumacker, RE., editors. *New developments and techniques in structural equation modeling*. Lawrence Erlbaum Associates; Mahwah, NJ: 2001. p. 1-33.
- Muthén, LK.; Muthén, BO. *Mplus user's guide*. 5th ed.. Muthén & Muthén; Los Angeles, CA: 1998/2007.
- Muthén BO, Muthén LK. Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research* 2000;24(6):882–891.
- Muthén BO, Shedden K. Finite mixture modeling with mixture outcomes using the EM algorithm. *Biometrics* 1999;55:463–469. [PubMed: 11318201]
- Nagin DS. Analyzing developmental trajectories: A semiparametric group-based approach. *Psychological Methods* 1999;4(2):139–157.
- Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling: A Multidisciplinary Journal* 2007;14(4):535–569.
- Park NS, Lee BS, Bolland JM, Vazsonyi AT, Sun F. Early adolescent pathways of antisocial behaviors in poor, inner-city neighborhoods. *The Journal of Early Adolescence* 2008;28(2):185–205.
- Patterson GR, DeBaryshe BD, Ramsey E. A developmental perspective on antisocial behavior. *American Psychologist* 1989;44(2):329–335. [PubMed: 2653143]
- Patterson GR, Forgatch MS, Yoerger K, Stoolmiller M. Variables that initiate and maintain an early-onset trajectory for juvenile offending. *Development and Psychopathology* 1998;10:541–547.
- Patterson, GR.; Yoerger, K. A developmental model for early- and late-onset delinquency. In: Reid, JB.; Patterson, GR.; Snyder, J., editors. *Antisocial behavior in children and adolescents: A developmental analysis and model for intervention*. American Psychological Association; Washington, DC: 2002. p. 147-172.
- Piquero AR, Chung HL. On the relationships between gender, early onset, and the seriousness of offending. *Journal of Criminal Justice* 2001;29(3):189–206.
- Raffaele Mendez LM, Knoff HM, Ferron JM. School demographic variables and out-of-school suspension rates: A quantitative and qualitative analysis of a large, ethnically diverse school district. *Psychology in the Schools* 2002;39(3):259–277.
- Rainone GA, Schmeidler JW, Frank B, Smith RB. Violent behavior, substance use, and other delinquent behaviors among middle and high school students. *Violence and Juvenile Justice* 2006;4:247–265.
- Schaeffer CM, Petras H, Ialongo N, Poduska J, Kellam S. Modeling growth in boys' aggressive behavior across elementary school: Links to later criminal involvement, conduct disorder, and antisocial personality disorder. *Developmental Psychology* 2003;39(6):1020–1035. [PubMed: 14584982]
- Seidman E, Yoshikawa H, Roberts A, Chesir-Teran D, Allen L, Friedman JL, et al. Structural and experiential neighborhood contexts, developmental stage, and antisocial behavior among urban adolescents in poverty. *Development and Psychopathology* 1998;10(2):259–281. [PubMed: 9635224]
- Silverthorn P, Frick PJ. Developmental pathways to antisocial behavior: The delayed-onset pathway in girls. *Development and Psychopathology* 1999;11:101–126. [PubMed: 10208358]
- Sinclair, B. Report on state implementation of the Gun-Free Schools Act: School year 1997-98. Westat; Rockville, MD: 1999.
- Spano R, Rivera C, Bolland J. The impact of timing of exposure to violence on violent behavior in a high poverty sample of inner city African American youth. *Journal of Youth and Adolescence* 2006;35(5):681–692.
- Spano R, Rivera C, Vazsonyi AT, Bolland JM. The impact of exposure to violence on a trajectory of (declining) parental monitoring: A partial test of the ecological--transactional model of community violence. *Criminal Justice and Behavior* 2008;35(11):1411–1428.
- Strand PS. Treating antisocial behavior: A context for substance abuse prevention. *Clinical Psychology Review* 2002;22:707–728. [PubMed: 12113202]
- Tolan PH, Gorman-Smith D, Henry DB. The developmental ecology of urban males' youth violence. *Developmental Psychology* 2003;39(2):274–291. [PubMed: 12661886]

- U.S. Census Bureau. 2002 Census. 2002. Retrieved Dec 10, 2004, from <http://www.census.gov>
- Walker HM, Sprague JR. The path to school failure, delinquency, and violence: Causal factors and some potential solutions. *Intervention in School and Clinic* 1999;35:67–73.
- Walker SC, Maxson C, Newcomb MN. Parenting as a moderator of minority, adolescent victimization and violent behavior in high-risk neighborhoods. *Violence and Victims* 2007;22(3):304–317. [PubMed: 17619636]
- Webster DW, Gainer PS, Champion HR. Weapon carrying among inner- city junior high school students: Defensive behavior vs aggressive delinquency. *American Journal of Public Health* 1993;83(11): 1604–1608. [PubMed: 8238686]
- Wiesner M, Silbereisen RK, Weichold K. Effects of deviant peer association on adolescent alcohol consumption: A growth mixture modeling analysis. *Journal of Youth and Adolescence* 2008;37(5): 537–551.

Figure 1.

Growth Mixture Model with Predictors and a Distal Outcome

Note. y1 – y6 are antisocial behaviors from age 11 to age 16. A linear function, which consists of an intercept and a slope, is used as the functional form of the longitudinal trajectories.

Predictors contribute to classifying the trajectories. A distal outcome is predicted by the class which the individual belongs to.

Figure 2.
Observed Means of Antisocial Behavior (N = 566)

Figure 3.
Antisocial Behavior Means Weighted by Estimated Class Probabilities (N = 566)

Table 1

Model Selection Criteria

Model	BIC	Entropy	BLRT ($H_0 = k - 1$ classes)
1 class	11,235.87	N/A	N/A
2 classes	11,087.34	0.85	$p < 0.0001$
3 classes	11,044.40	0.88	$p < 0.0001$
4 classes	11,053.24	0.91	$p < 0.0001$
5 classes	11,102.21	0.87	$p = 0.43$

Table 2

Association between Predictors and Class Membership

Predictor	Incremental		High Starter	
	Odds Ratio	95% C.I.	Odds Ratio	95% C.I.
Family Factor				
Parental behavioral control	1.11	0.91 – 1.34	1.30*	1.00 – 1.68
School Factors				
Suspension	2.37**	1.48 – 3.80	3.56**	1.89 – 6.69
Expulsion	1.99	0.93 – 4.28	1.08	0.31 – 3.71
Individual Factors				
Smoke	2.25**	1.32 – 3.84	2.23*	1.11 – 4.47
Alcohol/Drug	7.33**	2.48 – 21.72	89.37**	32.96 – 242.32
Self-worth	0.93	0.82 – 1.04	0.86	0.74 – 1.01
Hopelessness	0.97	0.85 – 1.12	1.54**	1.28 – 1.84

Note. Odds ratios are relative to the *low steady* group.

* $p < .05$;

** $p < .01$.