Trajectories of aggression, delinquency, and substance use across middle school among urban, minority adolescents

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Abstract:

This study evaluated bidirectional associations between substance use, aggression, and delinquency across sixth, seventh, and eighth grades using data available from a large study of urban minority youth (n = 2,931). Group-based trajectory analysis revealed trajectories of aggression, delinquency, and substance use which support the existence of both adolescent-limited and life-course persistent offenders. In addition, a pattern of decreasing aggression was observed during middle school. Clear temporal associations were observed between developmental changes in aggression, delinquency, and substance use. Notably, the decreasing aggression trajectory was as likely to be associated with high trajectories of substance initiation as was the high aggression trajectory. Furthermore, trajectories of delinquency were differentially associated with future substance use; however, substance use trajectories did not predict trajectories of delinquency. There were few gender differences in the developmental progression of these problem behaviors during middle school with only two exceptions, males were more likely to follow a trajectory of decreasing aggression and a trajectory of high stable delinquency. Evaluations of ethnic/racial differences in the trajectory group membership also revealed few differences. The results of this study provide important information regarding interconnections between developmental changes in problem behavior that occur during the middle school years, highlighting groups that may be missed via traditional analytic approaches that predict mean changes.

Keywords: Adolescents | Middle school | Behavior | Substance use | Delinquency | Aggression

Article:

INTRODUCTION

Understanding interconnections between the onset of substance use and aggressive and delinquent behavior during adolescence is critical to promoting a healthy transition from adolescence into adulthood. For instance, carrying a weapon, being involved in physical fights, tobacco use, alcohol use, binge drinking, marijuana use, and other drug use during adolescence contribute to unintentional injury and violence during adolescence, and also contribute to motor vehicle crashes, homicide, suicide, cardiovascular disease, and cancer throughout adulthood [Centers for Disease Control and Prevention [CDC], 2010]. Furthermore, it has been widely acknowledged that the prevention and treatment of adolescent substance use benefits from consideration of other types of problem behaviors in adolescence, such as aggression and delinquency [Newcomb, 1997].

Aggression commonly refers to acts intended to cause harm to others [Dodge et al., 2006], whereas delinquent behavior is typically defined as any behavior which is considered a criminal offense if committed by an adult [Dishion and Patterson, 2006]. Although aggression and delinquency are both forms of externalizing behavior problems, they are conceptually distinct constructs. Delinquency is generally considered more severe and encompasses both violent and nonviolent criminal offenses (e.g. theft, assault, etc.). Aggressive behavior is not necessarily illegal but, as noted, is intended to cause harm (e.g. insulting, shoving, etc.).

Theoretical Perspectives Relevant to Trajectories of Problem Behavior

Moffitt's theory of adolescent-limited vs. life-course persistent antisocial behavior highlights the importance of determining the existence of different subgroups of individuals within the population who follow similar trajectories of a specific problem behavior [Moffitt, 2006; Moffitt et al., 2001]. The identification of these subgroups of individuals is important, because different patterns of change in a behavior may have different antecedents or associations with risk for engagement in future problem behaviors. More recent studies have employed advanced statistical methodology with the capability of identifying latent subgroups of individuals following distinct patterns of change in a particular behavior over time, based on data rather than simply creating subgroups of individuals based on theory alone [Nagin, 2005]. This methodology has allowed the verification and expansion of current theories by confirming the existence of theorized subgroups while simultaneously identifying unique subgroups of individuals not anticipated by theory.

Current research is limited in that most studies have evaluated patterns of change for single problem behaviors, rather than looking for associations between patterns of change in multiple problem behaviors. Jessor's problem behavior theory [1987] highlights the importance of evaluating commonalties between a variety of problem behaviors to aid in the identification of psychological, social, and behavioral influences on problem behaviors. However, the question of the directionality of effects is an important issue to try and disentangle to further understand the development of these problem behaviors and establish age appropriate intervention techniques.

Informed by both Jessor's problem behavior theory and Moffitt's adolescent-limited vs. life-course persistent theory, this study evaluated subgroups within the population that followed distinct developmental trajectories of multiple problem behaviors across middle school. Bidirectional associations between the subgroups of aggression, delinquency, and substance use were evaluated to provide a richer understanding of associations between these three problem behaviors in adolescence.

Interconnections Between Problem Behaviors in Early Adolescence

Clearly, there are some individuals who engage in only one form of problem behavior (e.g. delinquent or criminal behavior). In line with these individuals, most research that has evaluated problem behaviors either examined only one form of problem behavior or problem behaviors were combined into a single construct of general deviance a priori. However, adolescents who are engaging in multiple problem behaviors represent a significant subgroup of individuals at higher risk for continued problems in adulthood. A few studies have specifically examined the predictive role of aggression or delinquency on substance use initiation in early adolescence, and have found that higher average levels of aggressive or delinquent behavior were associated with higher levels of substance use among both females and males [Brook et al., 1986; Farrell et al., 2005; Tiet et al., 2001]. Tiet et al. [2001] found that 51% of youth with pervasive conduct problems (five or more) reported high levels of substance use compared with 11% of youth without pervasive conduct problems. In addition, Tiet et al. [2001] reported evidence of a gender paradox, such that girls were found to have lower conduct problems overall; however, a greater proportion of females (19%) reported pervasive conduct problems compared with males (9%). Farrell et al. [2005] found that while females had lower initial rates of substance use, aggression, and delinquency, there were no differences by gender in pattern or rates of change for any of the problem behaviors across middle school. In addition, a general problem behavior factor did not account for the data as well as the models evaluating direct effects between separate problem behaviors. Lillehoj et al. [2005] found no gender differences in aggression, disobedience, and misconduct among a sample of rural seventh graders; however, males did report higher levels of substance initiation in the seventh grade compared with females. Among both genders, aggression, disobedience, and misconduct predicted initiation of substance use but not change in substance use over time.

Many of the studies that have evaluated associations between aggression, delinquency, and substance use were limited in that they evaluated associations between average changes in these constructs across time despite theoretical support for the existence of distinct patterns of change in these constructs among subgroups of individuals within the population [Moffitt et al., 2001]. More recent work has provided new insights into interconnections between trajectories of aggression, delinquency, and substance use among subgroups. For example, Nagin et al. [2008] evaluated joint trajectories of childhood aggression with subsequent adolescent delinquency among males. Individuals who followed a high trajectory of childhood aggression had the highest probability of also following a high trajectory of delinquency in adolescence. The results

of this study largely supported continuity in behavior over time but did find support for discontinuity as well.

This Study

Although numerous studies have evaluated substance initiation and use as well as increases in rates of aggression and delinquency during the middle school years, interconnections between these factors have not systematically been evaluated longitudinally in a large sample of urban, minority adolescents. Studies have shown that rates of aggression and delinquency begin to increase earlier than rates of drug use and co-occurrence of these behaviors is often reported [Dodge et al., 2006; Mayes and Suchman, 2006]. However, the temporal associations among these factors and individual differences in these pathways have yet to be fully evaluated. This study was a descriptive analysis of group-based trajectories of aggression, delinquency, and substance use, as well as interconnections between these trajectories during early adolescence in a longitudinal sample of ethnically diverse females and males.

The study had two primary aims. The first aim examined group-based patterns of change for aggression, delinquency, and substance use over three assessments in early adolescence. The second aim evaluated interconnections between patterns of change for aggression, delinquency, and substance use. Moreover, there is substantial evidence indicating that rates of engagement in aggression, delinquency, and substance use differ by gender and race/ethnicity [Dodge et al., 2006; Mayes and Suchman, 2006]. It is, therefore, imperative to examine commonalities as well as differences between genders and among racial/ethnic groups regarding interconnections between aggression, delinquency, and drug use in middle school. Based on previous research, it was expected that significant increases in problem behaviors would be observed. Descriptive evaluations of demographic differences in average levels of problem behaviors as well as trajectories of problem behaviors were also evaluated.

METHODS

Participants

This study is part of a larger randomized clinical trial (RCT), designed to expand and test the effectiveness of an already proven drug prevention strategy on violent and aggressive behavior. Forty-two public and parochial middle schools in New York City participated in the RCT. All schools participated in baseline data collection activities with their sixth grade classes before the intervention and annual surveys in seventh and eighth grades; half the schools (n = 20) received prevention programming for 3 years. Participants in this study were students assigned to the control condition schools (n = 22) of the larger RCT. The control condition completed all the survey assessments, but did not receive any of the life-skills training intervention sessions. The control schools received an information-only intervention. Students were recruited from all classes in a given grade. The only exceptions were English as a second language classes if the survey could not be completed in English. In this study, participants were 2,931 young

adolescents drawn from the control condition of the program evaluation study. In the sixth grade, participants reported a mean age of 11.72 years (*SD* = 0.54) with a range from 9.64 to 14 years. Fifty percent of the sample was female and the sample was largely minority with 48% African American, 30% Latino, 7% White, 5% Asian, and 9% Other (1% did not report race). Just under half the students came from two-parent families (43%), 32% lived with a single parent, and 20% lived in other household structures. Youth were enrolled in public (90%) and parochial (10%) schools. Public and parochial schools were targeted for recruitment from the same geographical regions within the city, resulting in a representative sample of multiethnic, urban youth. Parochial schools are a viable option for lower-income families in New York City. Although a measure of family socioeconomic status was not available, archival school records of participating schools showed that the majority (88%) of schools had greater than 65% student eligibility for free or reduced lunch with no differences by school type across the entire sample.

Procedure

A passive consent procedure approved by Weill Cornell Medical College's Internal Review Board was used to inform parents about the nature of the study and to provide them with an opportunity to disallow their child's participation. Parents and students were told this was a health study to help develop health programs at the school. In the consent form, parents were told in general terms the types of items that would be on the survey (behaviors, attitudes, and beliefs regarding smoking, drinking, and violence). The consent form was both distributed in the schools and mailed directly to students' homes to maximize the probability that guardians received and read the consent document. In addition, a confidentiality certificate from the National Institute of Health was obtained to protect participants from any potential legal action that could be taken against them from admitting to some of the behaviors reported in the survey. There were 477 Negative Consents during the first year of data collection based on the passive consent procedure. Negative assents (or verbal refusals) from the students ranged from 4–68 throughout middle school.

The participants completed a survey which was divided into two booklets and administered over a 2-day period during regular 40 min class periods. A multiethnic team of three to five data collectors administered the questionnaire following a standardized protocol used in previous research [e.g. Botvin et al., 1994]. To ensure the quality of self-report data, identification codes rather than names were used to emphasize the confidential nature of the questionnaire and students were assured about the confidentiality of their responses. Students provided carbon monoxide breath samples from sixth, seventh, and eighth grades to enhance the validity of self-report data utilizing a variant of the bogus pipeline procedure [Evans et al., 1977]. No actual biological specimens were collected; however, this procedure has been shown to enhance the validity of self-report cigarette use as well as other problem behaviors [Tourangeau et al., 1997].

Measures

Demographics

Data concerning the demographic characteristics of the participants were collected using standard survey items concerning gender, age, family structure, and race/ethnicity. For purposes of analyses, a single dichotomous variable was created to capture the type of household structure where 1 indicated living in a two-parent household and 0 indicated all other household configurations. Two dichotomous variables were created to capture participants' race or ethnic affiliation. The first represented participants who were Latino (1) vs. all other participants (0). The second represented participants who were African American (1) vs. all other participants (0). Values of zero on both of these variables represented individuals from all other racial/ethnic groups (White/Caucasian, Asian, American Indian, and Other). A single dichotomous variable was created to indicate if the adolescent was attending a public (1) or a parochial school (0).

Substance use

Survey items assessed frequency of cigarette smoking, drinking alcohol, drinking until drunk, smoking marijuana, smoking marijuana until high or stoned, and using inhalants. Frequency of each item was measured with the following response options: never (0), a few times but not in the past year (1), a few times a year (2), once a month (3), a few times a month (4), once a week (5), a few times a week (6), once a day (7), or more than once a day (8). Owing to the fact that reports of individual substance use are quite low at the initial assessment but increase, this study created a composite sum score of drug use across items for all participants with data for at least four of the items. Sum scores were weighted to account for differences in the number of items used based on missing data per individual. Higher values represented more overall drug use at each grade. Values higher than eight can only be obtained via the use of multiple substances or severe levels of either alcohol or marijuana use. Cronbach's is somewhat low in the sixth grade ($\alpha = .61$), owing to the low reported rates of substance use at this age, but increases to appropriate levels in the seventh ($\alpha = .78$) and eighth ($\alpha = .86$) grades. Previous studies have found composites to be useful, although they do not allow for testing patterns of change in individual substances or gateway models of initiation [Chen and Kandel, 1995; Kandel and Logan, 1984]. This study is not testing gateway models. In addition, as rates of initiation and use were low, the composite measure was more informative.

Aggression

Aggression was assessed via the aggression scale of the Youth Self-Report [YSR; Achenbach, 1991]. Students were asked how many times in the past month they had engaged in ten incidents of overtly aggressive behavior in the sixth grade ($\alpha = .93$), seventh grade ($\alpha = .94$), and eighth grade ($\alpha = .94$). Examples of items included “Yelled at someone (you were mad at),” “Told someone off,” “Pushed or shoved someone on purpose,” and “Hit someone.” Response options included never (1), once (2), 2–3 times (3), 4–5 times (4), and more than 5 times (5). Items were rescored onto a scale of 0–4 and then summed to create a continuous measure where

higher scores indicated greater aggression. The response options were changed from the three-point scale in the YSR to the five-point scale in this study to be consistent with the other measures in the survey.

Delinquency

Students were also asked how many times in the past year they had engaged in ten incidents of delinquent behavior [adapted from Elliott et al., 1989]. The delinquency items tap into severe and illegal behaviors. The same ten items were used in the sixth grade ($\alpha = .86$), seventh grade ($\alpha = .88$), and eighth grade ($\alpha = .90$). Examples of items included "Thrown objects such as rocks or bottles at cars or people," "Hit someone with the idea of seriously hurting them," "Taken something from a person by force (other than just playing around)," "Taken part in a fight where a group of your friends were against another group," "Purposefully damaged or destroyed property or things that did not belong to you," and "Taken something from a store when the clerk wasn't looking." Response options included never (1), once (2), 2–3 times (3), 4–5 times (4), and more than 5 times (5). Items were rescored onto a scale of 0–4, and then summed to create a continuous measure where higher scores indicated greater delinquency.[1]

Analysis Plan

It was expected that change over time or trajectories of aggression, delinquency, and substance use were more important than specific levels of these constructs at any given time of assessment. Although it is possible to assess time points nested within individuals using a multilevel framework, the use of linear growth modeling is an alternative and widely accepted method. Group-based trajectory analysis is a form of linear growth modeling, and as such captures meaningful change over time within individuals while also providing information on how individual trajectories cluster at the population level based on the data. As such, the major research objectives of this study were pursued via advanced methods that assess developmental trajectories for group-based rather than individual growth curves [Nagin, 1999; Nagin and Tremblay, 2001]. This method was used to identify distinctive groups of individual trajectories of aggression, delinquency, and substance use within this sample of multiwave data, addressing the first aim of the study. These initial group-based trajectory analyses determined if there were different patterns of change within each construct. Missing data were accounted for via full information maximum likelihood estimation of the trajectory groups, which used information from all individuals in the sample who provided data for at least one time of assessment across middle school [Nagin, 2005]. As such, all individuals were included in the formation of the group-based trajectories and were assigned to a specific trajectory group class based on their highest posterior probability for each outcome.

The second aim of the study was to evaluate bidirectional or temporal associations between these patterns of change in substance use, aggression, and delinquency, by evaluating the probability that an individual following a particular trajectory for outcome "A" (e.g. aggression) also

followed a particular trajectory on outcome "B" (e.g. delinquency). Joint trajectory analysis allowed for a more thorough examination of bidirectional longitudinal associations between problem behaviors across middle school, by evaluating the probability of substance use trajectory given aggression trajectory as well as the probability of aggression trajectory given substance use trajectory, etc. Demographic differences in trajectory group membership were analyzed.

RESULTS

Descriptive Analysis

There were no significant differences in the percentage of males compared with females among the demographic variables (e.g. household structure and school type) with one exception. There were slightly more African American females (50%) than African American males (46%), $\chi^2(1, N = 2{,}906) = 4.39$, $P = .020$, $\eta^2 = .039$. In addition, there were significant racial/ethnic differences regarding household structure and school type. African American adolescents were less likely to live with two parents in the sixth grade (47%) compared with Latinos (62%) and White/Other adolescents (71%), $\chi^2(2, N = 2{,}879) = 112.50$, $P<.001$, $\eta^2 = .198$. African American and Latino adolescents were also more likely to attend public school as opposed to parochial school (92 and 90%, respectively) compared with White/Other adolescents (86%), $\chi^2(2, N = 2{,}912) = 22.12$, $P<.001$, $\eta^2 = .087$.

Significant increases in aggression $F(2, 3{,}116) = 28.74$, $P<.001$, $\eta^2 = .018$, delinquency $F(2, 3{,}116) = 10.21$, $P<.001$, $\eta^2 = .007$, and substance use $F(2, 3{,}116) = 5.86$, $P = .003$, $\eta^2 = .004$ were observed across middle school for the sample. There were a few differences in average rates of these outcomes between genders and race/ethnicities (see Table I); however, there were no differences in average rates associated with school type. There was a significant interaction between grade and gender for aggression, $F(2, 3{,}116) = 4.99$, $P = .007$, $\eta^2 = .003$. Bonferroni-corrected follow-up tests found that males reported slightly higher rates of aggression compared with females in the sixth grade only ($P = .026$). Males did report significantly higher rates of delinquency compared with females across middle school, $F(1, 1{,}558) = 25.04$, $P<.001$, $\eta^2 = .016$. There were no gender differences in reports of substance use. African American adolescents reported significantly higher levels of aggression $F(2, 1{,}558) = 12.15$, $P<.001$, $\eta^2 = .015$ and delinquency $F(2, 1{,}558) = 6.98$, $P = .001$, $\eta^2 = .009$, compared with Latino and White/Other adolescents. There were no significant racial/ethnic differences in reported rates of substance use. An evaluation of the correlations between the outcomes of interest revealed high positive correlations between aggression and delinquency (rs = .66–.71). Both aggression and delinquency showed moderate positive correlations with substance use (rs = .25–.41).

Table I. Descriptive Information

	Gender	**Race/ethnicity**	

	Males	Females	Black	Latino	White/Other	Total sample
Outcome variables	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Aggression, sixth grade	12.34* (0.39)	11.14* (0.37)	13.27^{a} (0.36)	10.44^{b} (0.49)	11.51^{b} (0.55)	11.74 (0.27)
Aggression, seventh grade	17.40 (0.46)	18.00 (0.44)	19.62^{a} (0.43)	16.61^{b} (0.57)	16.88^{b} (0.64)	17.70 (0.32)
Aggression, eighth grade	19.30 (0.48)	19.68 (0.45)	20.58^{a} (0.44)	18.57^{b} (0.60)	19.32^{b} (0.67)	19.49 (0.33)
Delinquency, sixth grade	4.07*** (0.20)	2.67*** (0.19)	4.03^{a} (0.18)	3.02^{b} (0.25)	3.06^{b} (0.28)	3.37 (0.14)
Delinquency, seventh grade	6.00*** (0.26)	4.76*** (0.24)	6.28^{a} (0.24)	5.12^{b} (0.32)	4.74^{b} (0.36)	5.38 (0.18)
Delinquency, eighth grade	7.17*** (0.30)	5.57*** (0.28)	6.85^{a} (0.28)	6.01^{b} (0.37)	6.25^{b} (0.42)	6.37 (0.21)
Substance use, sixth grade	0.45 (0.04)	0.31 (0.04)	0.38 (0.04)	0.39 (0.05)	0.36 (0.06)	0.38 (0.03)
Substance use, seventh grade	0.80 (0.07)	0.80 (0.07)	0.78 (0.07)	0.91 (0.09)	0.72 (0.10)	0.80 (0.05)
Substance use, eighth grade	1.24 (0.11)	1.34 (0.10)	1.25 (0.10)	1.30 (0.13)	1.32 (0.15)	1.29 (0.07)

$^{*}P<.05$; $^{**}P<.01$; $^{***}P<.001$; Means with the same letter are not statistically different within row.

Group-Based Trajectory Analyses

Group-based trajectory analysis was used to determine the number and shape of trajectories of aggression, delinquency, and substance use for the full sample, as indicated in the first aim of this study.[2] The number of groups identified as most parsimonious and descriptive of the developmental patterns in the data for each outcome was based on maximizing the Bayesian Information Criterion (BIC) score for the outcome of interest. The BIC has been established as an effective criterion for selection of the number of groups which best represent the data in finite mixture models [Nagin, 2005]. BIC is based, in part, on the maximized likelihood function with a penalty based on sample size and the number of parameters estimated to promote parsimony. In cases where the BIC score did not clearly identify a preferred number of groups, model selection was based on domain knowledge and the objectives of the analysis, as recommended by Nagin [2005].

In addition, three diagnostic guidelines for evaluating the adequacy of model fit were employed [Nagin, 2005]. The first guideline is that the average posterior probability (*AvePPj*) must be 0.70 or greater for all groups. This indicates that, on average, the individuals assigned to a particular trajectory group had a 70% or greater probability of belonging to that group based on their individual data. The second diagnostic is the odds of correct classification for group *j* (*OCCj*). The *OCCj* should be 5 or greater for all groups, indicating high accuracy in individual assignment to trajectory groups. Finally, the correspondence between the model estimation of the proportion of the population that follows a particular trajectory group (πj) with the proportion of the sample assigned to a particular trajectory group (*Pj*) provides a third diagnostic. Closer correspondence between these estimates indicates better model fit.

It is important to emphasize that the number of groups selected for each outcome is not immutable and even individuals who are assigned to a particular trajectory group do not necessarily follow that group's trajectory in lockstep. These trajectory groups are meant to serve as a useful heuristic device in describing developmental patterns in the data.

Individuals were classified into trajectory groups for each outcome of interest, based on posterior probability of group membership. Posterior probabilities are estimated for each individual by evaluating their own response data for a particular outcome and determining the probabilities that an individual with that pattern of response over time would belong to each of the trajectory groups for a given outcome. Individuals were classified as belonging to the trajectory group for which they had the highest posterior probability for each outcome. Demographic differences in trajectory group membership were evaluated.

Aggression

Examination of the BIC scores resulted in strong evidence in support of a four-group model of aggression across middle school. Indices of model fit, based on the guidelines described above, indicated excellent model fit (*AvePPj*s>.77, *OCCj*s>5.5). *Pj* did not differ from πj by more than 2 percentage points. The four-group model of aggression during middle school is presented in Figure 1. The assessment of aggression used in this study was a sum score of self-reported engagement in aggressive behaviors over the past month. As such, the numeric value represented on the *y*-axis refers to discrete numbers of aggressive acts over the past month. See Table II for average levels of aggressive behavior within each trajectory group.

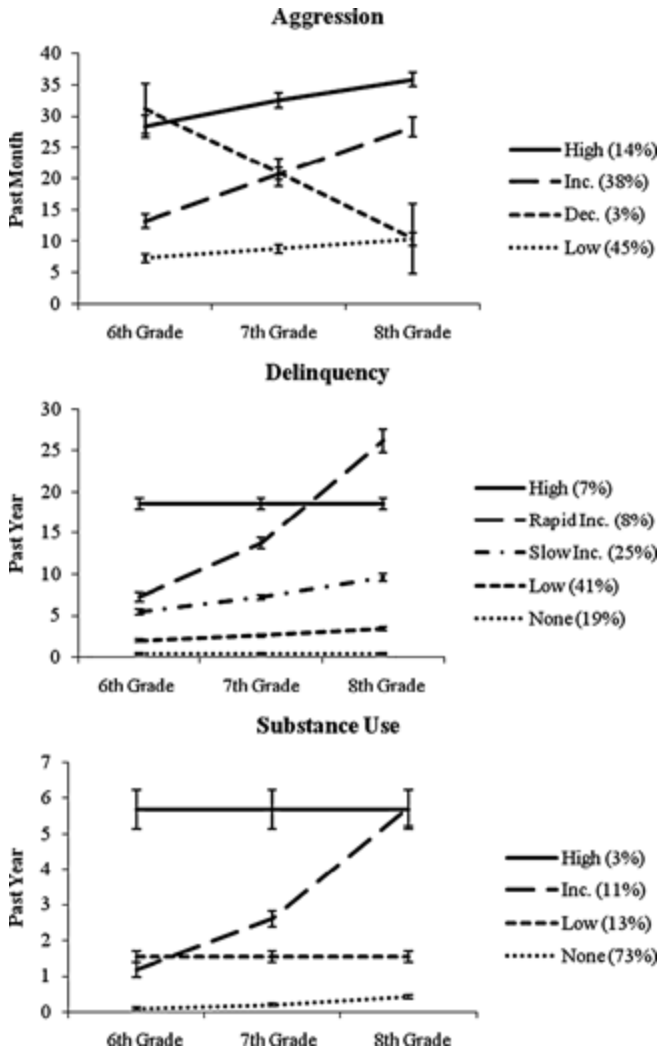

Figure 1. Predicted trajectory models of aggression, delinquency, and substance use with 95% confidence intervals. Inc., increasing; Dec., decreasing.

Table II. Descriptive Statistics Within Aggression Trajectory Group

	Aggression trajectory group				
	Low (*n* = 1,376)	**Inc. (*n* = 1,075)**	**Dec. (*n* = 58)**	**High (*n* = 422)**	**Total sample**
Demographic variables					
Gender (% female)**	52%	51%	31%	46%	50%
% African American***	42%	51%	60%	61%	48%

% Latino***	35%	28%	19%	21%	30%
% Living with two parents***	61%	54%	46%	49%	56%
School type (% public)**	91%	88%	85%	93%	90%
Aggression variables	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Sixth grade	5.89 (5.21)	13.02 (7.02)	33.25 (5.58)	29.74 (7.15)	12.54 (10.54)
Seventh grade	8.88 (6.89)	23.73 (8.37)	22.13 (12.79)	34.64 (5.67)	18.98 (12.08)
Eighth grade	9.35 (6.83)	27.46 (7.31)	7.98 (7.35)	35.38 (5.44)	19.39 (12.42)

*P<.05; **P<.01; ***P<.001; Inc., increasing; Dec., decreasing.

There was a consistently low group (n = 1,376, 47% of the sample); this group displayed very low levels of aggression across the middle school years. There was an increasing group (n = 1,075, 37% of the sample); this group began with levels of aggression which were only slightly higher than the consistently low group in the sixth grade. However, over seventh and eighth grades, the increasing group roughly doubled their reports of engagement in aggressive behaviors. A chronic highly aggressive group of individuals was identified (n = 422, 14% of the sample); these individuals reported high levels of aggression in all 3 years. Finally, a small group of individuals evinced a decreasing pattern of aggression across middle school (n = 58, 2% of the sample); these individuals reported sixth grade levels of aggressive behavior comparable to the chronic aggression group, but subsequently dropped in their reports of aggressive behavior across middle school to levels comparable to the consistently low aggression group in the eighth grade.

In addition, there were significant demographic differences found among individuals following different trajectories of aggressive behavior during middle school. As shown in Table II, there were significantly fewer females who followed a trajectory of decreasing aggression across middle school, $\chi^2(3, N = 2{,}915) = 13.03$, $P = .005$, $\eta^2 = .067$. There were significantly more African American adolescents, $\chi^2(3, N = 2{,}912) = 55.84$, $P<.001$, $\eta^2 = .138$, who followed a trajectory of decreasing or high aggression and significantly fewer Latinos, $\chi^2(3, N = 2{,}912) = 38.16$, $P<.001$, $\eta^2 = .114$, following those same trajectories. Furthermore, adolescents in the decreasing and high trajectory groups were less likely to live in a two-parent household in the sixth grade, $\chi^2(3, N = 2{,}882) = 26.57$, $P<.001$, $\eta^2 = .096$. Individuals who followed a decreasing

trajectory of aggression were less likely to attend public school, $\chi^2(3,N = 2,931) = 14.22$, $P = .003$, $\eta^2 = .070$.

Delinquency

Examination of the BIC scores did not produce conclusive results regarding the optimal number of delinquency trajectory groups. As discussed previously, for some constructs, the BIC score cannot be used to determine the best fitting model because the score continues to rise with the addition of more groups. As such, a five-group model for the delinquency construct was selected as the best fitting model, based on maximizing parsimony without sacrificing meaningful variation in developmental trajectories. Models with fewer groups did not fully capture the rich trends in the data, whereas models with more groups did not continue to add any new meaningful developmental patterns of delinquency across middle school. Furthermore, all three diagnostic guidelines indicated that the five-group model of delinquency fit the data well (*AvePPj*s>.74, *OCCj*s>7.6). *Pj* did not differ from πj by more than 3 percentage points.

The final trajectory model of delinquency across the middle school years is presented in Figure 1. Self-reported delinquent acts over the past year were summed for each adolescent, and as such the numeric values represented on the y-axis refer to individual acts of delinquency over the past year. There were two consistently low groups: one reported no delinquency across middle school (*n* = 642, 22% of the sample) while the other reported consistently low levels of delinquency (*n* = 1,188, 40% of the sample). Notably, these two groups comprise 62% of the sample, indicating that most youth engage in no or very few delinquent acts during early adolescence. A chronic, highly delinquent group of individuals were identified (*n* = 194, 7% of the sample). These individuals reported high levels of delinquency in all three years. There were also two groups with increasing levels of delinquency across middle school. One increased more slowly (*n* = 701, 24% of the sample) while the other evinced rapid increases in delinquency (*n* = 206, 7% of the sample). The slowly increasing delinquency group began with low levels of delinquency in the sixth grade, which approximately doubled across middle school to moderate levels. In contrast, the rapidly increasing group had delinquency levels that subsequently quadrupled to be comparable to the chronically high delinquent group by the eighth grade.

There were significant gender and racial/ethnic differences found for delinquency trajectory group membership. As can be seen in Table III, there was a slightly higher percentage of females in the two lower delinquency trajectory groups. However, the high delinquency group showed significantly fewer females than all of the other groups, $\chi^2(4,N = 2,915) = 84.79$, $P<.001$, $\eta^2 = .171$. In addition, there were significantly more African American adolescents who followed a trajectory of rapidly increasing or high delinquency, $\chi^2(4, N = 2,912) = 52.69$, $P<.001$, $\eta^2 = .135$, with significantly fewer Latinos following these same trajectories, $\chi^2(4, N = 2,912) = 22.13$, $P<.001$, $\eta^2 = .087$. There were no differences in delinquency trajectory membership by school type of household structure.

Table III. Descriptive Statistics Within Delinquency Trajectory Group

	Delinquency trajectory group					
	None (*n* = 642)	**Low (*n* = 1,188)**	**Slow Inc. (*n* = 701)**	**Rapid Inc. (*n* = 206)**	**High (*n* = 194)**	**Total sample**
Demographic variables						
Gender (% female)***	59%	54%	44%	47%	25%	50%
% African American***	39%	47%	53%	61%	60%	48%
% Latino***	35%	32%	28%	25%	21%	30%
% Living with two parents	61%	56%	56%	52%	51%	56%
School type (% public)	91%	90%	89%	93%	93%	90%
Delinquency variables	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Sixth grade	0.27 (0.55)	1.99 (1.77)	5.34 (4.01)	6.27 (4.20)	18.67 (8.29)	3.83 (5.55)
Seventh grade	0.38 (0.60)	2.98 (2.22)	8.60 (4.80)	16.76 (6.88)	20.59 (10.80)	6.16 (7.37)
Eighth grade	0.40 (0.63)	3.61 (2.63)	9.31 (5.33)	25.83 (8.00)	16.93 (10.77)	6.64 (8.17)

*P<.05; **P<.01; ***P<.001; Inc., increasing.

Substance use

Similar to the delinquency model selection procedure, examination of the BIC scores did not produce conclusive results regarding the optimal number of substance use trajectory groups. A four-group model was selected as the best fitting model to maximize parsimony while capturing meaningful variation in the data. The diagnostic guidelines indicate good model fit (*AvePPj*s>.72, *OCCj*s>3.0). *Pj* did not differ from πj by more than 6 percentage points. The four group model of substance use during middle school is presented in Figure 1. Higher values on this sum score of substance use represent more frequent use of multiple substances. Most

notably, the majority of adolescents report no use of substances during the middle school years (*n* = 2,303, 79% of the sample) or very little use (*n* = 328, 11% of the sample). The remaining individuals are best described by two groups: an increasing group (*n* = 234, 8% of the sample) and a high group (*n* = 66, 2% of the sample). The increasing trajectory group began with initial levels of substance use near zero in the sixth grade, subsequently increasing to levels of use comparable to the high group by the eighth grade. The high trajectory group began with levels of substance use in the sixth grade, which were four times higher than the other trajectory groups. This group reported slight increases between sixth and seventh grade, followed by maintenance of high level usage in the eighth grade. Although this is a small subgroup of individuals, they represent those adolescents at most risk for more serious problems. There were no demographic differences in substance use trajectory group membership (Table IV).

Table IV. Descriptive Statistics Within Substance Use Trajectory Group

	Substance use trajectory group				
	None (*n* = 2,303)	**Low (*n* = 328)**	**Inc. (*n* = 234)**	**High (*n* = 66)**	**Total sample**
Demographic variables					
Gender (% female)	51%	48%	56%	44%	50%
% African American	48%	52%	43%	49%	48%
% Latino	31%	28%	33%	24%	30%
% Living with two parents	57%	54%	58%	61%	56%
School type (% public)	91%	86%	91%	91%	90%
Substance use variables	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Sixth grade	0.10 (0.36)	1.78 (1.38)	0.92 (1.30)	6.54 (5.82)	0.50 (1.52)
Seventh grade	0.20 (0.53)	1.85 (1.21)	3.71 (3.00)	8.85 (5.16)	0.93 (2.10)
Eighth grade	0.43 (0.98)	1.67 (1.15)	7.08 (4.58)	7.26 (5.68)	1.30 (2.74)

$^{*}P<.05$; $^{**}P<.01$; $^{***}P<.001$.

Joint Trajectories of Aggression, Delinquency, and Substance Use

The probability that individuals who follow a particular trajectory on one of the outcomes (e.g. low aggression) will follow a particular trajectory for another outcome (e.g. low substance use) was estimated via cross tabulation of group membership. These analyses provide information on the temporal associations between substance use and aggression and delinquency, as indicated in the second aim of the study.

Aggression and delinquency

Based on the models established in the single outcome group-based trajectory analyses, a joint trajectory analysis was estimated for a four-group aggression model and a five-group delinquency model. The probabilities of delinquency trajectory group conditional on aggression trajectory group as well as aggression trajectory group conditional on delinquency trajectory group are presented in Table V.

Table V. Overlap of Aggression and Delinquency

		Aggression trajectory group			
		Low	**Inc.**	**Dec.**	**High**
1. Inc., increasing; Dec., decreasing; Bold, highest probabilities.					
Probability of delinquency group conditional on aggression group					
Delinquency trajectory group	None	**41%**	6%	9%	1%
	Low	**49%**	**43%**	**21%**	9%
	Slow Inc.	9%	**39%**	**31%**	**33%**
	Rapid Inc.	0%	9%	7%	24%
	High	0%	3%	**33%**	**33%**
Probability of aggression group conditional on delinquency group					
Delinquency trajectory group	None	**89%**	10%	1%	1%
	Low	**57%**	**39%**	1%	3%
	Slow Inc.	18%	**60%**	3%	20%
	Rapid Inc.	2%	47%	2%	**50%**
	High	2%	16%	**10%**	**72%**

A noticeable pattern between trajectories of aggression and delinquency emerged, such that individuals following a particular trajectory of aggression tended to follow a similar pattern of delinquency during middle school. For example, individuals in the low aggression trajectory group have a very high probability of also following a trajectory of no delinquency or low levels of delinquency. The high aggression trajectory group was most strongly associated with increasing or high trajectories of delinquency.

However, there is an interesting split among individuals in the decreasing aggression group, illustrated by a 21% probability of following a trajectory of low delinquency, a 31% probability of following a trajectory of slowing increasing delinquency, and a 33% probability of following a trajectory of high delinquency. These findings raise many questions regarding why there is such diversity in the probability of belonging to a particular delinquency trajectory group given a pattern of decreasing aggression during middle school.

Aggression and substance use

A joint trajectory analysis was estimated for a four-group aggression model and a four-group substance use model. The probabilities of substance use trajectory group conditional on aggression trajectory group and aggression trajectory group conditional on substance use trajectory group are presented in Table VI.

Table VI. Overlap of Aggression/Delinquency and Substance Use

		Aggression trajectory group				**Delinquency trajectory group**				
		Low	**Inc.**	**Dec.**	**High**	**None**	**Low**	**Slow Inc.**	**Rapid Inc.**	**High**
1. Inc., increasing; Dec., decreasing; Bold, highest probabilities.										
Probability of substance use group conditional on aggression/delinquency group										
Substance use trajectory group	None	**90%**	**74%**	**60%**	**57%**	**95%**	**85%**	**69%**	**56%**	**42%**
	Low	6%	13%	**22%**	**23%**	3%	9%	**16%**	**15%**	**28%**
	Inc.	3%	11%	**10%**	**15%**	1%	4%	13%	**24%**	**19%**
	High	1%	2%	**7%**	**6%**	0%	1%	2%	**5%**	**11%**
Probability of aggression/delinquency group conditional on substance use group										
Substance use	None	**54%**	34%	2%	10%	**27%**	**44%**	21%	5%	4%

trajectory group										
	Low	24%	**44%**	4%	**29%**	7%	**33%**	**35%**	10%	**17%**
	Inc.	20%	**51%**	3%	**27%**	3%	22%	**39%**	**21%**	**16%**
	High	**26%**	**30%**	**6%**	**38%**	2%	**26%**	**23%**	**17%**	**33%**

A similar pattern emerged between trajectories of aggression and substance use, as was observed between trajectories of aggression and delinquency, although somewhat muted given the lower levels of reported substance use during the middle school years. Individuals following a trajectory of low aggression had a high probability of abstaining from substance use during middle school. Among the other trajectories of aggression, more problematic trajectories had a high probability of also following more severe substance use trajectories. The high aggression trajectory group was at most risk for following a trajectory of increasing substance use. The decreasing aggression trajectory group had probabilities of substance use trajectory group membership comparable to the high aggression trajectory group. This is noteworthy because the decreasing aggression trajectory group has a split probability of following either high or low trajectories of delinquency and higher probabilities of increasing substance use. Evaluating the probability of aggression trajectory group, given membership in the low, increasing, or high substance use trajectory groups, provides information about adolescents who initiated substance use during middle school (21% of the sample). Individuals who followed a trajectory of low or increasing substance use during middle school had the highest probabilities of increasing in aggression, followed by virtually equal probability of following trajectories of either low or high aggression. Adolescents in the high substance use trajectory group had relatively similar probabilities of membership in low, increasing, or high aggression trajectory groups. This highlights some diversity among individuals initiating substance use during middle school, some of which also engage in increasing or high aggression while others follow trajectories of low aggression.

Delinquency and substance use

A joint trajectory analysis estimated the probabilities of substance use trajectory group conditional on delinquency trajectory group, as well as delinquency trajectory group conditional on substance use trajectory group, based on the previously established five-group delinquency model and the four-group substance use model (Table VI).

Similar to both the previous joint analyses, more problematic trajectories of delinquency were associated with more severe trajectories of substance use during middle school. Trajectories of low and no delinquency were most strongly associated with no substance use. The increasing delinquency trajectories had slightly higher probabilities of following a low or increasing

substance use trajectory. The high delinquency trajectory group was at most risk for following a trajectory of increasing or high substance use.

Of note is an interesting pattern that emerged from evaluating the probability of delinquency group membership conditional on substance use trajectory group. Similar to the associations between aggression and substance use trajectory groups, the probabilities of following any trajectory of delinquency, aside from no delinquency, were relatively similar among individuals who followed trajectories of low, increasing, or high substance use during middle school. For example, individuals from the high substance use trajectory group have roughly similar probabilities of membership in the low, slowly increasing, rapidly increasing, and high delinquency trajectories. As such, information regarding an individual's pattern of substance use is not as useful in predicting patterns of delinquent behavior. On the other hand, individuals who followed a trajectory of high delinquency in middle school have the highest probability of membership in the high substance use trajectory compared with other delinquency trajectory groups.

DISCUSSION

The first aim of this study was to evaluate trajectories of change across middle school for aggression, delinquency, and substance use. Subgroups of increasing as well as stable high aggression and delinquency were found, which map well onto Moffitt's theory of adolescent limited vs. life-course persistent antisocial behavior [Moffitt et al., 2001]. Broidy et al. [2003] evaluated multiple samples from within and outside the United States for gender differences in associations between trajectories of childhood overt aggression and adolescent delinquency. Similar to the results of this study, they found significant associations between overt aggression in childhood and adolescent delinquency across samples for males. However, they found less support for this association among females, with the one exception being a sample of females from within the United States. This study lends support to the findings of Broidy et al. [2003] and provides new information regarding connections to trajectories of substance use. Both studies highlight the need for more comprehensive evaluations of gender differences in associations between problem behaviors, from childhood through young adulthood among individuals from diverse backgrounds.

The ability to identify developmental patterns in the data, which would not necessarily have been predicted a priori, is one of the key advantages of group-based trajectory analysis. Further evaluation of the decreasing aggression trajectory group has the potential to provide new insights regarding developmental changes in aggressive behavior and associations with other problem behaviors in middle school. Despite reported decreases in aggressive behavior during middle school, these individuals may be engaging in other high risk behavior. The decreasing aggression trajectory group had significantly more males, more African American adolescents, and fewer Latino adolescents. In addition, individuals that followed a trajectory of decreasing aggression during middle school were significantly less likely to attend public school. Given the high levels

of aggression upon entry into sixth grade reported for this group, it may represent a subset of children who evinced behavior/conduct problems during elementary school. There are documented gender differences in early childhood conduct/behavioral problems with males reporting higher levels than females [Dodge et al., 2006]. Moreover, the higher levels of parochial school attendance may be a contributing factor to the decreasing pattern of aggression observed among these particular individuals. Although there were no school type differences in aggression, delinquency, and substance use for the sample as a whole, this subgroup difference emerged in the group trajectory analyses. Of course, results of this investigation are exploratory. Hence, these results should be considered as stepping stones in which future studies can use to gain a richer perspective on patterns of change in the development of aggression, delinquency, and substance use over time.

Individuals who followed trajectories of increasing substance use represent adolescents at the highest risk of developing substance use problems and other negative adjustment outcomes in later adolescence and young adulthood. Joint trajectory analyses revealed that individuals with patterns of high stable aggression and delinquency had high probabilities of increases in substance use during middle school. As such, information about externalizing behaviors does inform risk for future substance use. However, the reverse association of predicting externalizing behavior based on substance use trajectory was not as informative. Individuals who followed patterns of increasing substance use during middle school had virtually equal probabilities of engaging in low, increasing, or high levels of both aggression and delinquency. This provides some evidence that externalizing behaviors may serve as a pathway to substance use during middle school, whereas the reverse is not necessarily true.

Notably, there were very few gender differences in trajectory group membership. Only two groups, the decreasing aggression group and the stable high delinquency group, consisted of significantly more males compared with females, and there were no gender differences found regarding substance use trajectory group membership. The lack of gender differences in trajectories of aggression, delinquency, and substance use implies that the developmental progression of engagement in these behaviors during middle school is roughly equivalent for both males and females, at least in our urban minority sample. This finding is in line with previous research on gender differences in patterns of change for childhood aggressive behavior [Broidy et al., 2003]. As indicated, Broidy et al. [2003] reported very few differences between females and males in patterns of change in overt aggression across childhood and into early adolescence. However, a lack of gender differences in patterns of change does not necessarily imply that average rates of these behaviors are the same for both males and females. In fact, this study found that males reported somewhat higher average rates of aggression in the sixth grade and significantly higher average rates of delinquency throughout middle school. Although females and males follow similar patterns of change during middle school regarding aggression, delinquency, and substance use, the greater number of males who follow a trajectory of stable high delinquency may account for the gender difference in average rates of this behavior.

The general lack of gender differences in trajectories of aggression, delinquency, and substance use during middle school has strong implications for prevention programming. It is important to emphasize that prevention of aggressive, delinquent, and substance using behaviors at this early age is not just limited to males. Future research should continue to evaluate underlying mechanisms associated with patterns of change in these behaviors separate for males and females. This will help determine which individual and contextual antecedents of aggression, delinquency, and substance use are salient to the developmental progression of these behaviors for females and males.

Racial/ethnic differences were found in trajectory group membership, in this sample of urban middle school adolescents for both aggression and delinquency. African American adolescents were more likely to follow trajectories of decreasing and chronically high aggression as well as rapidly increasing and chronically high delinquency compared with Latino and White/Other adolescents. This finding is in line with previous research which has found higher prevalence rates of aggression and delinquency among minority adolescents compared with White adolescents [CDC, 2010]. There were no race/ethnic differences in substance use trajectory membership despite previous research which has found higher prevalence rates of substance use among White adolescents and increases among Latinos [CDC, 2010]. This may be due, in part, to the young age range of this sample. More distinct patterns of racial/ethnic differences in substance use may appear in the high school years and early adulthood. In addition, this study evaluated an urban sample. It may be that previously reported racial/ethnic differences in substance use are more pronounced among suburban adolescents.

At present, it is not clear whether ethnicity is particularly informative in understanding pathways for problem behaviors or whether confounding contextual factors (e.g. urban vs. suburban environments) or socioeconomic factors (e.g. poverty, parental education, employment) are more salient for prediction. Clearly, these distinctions are important for prevention programming and accurately identifying not only who may be at heightened risk, but also who may be protected from risk, and most importantly, why risk or protection is conferred [Newcomb, 1995]. Elucidating the underlying risk and protective factors, associated with initial trajectories of problem behaviors during the middle school years among ethnic minorities, will aid in the development of ethnically sensitive and appropriate intervention strategies, with the ultimate goal of reducing ethnic and racial disparities in adjustment outcomes in later adolescence and during the transition to adulthood.

Strengths and Limitations

This study was able to evaluate separate longitudinal trajectories of aggression, delinquency, and substance initiation across the middle school years, and associations between these trajectories through the use of novel statistical methodology. Group-based trajectory analysis has the capability to go beyond theory by allowing the data to determine if there are different subgroups of individuals within the population who differ in terms of their initial levels of a behavior as

well as changes in that behavior across time. The ability to confirm the existence of theorized subgroups of individuals [adolescence limited vs. life-course persistent offenders; Moffitt, 2006] as well as identify subgroups within the population that are not necessarily anticipated by theory is a useful tool for moving the field forward. However, replication of these findings in similar samples as well as other populations is critical, given the exploratory nature of this research.

Another strength is the longitudinal data across the middle school years, given that increases in problem behaviors often begin to emerge during this time. However, future research would benefit from evaluations of changes in problem behaviors from childhood, through adolescence, and into adulthood, to provide the most complete picture of interconnections in the development of these behaviors over time.

Perhaps, most importantly, this study evaluated gender and racial/ethnic differences in trajectories of problem behaviors and associations between problem behaviors among a group of urban adolescents as they transition through middle school. These results contribute to a growing knowledge base regarding pathways to substance use and delinquency among this group of adolescents. Although this study provided information on an understudied segment of the population, one limitation is that the results may not generalize to the national population.

In addition, measurement issues associated with accurately assessing aggression, delinquency, and substance use will always be a challenge. This study utilized self-report only; however, future studies would benefit from including multiple informants (e.g. parents, teachers, and school records) or observational data to provide additional perspectives on the participant's behavior [Achenbach et al.,1987; Phares et al., 1989]. Validity of self-report in this study was promoted through the use of the bogus pipeline procedure, which has been shown to increase the accuracy of reports of tobacco use [Evans et al., 1977] as well as other problem behaviors [Tourangeau et al.,1997]. Although this study was completed with paper and pencil, future research would benefit from use of computer-based survey formats, a methodological technique which has been shown to increase the validity of self-reported sensitive information, such as engagement in problem behaviors [Booth-Kewley et al., 2007; Turner et al., 1998].

Another measurement issue is the conceptual distinction between aggression and delinquency, as evaluated in this study. The results of an exploratory factor analysis revealed that the aggression and delinquency items loaded onto two separate factors distinguishing and further validating the separate scales. However, this could be due, in part, to differences in the outcome timeframe (1 month vs. 1 year). The items used to assess these constructs do have some conceptual overlap (e.g. delinquency items seem to be more extreme versions of aggression), which is highlighted by the observed correlation between them. Despite these similarities, the distinction between these two behaviors is quite important and emphasizes the need to evaluate them separately. The most important distinction between aggression and delinquency is that delinquent behavior refers to illegal behavior. This includes theft, assault, and vandalism. These delinquent behaviors are more extreme and emerge later in adolescence than aggressive behaviors, such as cursing,

teasing, or saying mean things to someone. As such, it remains important to evaluate aggression and delinquency separately, to more fully understand what factors are related to transitions from less serious forms of aggressive behavior to more serious delinquent acts. In addition, altering the items used to assess aggression and delinquency to try and minimize overlap will result in scales that have not been empirically validated and which may not capture the constructs of interest. Hence, it is important to be aware of the similarity between these constructs as well as the conceptual distinctions when interpreting the results of this study.

Implications

In sum, these findings highlight the potential predictive influences of engagement in one type of problem behavior on subsequent engagement in other problem behaviors. As such, the results of this study support the conclusion that interventions aimed at reducing engagement in aggressive behavior in late childhood and minimizing engagement in delinquent behavior in early adolescence may reduce substance use initiation in early and mid adolescence. This conclusion is in line with Problem Behavior Theory [Jessor, 1987, 1992] as well as the General Theory of Crime [Gottfredson and Hirschi, 1990]. However, problem behavior theory asserts that this generalization of intervention effects from one problem behavior to another is owing to overlap in common correlates, not direct influences of one problem behavior on the onset of another problem behavior. The general theory of crime asserts that the generalization of intervention effects is owing to the fact that all forms of problem behavior emerge as part of an individual tendency toward deviance in general. The results of this investigation suggest that there may be direct associations among problem behaviors. Future research should evaluate common correlates of aggression, delinquency, and substance use along with the direct effects between problem behaviors. This will help further elucidate if associations between problem behaviors are owing to direct effects of one problem behavior on future problem behaviors or if the emergence of multiple problem behaviors simply stems from common risk factors.

It is clear that adolescents who are engaging in multiple problem behaviors represent a significant subgroup of individuals at higher risk for continued problems in adulthood. This study took advantage of a longitudinal research design with assessments of multiple problem behaviors to elucidate associations between aggression, delinquency, and substance use in early adolescence. Identifying interconnections among problem behaviors in adolescence is the key to establishing effective prevention programming. Moreover, information regarding gender and racial/ethnic differences on associations between problem behaviors in early adolescence is sparse and inconsistent thus far, requiring further examination. Gaining a better understanding of commonalities and differences between genders and racial/ethnic groups in the etiology of problem behaviors is informative for the development and refinement of intervention strategies. Prevention and intervention programs, which are informed by studies of the interconnections between multiple problem behaviors as well as common correlates of these behaviors, may be most effective in minimizing negative adjustment outcomes during adolescence and the transition to adulthood.

1 Three exploratory factor analyses (EFAs) were conducted using the aggression and delinquency items at each grade (sixth, seventh, and eighth). At all three grades, a two-factor solution best fit the data with items loading onto an aggression factor and a delinquency factor, validating the separate scales. These results provide strong support for maintaining the validated delinquency and aggression scales and promoting comparability within the literature.

2 Excluding the 285 parochial school students did not result in substantive differences regarding the trajectory models of aggression, delinquency, and substance use. A cross-tabulation between the full-sample trajectory models and the public school-only trajectory models revealed that between 91 and 100% of the participants were assigned to the exact same trajectory class, with only one exception. Overlap in substance use assignment was 71% for the rapid increasing group. As such, maintaining all the students in the analyses is preferable.

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