Codevelopment of delinquency, alcohol use, and aggression towards peers and dates: Multi-trajectory patterns and predictors

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Abstract

We aimed to characterize developmental patterns of involvement in alcohol use, delinquency, and interpersonal aggression in a normative sample of adolescents by applying multi-trajectory group-based modeling. Using seven waves of data from a cohort sequential study spanning the sixth to 12th grades (n=2825; 50% girls) we identified four distinct trajectory groups: low risk (33%), declining peer aggressors (44%), peer and dating aggressors (13%), and multidomain high risk (10%). Across all comparisons, girls were more likely than boys to be members of the peer and dating aggressor group and less likely to be members of the multidomain high risk group. Moreover, individual (self-control, negative emotionality), family (family violence, parental monitoring) and peer (substance use norms) distinguished class membership.

Introduction

Adolescence is marked by increased risk of involvement in a variety of risky or "problem" behaviors, including substance use, delinquency, and interpersonal aggression towards peers and dating partners (D'Amico, Edelen, Miles, & Morral, 2008; Huang, Lanza, Murphy, & Hser, 2012; Reyes, Foshee, Markiewitz, Chen, & Ennett, 2018; Trim et al., 2015; Wu, Witkiewitz, McMahon, & Dodge, 2010). In turn, involvement in risky behaviors leads to a range of adverse health and psychosocial outcomes (Balsa, Giuliano, & French, 2011; Foshee, Reyes, Gottfredson, Chang, & Ennett, 2013; Marshall, 2014; McDougal & Vaillancourt, 2015; Moore et al., 2017; Trim et al., 2015). Although a growing body of longitudinal studies has increased understanding of the developmental course of risky behavior during adolescence, research to date has tended to use a siloed approach focused on describing trajectories of a particular behavior (e.g., alcohol use) in isolation from others (e.g., aggression). Theory and empirical research suggest, however, that different types of problem behaviors tend to cluster together during adolescence (Hawkins & Monahan, 2009; Steinberg, 2008) and failure to account for this co-occurrence may lead to spurious

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conclusions due to confounding (Rutter, 1997). Further, developmental perspectives suggest that transient involvement in some forms of risky behavior may be normative, whereas persistent involvement in multiple types of risk behavior is pathological (Mofitt, 1993).

Theoretical perspectives on the development of co-occurring risk behaviors

Several theoretical perspectives suggest that risky adolescent behaviors cluster together because they share underlying determinants (Catalano & Hawkins, 1996; Jessor, 1987). For example, Problem Behavior Theory broadly conceptualizes co-occurring problem behaviors as a syndrome driven by individual and environmental factors that reflect either instigations for or controls against involvement (Donavan, 1996). Developmental perspectives further suggest the importance of considering the potential for heterogeneous patterns of co-development in problem behaviors across ages or grade-levels and across different types of risk behavior. For example, Moffitt's Theory of Antisocial Behavior (Moffitt, 1993) posits that some temporary experimentation with risky behavior during adolescence—*adolescent-limited* risky behavior—is relatively common. For a smaller subgroup of youth, however, involvement in risky behavior is part of a long-term pattern that begins in childhood and persists into adulthood—*life-course persistent* risky behavior. The theory also postulates that the types of risky behaviors that adolescent-limited and life-course persistent youth engage in will differ. Adolescent-limited risky behaviors include those that signal maturity and independence, such as non-violent delinquent acts like skipping class and alcohol use (Moffitt, 1993). In contrast, the risky behaviors of life-course persistent youth are posited to include more severe antisocial behaviors, including more "victim-oriented" offences, such as violence perpetration.

The co-development of problem behaviors across adolescence

While most longitudinal studies of risky behavior during adolescence focus on examining trajectories for a single outcome behavior, the handful of studies that have examined the co-development of two or more risky behaviors demonstrate high levels of co-occurrence (Ehrenreich, Nahapteyan, Orpinas, & Song, 2015; Girard, Tremblay, Nagin, & Cote, 2019; Huang et al. 2013; Lynne-Landsman, Graber, Nichols, & Botvin, 2011; Mustanski et al., 2013; Trim et al., 2015; Orpinas, Nahapteyan, &Truszczynski, 2017; Van Lier, Vitaro, Barker, Coot, & Tremblay, 2009); for example, findings consistently suggest that more problematic trajectories of delinquency and aggression are associated with more severe trajectories of substance use. There are, however, important gaps in the research that hinder clear interpretation of findings. First, relatively few previous studies of risk behavior co-development have followed participants from early to late adolescence, precluding the ability to capture both initial levels and changes (e.g., persistence or desistence) in behavior occurring towards the latter end of this key developmental stage when the transition to young adulthood begins. Second, most previous studies have used measures that do not distinguish non-violent (e.g., skipping class) from violent forms of antisocial behavior (Huang et al., 2012; Lynne-Landsman et al., 2011; Mustanski et al., 2013; Trim et al., 2015). As noted above, violent and non-violent acts of antisocial behavior have been posited to follow distinct developmental patterns, suggesting the importance of analyzing these types of acts as separate constructs. Third, nearly all previous research examining the co-development of problem behavior trajectories has assessed overlap across *pairs* of behavior

trajectories, limiting understanding of patterns that cross multiple behavioral domains. Finally, almost no research has examined modifiable risk and protective factors that predict multi-trajectory membership.

The Current Study

In sum, limited longitudinal research has examined patterns of involvement in multiple problem behaviors across adolescence or identified predictors of pattern membership. Research that is narrowly focused on the development of a single risk behavior does not shed light on the co-development of multiple types of risk behavior or identify factors that predict different co-development patterns. Such research is key to informing the development of policies and programs that aim to prevent multiple adolescent risky behaviors simultaneously (Hale, Fitzgerald-Yau, & Viner, 2014). To this end, the current study used a person-centered approach, multi-trajectory group-based modeling (MTGBM; Nagin et al., 2016), to assess the conjoint development of four adolescent problem behaviors —heavy alcohol use, non-violent delinquency, physical peer aggression, and physical dating aggression—across grades six to twelve using data from a longitudinal cohort sequential study of a normative sample of adolescents.

The particular problem behaviors identified for study were selected based on the theoretical perspectives described above and because they represent both potentially normative and severe risky behaviors. Heavy alcohol use was selected rather than other forms of substance use, such as smoking, because alcohol use is highly correlated with delinquency and violence (Doran, Luczak, Bekman, Koutsenok, & Brown, 2012; White, Conway, & Ward, 2019), yet may also differentiate a subgroup of youth who increasingly engage in alcohol use, but not other forms of risky behavior (Laska et al., 2009; Wu et al. 2010). Peer and dating violence were selected based on cross-sectional research that has found that these behaviors co-occur in some subgroups of youth, but not others, and thus may differentiate trajectory patterns (Garthe, Sullivan, & Behrhorst, 2018; Heinze et al., 2018; Reyes, Foshee, Chen, & Ennett, 2018). Each of these behaviors has been found to be prevalent among youth in the US; for example, in the 2017 national Youth Risk Behavior Survey 30% of US high school students reported current alcohol use, 14% reported binge drinking, 19% reported having been bullied on school property, and 8% reported having experienced physical dating violence (Kann et al., 2018). Drawing on Moffitt's (1993) theory of antisocial behavior we anticipated identifying at least three distinct groups or classes: *low risk*, characterized by low levels of involvement in all four risky behaviors; *adolescent-limited* risky behavior, characterized by increasing and then decreasing involvement in alcohol use and non-violent delinquency and low levels of involvement in dating and peer aggression; and *high multi-risk* behavior, characterized by early onset of and persistently high levels of involvement in all four types of problem behavior across all grade-levels.

We examined associations between class membership and demographic variables (sex, race/ ethnicity, and parent education) that have been associated with problem behavior involvement (Kann et al., 2018; Piotrowska et al., 2015) as well as theory-based risk and protective factors. Specifically, based on Moffitt's (1993) theory of antisocial behavior we examined negative emotionality and low self-control as risk factors that may distinguish

trajectory groups. Further, based on Problem Behavior Theory (Jessor, 1987), we examined explanatory factors from both the personality and environmental systems. The former included future aspirations and deviance intolerance; the latter included parental monitoring, family conflict, and peer substance use. We hypothesized that higher scores on risk factors and lower scores on protective factors would distinguish those in the high multi-risk group from those in the adolescent-limited and low risk groups.

Method

Study Design and Data Collection Procedures

Data are from a longitudinal cohort sequential study of adolescent health risk behaviors (Ennett et al., 2006; Foshee et al., 2013). All eligible 6th, 7th and 8th grade students in two complete public-school systems in North Carolina were entered in the study in the Spring of 2002 and surveyed in school seven times, with six months intervals for the first six waves (T1-T6) and a one year interval between waves six and seven. Students were in the 10th, 11th, and 12th grades at study completion. At each wave, all enrolled students in the targeted grades able to complete the survey in English and not in special education classes were eligible to participate. Participants in the targeted grades were allowed to enter the study at any time point regardless of whether they had participated or not in previous waves. Parents had the opportunity to refuse consent for their child's participation by returning a written form or calling a toll-free number. Adolescent assent was obtained from teens whose parents did not refuse consent. Trained data collectors administered questionnaires on at least two occasions to reduce the effect of absenteeism on the response rates. Teachers stayed in classrooms to help maintain order but did not answer questions or walk around the classroom. Adolescents completed the questionnaire in approximately 1 hour. The Institutional Review Board for the University of North Carolina at Chapel Hill approved the study protocols.

At T1, 6% of parents refused consent, 6% of adolescents declined participation, and 8% were absent on data collection days for a total of 2,825 students completing a survey. Approximately half of T1 participants were male; 48% were Black, 45% were White, and 7% were of another race/ethnicity, and 28% reported the highest education achieved by either parent was high school or less across all waves. The T1 response rate, calculated as the proportion of adolescents who participated of those who were eligible, was 88%. Response rates for T2-T7 ranged between 73% and 80%.

Measures

Latent class indicators.—Indicators for the latent trajectory class profiles included composite measures of: (1) non-violent delinquency, (2) heavy alcohol use, (3) physical peer aggression, and (4) physical dating aggression. Each indicator was assessed using the same measure across all seven survey waves using a past 3-month reference period. *Non-violent delinquency* was assessed by summing scores on four items from the delinquency subscale of the Farrell Problem Behavior Frequency Scale (Farrell. Kung, White, & Valois, 2000) that assessed how many times students had: cheated on a test, damaged school or other property that did not belong to them, skipped school, or went to school but skipped class (average

Cronbach's α=.78). *Heavy alcohol use* was assessed by four items asking adolescents how many times they had: 3 or 4 drinks in a row, 5 or more drinks in a row, gotten drunk or very high from drinking alcohol, or been hung over in the past three months. Responses were summed, and because cell sizes were sparse, they were then dichotomized to create a binary measure of heavy alcohol use (i.e., reporting having engaged in any of these behaviors at least once was coded as a 1 on the binary measure; average Cronbach's α=.93). *Peer aggression* was similarly assessed by summing and then dichotomizing scores on two items assessing how many times participants had hit or slapped another kid or threatened someone with a weapon. *Dating aggression* was also similarly assessed by summing and then dichotomizing scores on two items assessing how many times participants had hit a dating partner and/or threatened a dating partner. Table 1 provides descriptive statistics for the outcome measures by grade.

Predictor measures.—All assessments of risk and protective factors were drawn from the T1 survey. *Low self-control* was assessed by averaging scores on three items from the Grasmick Low Self-Control Scale (Grasmick, Tittle, Bursik, & Arneklev, 1993) that assessed how strongly participants agreed or disagreed with the following statements: "I like to test myself every now and then by doing something a little risky"; "I sometimes find it exciting to do things for which I may get in trouble"; and "excitement and adventure are more important to me than security" (Cronbach's α=.77). *Negative emotionality* was assessed by averaging scores on three items from the revised Multiple Affective Adjective Checklist (Zuckerman & Lubin, 1985) that asked adolescents how often they felt mad, angry or furious in the past three months (Cronbach's α=.87). *Future aspirations* was assessed by averaging scores on three items from a scale developed to measure commitment to conventional activities that index how important adolescents felt it is to: finish high school, go to college, and have a happy family life (Cronbach's α=.70; Foshee, Bauman, & Linder, 1999). *Deviance intolerance* was measured by averaging scores on three items from a scale assessing belief in conventional rules that asked adolescents how strongly they agreed or disagreed with the following statements: "it is good to be honest"; "people should not cheat on tests" and; "in general, police deserve respect" (Cronbach's α=.70; Foshee et al., 1999). *Family violence* was assessed by averaging scores on three items from Bloom's (1985) self-report measure of family functioning that asked how strongly participants agreed or disagreed with the following three statements; "we fight a lot in our family," "family members sometimes get so angry they throw things" and, "family members sometimes hit each other" (Cronbach's α=.84). *Parental monitoring* was assessed by three items from the Authoritative Parenting Index (Jackson, Henrikson, & Foshee, 1998) that asked adolescents the extent to which it was or was not like their parents to: have rules they should follow; tell them when they should come home; and make sure they don't stay up too late" (Cronbach's α=.82). *Perceived peer substance use* was assessed by asking students to report about how many students their age engage in substance use at their school. The perceived prevalence of six different substance use types was assessed: drinking, cigarette smoking, other tobacco use, inhalants, marijuana use, and hard drug use. Responses were averaged across items to create a composite measure with higher scores denoting greater perceived peer substance use (Cronbach's α=.88; Kobus & Henry, 2010).

Demographic covariates.—Gender was dummy coded such that the reference group was female. Race/ethnicity was dummy coded as Black, other race/ethnicity (including Latinos), or White (reference). Parent education, a proxy for socioeconomic status, was measured as the highest education attained by either parent during the study and ranged from less than high school (0) to graduate school or more (5).

Analytic Strategy

Of the 3979 participating adolescents, we restricted the analytic sample to those who had completed the survey at T1 (n=2825). Two participants were dropped from analyses due to missing data on behavior outcomes across all time points, yielding a final analytic sample of 2823. Most (70%) of the analytic sample participated in 5 or more study waves; 6% participated in only one wave and 5% participated in only two waves. MTGBM (Nagin et al., 2016) was used to examine joint trajectories of non-violent delinquency, heavy alcohol use, peer aggression and dating aggression and to identify predictors of multi-trajectory class membership. The group-based approach for modeling developmental trajectories identifies distinct classes of individuals who follow qualitatively similar trajectories over time (Bauer & Reyes, 2010). Of note, the MTGBM differs from related models that first estimate unique latent trajectory class solutions for each outcome and then combine the solutions post-hoc. Rather, using the MTGBM approach each class denotes a cluster of individuals who follow a similar joint course over time across each of the four outcome behaviors thus providing an overall "profile" of risky behavior development over time across multiple outcome types.

The data were reorganized prior to modeling such that the repeated measures denoted the adolescent's report of a risky behavior at a particular grade-level rather than assessment wave. This enabled trajectories to be defined based on indicators measured at 11 timepoints (grades 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, 11, and 12). In preliminary analyses trajectory models were estimated for each outcome separately with a censored normal model specified for non-violent delinquency and logistic models for the other outcomes. Flat, linear, and quadratic models were tested for each outcome. Across all outcomes the quadratic model fit best and hence our base MTGBM included intercept, slope, and quadratic factors for each outcome.

The first step in the MTGBM modeling process was to identify the optimum number of classes based on the following model fit indices: the Bayesian information criterion (BIC), the Voung-Lo-Mendel-Rubin likelihood ratio test (VLMR-LRT), and the Lo-Mendel-Rubin adjusted likelihood ratio test (LMR-aLRT). The best-fitting most parsimonious models are those that minimize the BIC and for which adding an additional class does not result in a significant increase in model fit as indicated by a p-value of greater than .05 for the VLMR-LRT and LMR-aLRT. We also evaluated classification quality, as indicated by entropy scores (greater entropy scores indicate better classification quality), and considered the substantive interpretation of the multi-trajectory profiles (Collins & Lanza, 2010).

After selecting the best-fitting model, a three-step approach was used to examine associations between latent class membership and (1) demographic factors and (2) risk and protective factors, while controlling for demographic factors. This approach allows for inclusion of covariates using an estimation process that accounts for measurement error due

to uncertainty of classification (Asporouhov & Muthén, 2014). Missing data on the latent class indicators were dealt with using full information maximum likelihood. Missing data on covariates were accounted for using a modified joint likelihood approach that retains all cases under missing at random assumptions (Sterba, 2014). All analyses were conducted using Mplus version 7.4 (Muthén and Muthén, 1998–2012). Figure 1 provides a visual depiction of the relationships that were modeled.

Results

A series of MTGBM were estimated that ranged from one to six classes. Table 2 provides fit indices for these models. The BIC decreased as the number of classes increased, although decreases leveled off as the number of classes increased from four to five. The VLMR-LRT and LMR-aLRT favored a four-class solution and the four-class solution was clearly interpretable based on item response patterns. Considering also the criteria of parsimony and interpretability we selected the four-class model. The four-class model had high classification quality (entropy=.74 and all average classification probability values > .80), indicating reliable classification.

The Four-Class Model

Figure 2 presents predicted outcome trajectories for each of the four classes in the selected model. Consistent with expectations, one class, labeled *low risk* (LR; 34% of the sample), reported no or very low levels of involvement in all four behaviors across all grades. A second, larger class, *declining peer aggressors* (DPA; 44% of the sample), emerged that was characterized by relatively high and then declining risk for involvement in peer aggression, concomitant with increasing but relatively low involvement in heavy alcohol use and non-violent delinquency and low engagement in dating aggression. A third class, *peer and dating aggressors* (PDAG; 12% of the sample), was characterized by high risk for involvement in peer and dating aggression, but relatively low stable risk of non-violent delinquency and heavy alcohol use. The final class, *multidomain high risk* (HR; 10% of the sample), was characterized by very high increasing and then moderately decreasing risk of involvement in non-violent delinquency, heavy alcohol use, and peer aggression but relatively low risk for dating aggression.

Covariate associations with class membership

Tables 3 and 4 present adjusted odds ratios from separate multivariate multinomial regression models that link class membership to demographic factors (Table 3) and risk and protective factors, adjusting for demographic associations (Table 4). All possible comparisons between classes are shown with the class of interest specified in each table row and the reference class specified in the table column.

Demographic factors distinguishing class membership

Gender and race/ethnicity, but not parent education, were significantly associated with class membership (Table 3). Across all comparisons, males were more likely than females to be members of the HR class and less likely than females to be in the PDAG group. Across all comparisons, adolescents of Black and other race/ethnicity were significantly more likely

than White adolescents to be in the PDAG group. Adolescents of other race/ethnicity were at increased risk of being in the HR group compared to the LR group. Being of Black (vs. White) race/ethnicity was associated with decreased risk of being in the HR group compared to the DPA group. Neither gender nor race/ethnicity distinguished those in the DPA group from those in the LR group.

Risk and protective factors distinguishing class membership

Distinguishing the multidomain high risk class (HR).—Consistent with our general study hypothesis, across all comparisons, greater family violence was associated with significantly increased risk of being in the HR class whereas greater deviance intolerance was associated with significantly decreased risk of being in the HR class (Table 4). Lower self-control and greater perceived peer substance use were also associated with increased likelihood of being in the HR group compared to being in the DPA and LR groups but did not distinguish those in the HR class from those in the PDAG group. Negative emotionality increased the likelihood of HR group membership and increased parental monitoring decreased the likelihood of membership compared to the LR group, but did not distinguish those in the HR group from those in the other problem behavior classes.

Distinguishing Peer and Dating Aggressors (PDAG) and Declining Peer Aggressors (DPA).—Lower self-control, greater negative emotionality and greater perceived peer substance use were each associated with increased risk of being in the PDAG class compared to being in the DPA and LR classes. Greater deviance intolerance and increased parental monitoring were associated with decreased risk of being in the PDAG class compared to the LR class but did not distinguish those in the PDAG class from those in the DPA class. Except for future aspirations, all of the risk and protective factors distinguished those in DPA class from those in the LR class in the expected direction.

Exploratory analysis of gender differences.—Previous empirical research has found gender differences in the associations between risk and protective factors and problem behaviors during adolescence (e.g., Dardis, Dixon, Edwards, & Turchik, 2015; Kelly et al., 2011; Ribeaud & Eisner, 2010). We thus conducted exploratory analyses to determine whether gender moderated the influence of risk and protective factors on class membership through the inclusion of interaction terms between each risk/protective factor and gender in a series of models with one model for each factor. A multiparameter Wald test was used to determine whether the set of interaction terms between the focal risk/protective factor and gender for each possible comparison between the specified reference group and the other classes was statistically significant. Wald tests were statistically significant for models that included interactions between gender and family violence, but not for models including interactions between gender and any of the other risk/protective factors. Post-hoc analyses to probe the interaction effect determined that greater family violence was associated with significantly increased risk of being in the HR class compared to the low risk group for girls (AOR=1.66, 95% CI [1.28, 2.15], p<.001), but not for boys (AOR=1.13, 95% CI [0.93, 1.38], p=.22). Similarly, for girls, greater family violence was associated with greater risk of being in the HR group than the PDAG group (AOR=1.39, 95% CI [1.06, 1.83], p=.02); whereas among boys, family violence did not distinguish those in the HR group from those

in the PDAG group (p=.53). Likewise, greater family violence was associated with increased risk of being in the DPA class versus the low risk class for girls (OR=1.23, 95% CI [1.01, 1.50], p=.04), but not boys (p=.31).

Discussion

While theoretical perspectives suggest that risky behaviors co-develop during adolescence and further suggest the possibility of heterogeneity in patterns and predictors of co-development, few longitudinal studies of adolescents have examined patterns of co-development across multiple risky behaviors. This is the first study, to our knowledge, that has used a multi-trajectory approach to assess developmental patterns of four risky behaviors across grades 6–12 and identify predictors of pattern membership. As suggested by Moffitt (1993) both potentially normative and severe risky behaviors were examined and, as suggested by Problem Behavior Theory (Jessor, 1987), predictive factors from multiple domains were assessed. Overall, study findings suggest there is important subgroup heterogeneity in problem behavior involvement during adolescence and the importance of considering both behavior type and development over time when distinguishing patterns of risky behavior. In addition, findings suggest that gender and race/ethnicity shape the types of problem behaviors that youth engage in and provide evidence that both individual and contextual variables distinguish youth following distinct problem behavior trajectory patterns.

We identified four qualitatively distinct patterns or "classes" of problem behavior involvement that aligned only partially with expectations based on Moffitt's (1993) theory. As anticipated, we did find a low risk class, a finding consistent with previous studies that have found a subgroup of youth that engage in little, if any, risky behavior during adolescence (Ahmadi-Montecalvo et al., 2019; Mustanski et al., 2013). Surprisingly, however, the largest subgroup in the sample was the declining peer aggression group (44% of the sample). The finding of a large class characterized primarily by early declining risk of aggression against peers is consistent with other studies of general population samples that have found a substantial subgroup of youth who engage in peer-directed aggression during childhood and early adolescence (Espelage, Van Ryzin, & Holt, 2018) and with research suggesting that, for the majority of youth, physical aggression against peers tends to decline during adolescence (for a review see, Tremblay, Vitaro, & Cote, 2018). The concomitant moderate increases in non-violent delinquency and heavy alcohol use in this group may reflect heterotypic continuity in antisocial behavior or different behavioral presentations of the same processes at different developmental periods (Cicchetti & Rogosch, 2002). As these early aggressive youths mature, they may engage less in direct physical aggression towards peers—perhaps due to social controls that make this behavior likely to be punished—and engage more in socially acceptable risky behaviors that confer mature status or privilege. Notably, while this group did not follow the anticipated curvilinear adolescent-limited trajectory for any of the behaviors examined, this pattern of "flexible" involvement in some, but not all, forms of risky behavior is consistent with the predictions of Moffit's theory for adolescent-limited delinquents (Moffitt, 1993).

The peer and dating aggression subgroup also followed an unexpected pattern in that individuals in this group were characterized by relatively low stable involvement in heavy alcohol use and non-violent delinquency concomitant with fairly high, stable risk of involvement in dating aggression and high initial risk for involvement in peer aggression that declined over time but remained higher than that of the declining peer aggression group. While this pattern was not predicted by Moffitt's theory, the finding of a subgroup characterized by a high likelihood of engaging in aggression towards peers *and* dating partners is consistent with previous studies examining cross-contextual aggression patterns (e.g., Garthe et al., 2018; Heinze et al., 2018; Reyes et al., 2018). The fact that aggression risk in this subgroup did not track together with risk for non-violent delinquency or alcohol use was surprising, however, and suggests there may be unique factors influencing the propensity to engage in physical aggression that may differ from those influencing risk for other problem behaviors.

Along these lines an unexpected finding was that that girls (vs. boys) and Black (vs. White) youth were significantly *less* likely to belong to the multidomain high risk group than to the other risky behavior patterns (PDAG and DPA) and were significantly *more* likely to belong to the peer and dating aggressor group compared with all of the other patterns identified. The latter finding is consistent with some previous cross-sectional research (Heinze et al., 2018; Whiteside et al., 2013). For example, Heinze (2018) conducted a study examining partner and non-partner violence perpetration in a sample of high-risk young adults and found that, relative to those in the non-violent group, youth involved in both partner and non-partner violence perpetration were more likely to be female than male and to be African-American than non-African-American. It may be that these socio-demographic factors are markers denoting an increased risk of being embedded in social environments that impel rather than constrain interpersonal aggression against dating partners and others. For example, racial/ethnic disparities in exposure to childhood adversity, including community and family violence exposure, may contribute to increased risk of involvement in multiple forms of aggression among Black youth (Malik et al., 1997; Slopen et al., 2016). Similarly, social norms condemning physical aggression by boys against girls are stronger than those condemning aggression by girls against boys; as such, on average, aggression may be more likely to spill over from peer to dating relationships among adolescent girls vs. boys (Reyes et al., 2018).

While we anticipated identifying a *multidomain high risk* group, the trajectory patterns characterizing this group were not fully consistent with expectations. In particular, as expected, this group was characterized by high increasing delinquent behavior, heavy alcohol use, and peer aggression risk and risk of involvement in these three behaviors was higher in this group compared to the other classes even as trajectories leveled off and declined in late adolescence. Surprisingly, however, risk for involvement in dating aggression for youth in this group stayed relatively low (predicted probability <40%) across all timepoints. We speculate that gender differences in the composition of this class may help explain this result. Across all comparisons, boys were significantly more likely to belong to this class than girls. As noted above, social norms constraining the use of physical dating aggression by boys against girls are strong, perhaps contributing to make it less likely that this behavior would track together with other, less gendered, risk behaviors.

We identified several shared risk and protective factors that distinguished those in the three problem behavior classes from the low risk class as well as factors that distinguished the problem behavior classes from each other. Specifically, consistent with expectations, two individual factors—low self-control and negative emotionality—and two environmental factors—parental monitoring and perceived peer substance use—distinguished those in each of the problem behavior classes from those in the low risk class. This finding suggests that prevention programs that effectively strengthen children and early adolescents' self-regulatory abilities, increase parental monitoring, and/or change descriptive norms about peer substance use, may effectively prevent involvement in a range of risky behaviors across adolescence.

Low self-control, negative emotionality, and peer substance use norms also distinguished those in the PDAG group from those in the declining peer aggression group. This suggests that early intervention programs for aggressive children should target these constructs to reduce the likelihood that physically aggressive behaviors against peers will spill over into dating relationships during middle and high school. Finally, two factors, family violence and deviance intolerance, uniquely distinguished risk of involvement in the HR group from all other groups. This finding suggests that youth who have been exposed to family violence and/or are disengaged from institutions (e.g., schools) that promote prosocial values should be targeted by selective programs early in the life-course in order to prevent involvement in multiple risky behaviors. These youth may be at increased risk due to low social controls on risky behavior and thus benefit from programs that promote social connectedness; such programs may increase resilience and social bonding in vulnerable youth that, in turn, inhibit involvement in risk behavior (Deuchar & Bhopal, 2017; Foster et al. 2017).

Notably, while gender was associated with class membership, suggesting that the types of risk behaviors youth engage in may differ for boys and girls, we did not find strong evidence that associations between risk and protective factors and class membership differed by gender. In fact, the only risk factor that demonstrated differential impacts by gender was family violence; family violence exposure was more strongly associated with some patterns of problem behavior involvement among girls compared to boys, suggesting that boys and girls may have different reactions to conflict in the family environment. We view this finding with caution, however, as these analyses were exploratory and previous research on gender differences in the effects of family violence exposure on problem behaviors has been very mixed (Evans, Davies, & Dilillo, 2008; Skeer et al., 2011; Sternberg, Baradaran, Abbott, Lamb, & Guterman, 2006).

Findings suggest several directions for future research. We examined a subset of risky behaviors; while there are computational limits on the number of risky behavior trajectories that can be modeled simultaneously, future research should build on the current study to examine other types of risky behaviors such as other forms of substance use (e.g., vaping, marijuana use) as well as risky sexual behavior. Further, our measures of aggression were limited in that they only assessed physical aggression, did not tap into different levels of aggression severity, and did not differentiate between reactive and proactive aggression. Empirical research suggests that different forms of aggression may have distinct precursors and associations with other forms of risky behavior (e.g., Brendgen et al., 2001; Hubbard,

McAullife, Morrow, & Romano, 2010). Future research should build on the current study using more nuanced measures that: differentiate proactive from reactive aggression; assess other types of aggressive behavior, including those that become increasingly prevalent later in adolescence, such as sexual coercion and relational aggression; and assess forms of aggression that may be less strongly governed by gendered social norms (e.g., cyberbullying; psychological aggression; Courtain & Glowacz, 2018).

The study has several limitations in addition to those noted above that should be acknowledged. Data are over a decade old and the study used a non-probability sample collected from youth in two primarily non-metropolitan counties in the southern US, limiting generalizability of results. Measures were self-report and thus subject to social desirability and same-source bias. In addition, due to the one-year gap between waves 6 and 7, we had a limited number of assessment points in late adolescence which may have reduced our power to distinguish distinct patterns of persistence and desistence during this stage.

Notwithstanding these limitations, the study has several notable strengths. We used a novel person-centered approach—multi-trajectory group-based modeling—to assess the conjoint development of non-violent delinquency, heavy alcohol use, and interpersonal aggression across adolescence. Further, the study went beyond simply describing patterns of development to examine theory-based risk and protective factors that predicted multi-trajectory group membership using an approach that accounted for uncertainty in class membership. Other methodological strengths were the relatively large sample size and use of repeated measures that spanned middle and high school. Although more research is needed, the patterns identified suggest that subgroups of youth may engage in qualitatively distinct patterns of risky behavior that are distinguished both in terms of the types of behaviors they engage in and their change over time. Further, results suggest that early life-course prevention efforts to reduce involvement in multiple risky behaviors should seek to: reduce family violence exposure, increase positive parenting skills, foster prosocial bonding, change descriptive norms about peer risk taking, and improve self-regulatory skills.

Acknowledgements

References

Ahmadi-Montecalvo H, Lilly CL, Zullig KJ, Jarrett T, Cotrell LA, & Dino GA, (2019). A latent class analysis of the co-occurrence of risk behaviors among adolescents. American Journal of Public Health, 43(3), 449–463.

Asparouhov T, & Muthén B. (2014). Auxiliary variables in mixture modeling: Using the BCH method in Mplus to estimate a distal outcome model and an arbitrary secondary model. Mplus Web Notes, 21(2), 1–22.

Balsa AI, Giuliano LM, & French MT (2011). The effects of alcohol use on academic achievement in high school. Economics of Education Review, 30(1), 1–15. [PubMed: 21278841]

Bauer DJ & Reyes HLM (2010). Modeling variability in individual development: Differences of degree or kind? Child Development Perspectives, 4(2), 114–122. [PubMed: 24910711]

Bloom BL (1985). A factor analysis of self-report measured of family functioning. Family Process, 24, 225–239. [PubMed: 4018243]

Brendgen M, Vitaro F, Tremblay RE, & Lavoie F. (2001). Reactive and proactive aggression: Predictions to physical violence in different contexts and moderating effects of parental monitoring and caregiving behavior. Journal of Abnormal Child Psychology, 29(4), 293–304. [PubMed: 11523835]

Catalano RF, & Hawkins JD (1996). The social development model: a theory of antisocial behavior In Hawkins JD, ed. Delinquency and Crime: Current Theories. New York, NY: Cambridge University Press, 149–97.

Cicchetti D, & Rogosch FA (2002). A developmental psychopathology perspective on adolescence. Journal of Consulting and Clinical Psychology, 70(1), 6. [PubMed: 11860057]

Collins LM, & Lanza ST (2010). Latent class and Latent Transition Analysis: With Applications in the Social, Behavioral and Health Sciences. Hoboken, NJ: Wiley.

Courtain A, & Glowacz F. (2018). Exploration of dating violence and related attitudes among adolescents and emerging adults. Journal of Interpersonal Violence, 0886260518770185.

D'Amico EJ, Edelen MO, Miles JN, & Morral AR (2008). The longitudinal association between substance use and delinquency among high-risk youth. Drug and Alcohol Dependence, 93(1–2), 85–92. [PubMed: 17977669]

Dardis CM, Dixon KJ, Edwards KM, & Turchik JA (2015). An examination of the factors related to dating violence perpetration among young men and women and associated theoretical explanations: A review of the literature. Trauma, Violence, & Abuse, 16(2), 136–152.

Deuchar R, & Bhopal K. (2017). Assets-based, Border-crossing Approaches to Facilitate Youth Engagement and Social Connectedness: Scottish and English Illustrations In Young People and Social Control (pp. 127–147). Palgrave Macmillan, Cham.

Donovan JE (1996). Problem-behavior theory and the explanation of adolescent marijuana use. Journal of Drug Issues, 26(2), 379–404.

Balsa AI, Giuliano LM, & French MT (2011). The effects of alcohol use on academic achievement in high school. Economics of Education Review, 30(1), 1–15. [PubMed: 21278841]

Doran N, Luczak SE, Bekman N, Koutsenok I, & Brown SA (2012). Adolescent substance use and aggression: A review. Criminal Justice and Behavior, 39(6), 748–769.

Ehrenreich H, Nahapetyan L, Orpinas P, & Song X. (2015). Marijuana Use from Middle to High School: Co-occurring Problem Behaviors, Teacher-Rated Academic Skills and Sixth-Grade Predictors. Journal of youth and adolescence, 44(10), 1929–1940. [PubMed: 25376473]

Ennett ST, Bauman KE, Hussong A, Faris R, Foshee VA, Cai L, & DuRant RH (2006). The peer context of adolescent substance use: Findings from social network analysis. Journal of research on adolescence, 16(2), 159–186.

Espelage DL, Van Ryzin MJ, & Holt MK (2018). Trajectories of bully perpetration across early adolescence: Static risk factors, dynamic covariates, and longitudinal outcomes. Psychology of Violence, 8(2), 141.

Evans SE, Davies C, & DiLillo D. (2008). Exposure to domestic violence: A meta-analysis of child and adolescent outcomes. Aggression and Violent Behavior, 13(2), 131–140.

Farrell AD, Kung EM, White KS, & Valois RF (2000). The structure of self-reported aggression, drug use, and delinquent behaviors during early adolescence. Journal of Clinical Child Psychology, 29, 282–292. [PubMed: 10802836]

Foshee VA, Bauman KE, & Linder GF (1999). Family violence and the perpetration of adolescent dating violence: Examining social learning and social control processes. Journal of Marriage and the Family, 331–342.

Foshee VA, Reyes HLM, Gottfredson NC, Chang LY, & Ennett ST (2013). A longitudinal examination of psychological, behavioral, academic, and relationship consequences of dating abuse victimization among a primarily rural sample of adolescents. Journal of Adolescent Health, 53(6), 723–729.

Foster CE, Horwitz A, Thomas A, Opperman K, Gipson P, Burnside A, Stone DM, & King CA (2017). Connectedness to family, school, peers, and community in socially vulnerable adolescents. Children and Youth Services Review, 81, 321–331. [PubMed: 30202142]

Garthe RC, Sullivan TN, & Behrhorst KL (2018). A latent class analysis of early adolescent peer and dating violence: Associations with symptoms of depression and anxiety. Journal of Interpersonal Violence, 1–19.

Girard LC, Tremblay RE, Nagin D, & Côté SM (2019). Development of aggression subtypes from childhood to adolescence: a group-based multi-trajectory modelling perspective. Journal of Abnormal Child Psychology, 47(5), 825–838. [PubMed: 30402816]

Grasmick HG, Tittle CR, Bursik RJ Jr, & Arneklev BJ (1993). Testing the core empirical implications of Gottfredson and Hirschi's general theory of crime. Journal of Research in Crime and Delinquency, 30(1), 5–29.

Hale DR, Fitzgerald-Yau N, & Viner RM (2014). A systematic review of effective interventions for reducing multiple health risk behaviors in adolescence. American Journal of Public Health, 104(5), e19–e41.

Hawkins JD, & Monahan K. (2009). Covariance of problem behaviors in adolescence. In IOM Committee on the Science of Adolescence Workshop.

Heinze JE, Carter PM, Ngo Q, Zimmerman MA, Walton MA, & Cunningham (2018). Patterns of partner and non-partner violence among high-risk youth. Journal of Adolescent Health, 62, 598–604.

Huang DY, Lanza HI, Murphy DA, & Hser YI (2012). Parallel development of risk behaviors in adolescence: Potential pathways to co-occurrence. International Journal of Behavioral Development, 36(4), 247–257. [PubMed: 24482550]

Hubbard JA, McAuliffe MD, Morrow MT, & Romano LJ (2010). Reactive and proactive aggression in childhood and adolescence: Precursors, outcomes, processes, experiences, and measurement. Journal of Personality, 78(1), 95–118. [PubMed: 20433614]

Jackson C, Henrikson L, & Foshee VA (1998). The Authoritative Parenting Index: Predicting health risk behaviors among children and adolescents. Health Education and Behavior, 25, 319–337. [PubMed: 9615242]

Jessor R. (1987). Problem-behavior theory, psychosocial development, and adolescent problem drinking. British Journal of Addiction, 82(4), 331–342. [PubMed: 3472582]

Kann L, McManus T, Harris WA, Shanklin SL, Flint KH, Queen B, Lowry R, Chyen D, Whittle L, Thornton J, Lim C, Bradford D, Yamakawa Y, Leon M, Brener N, & Ethier KA (2018). Youth risk behavior surveillance—United States, 2017. MMWR Surveillance Summaries, 67(8), 1.

Kelly AB, O'flaherty M, Toumbourou JW, Connor JP, Hemphill SA, & Catalano RF (2011). Gender differences in the impact of families on alcohol use: A lagged longitudinal study of early adolescents. Addiction, 106(8), 1427–1436. [PubMed: 21438936]

Kobus K, & Henry DB (2010). Interplay of network position and peer substance use in early adolescent cigarette, alcohol, and marijuana use. The Journal of Early Adolescence, 30(2), 225–245.

Laska MN, Pasch KE, Lust K, Story M, & Ehlinger E. (2009). Latent class analysis of lifestyle characteristics and health risk behaviors among college youth. Prevention Science, 10(4), 376–386 [PubMed: 19499339]

Lynne-Landsman SD, Graber JA, Nichols TR, & Botvin GJ (2011). Trajectories of aggression, delinquency, and substance use across middle school among urban, minority adolescents. Aggressive Behavior, 37(2), 161–176. [PubMed: 21274853]

Malik S, Sorenson SB, & Aneshensel CS (1997). Community and dating violence among adolescents: Perpetration and victimization. Journal of adolescent health, 21(5), 291–302.

Marshall EJ (2014). Adolescent alcohol use: risks and consequences. Alcohol and Alcoholism, 49(2), 160–164. [PubMed: 24402246]

McDougall P, & Vaillancourt T. (2015). Long-term adult outcomes of peer victimization in childhood and adolescence: pathways to adjustment and maladjustment. American Psychologist, 70(4), 300.

Moffitt TE (1993). Life-course-persistent and adolescence-limited antisocial behavior: A developmental taxonomy. Psychological Review, 100(4), 674–701. [PubMed: 8255953]

Moore SE, Norman RE, Suetani S, Thomas HJ, Sly PD, & Scott JG (2017). Consequences of bullying victimization in childhood and adolescence: a systematic review and meta-analysis. World Journal of Psychiatry, 7(1), 60. [PubMed: 28401049]

Mustanski B, Byck GR, Dymnicki A, Sterrett E, Henry D, & Bolland J. (2013). Trajectories of multiple adolescent health risk behaviors in a low-income African American population. Development and Psychopathology, 25(4), 1155–1169. [PubMed: 24229555]

Muthén BO, Muthén LK (1998-2012). Mplus User's Guide (6th ed.). Los Angeles, CA: Muthén & Muthén.

Nagin DS, Jones BL, Passos VL, & Tremblay RE (2016). Group-based multi-trajectory modeling. Statistical Methods in Medical Research, 1–9.

Orpinas P, Nahapetyan L, & Truszczynski N. (2017). Low and Increasing Trajectories of Perpetration of Physical Dating Violence: 7-Year Associations with Suicidal Ideation, Weapons, and Substance Use. Journal of youth and adolescence, 46(5), 970–981. [PubMed: 28093667]

Piotrowska PJ, Stride CB, Croft SE, & Rowe R. (2015). Socioeconomic status and antisocial behaviour among children and adolescents: A systematic review and meta-analysis. Clinical Psychology Review, 35, 47–55. [PubMed: 25483561]

Reyes HLM, Foshee VF, Chen MS, & Ennett ST (2018). Patterns of adolescent aggression and victimization: Sex differences and correlates. Journal of Aggression Maltreatment and Trauma. 10.1080/10926771.2018.1466843.

Reyes HLM, Foshee VA, Markiewitz N, Chen MS, & Ennett ST (2018). Contextual risk profiles and trajectories of adolescent dating violence perpetration. Prevention Science, 19(8), 997–1007. [PubMed: 29629508]

Ribeaud D, & Eisner M. (2010). Risk factors for aggression in pre-adolescence: Risk domains, cumulative risk and gender differences-Results from a prospective longitudinal study in a multi-ethnic urban sample. European Journal of Criminology, 7(6), 460–498.

Rutter M. (1997). Comorbidity: concepts, claims and choices. Criminal Behaviour and Mental Health, 7(4), 265–285.

Skeer MR, McCormick MC, Normand SLT, Mimiaga MJ, Buka SL, & Gilman SE (2011). Gender differences in the association between family conflict and adolescent substance use disorders. Journal of Adolescent Health, 49(2), 187–192.

Slopen N, Shonkoff JP, Albert MA, Yoshikawa H, Jacobs A, Stoltz R, & Williams DR (2016). Racial disparities in child adversity in the US: Interactions with family immigration history and income. American Journal of Preventive Medicine, 50(1), 47–56. [PubMed: 26342634]

Steinberg L. (2008). A social neuroscience perspective on adolescent risk-taking. Developmental Review, 28(1), 78–106. [PubMed: 18509515]

Sterba SK (2014). Handling missing covariates in conditional mixture models under missing at random assumptions. Multivariate behavioral research, 49(6), 614–632. [PubMed: 26735361]

Sternberg KJ, Baradaran LP, Abbott CB, Lamb ME, & Guterman E. (2006). Type of violence, age, and gender differences in the effects of family violence on children's behavior problems: A mega-analysis. Developmental Review, 26(1), 89–112.

Tremblay RE, Vitaro F, & Côté SM (2018). Developmental origins of chronic physical aggression: A bio-psycho-social model for the next generation of preventive interventions. Annual review of psychology, 69, 383–407.

Trim RS, Worley MJ, Wall TL, Hopfer CJ, Crowley TJ, Hewitt JK, & Brown SA (2015). Bivariate trajectories of substance use and antisocial behavior: associations with emerging adult outcomes in a high-risk sample. Emerging Adulthood, 3(4), 265–276. [PubMed: 26889401]

Van Lier PA, Vitaro F, Barker ED, Koot HM, & Tremblay RE (2009). Developmental links between trajectories of physical violence, vandalism, theft, and alcohol-drug use from childhood to adolescence. Journal of Abnormal Child Psychology, 37(4), 481–492. [PubMed: 19089610]

White HR, Conway FN, & Ward JH (2019). Comorbidity of Substance Use and Violence In Handbook on Crime and Deviance (pp. 513–532). Springer, Cham.

Whiteside LK, Ranney ML, Chermack ST, Zimmerman MA, Cunningham RM, & Walton MA (2013). The overlap of youth violence among aggressive adolescents with past-year alcohol use—A latent class analysis: Aggression and victimization in peer and dating violence in an inner-city

emergency department sample. Journal of Studies on Alcohol and Drugs, 74(1), 125–135. [PubMed: 23200158]

Wu J, Witkiewitz K, McMahon RJ, Dodge KA, & Conduct Problems Prevention Research Group. (2010). A parallel process growth mixture model of conduct problems and substance use with risky sexual behavior. Drug and Alcohol Dependence, 111(3), 207–214. [PubMed: 20558013]

Zuckerman M, & Lubin B. (1985). Manual for the Multiple Affect Adjective Check List – Revised. San Diego, CA: Educational & Industrial Testing Service.
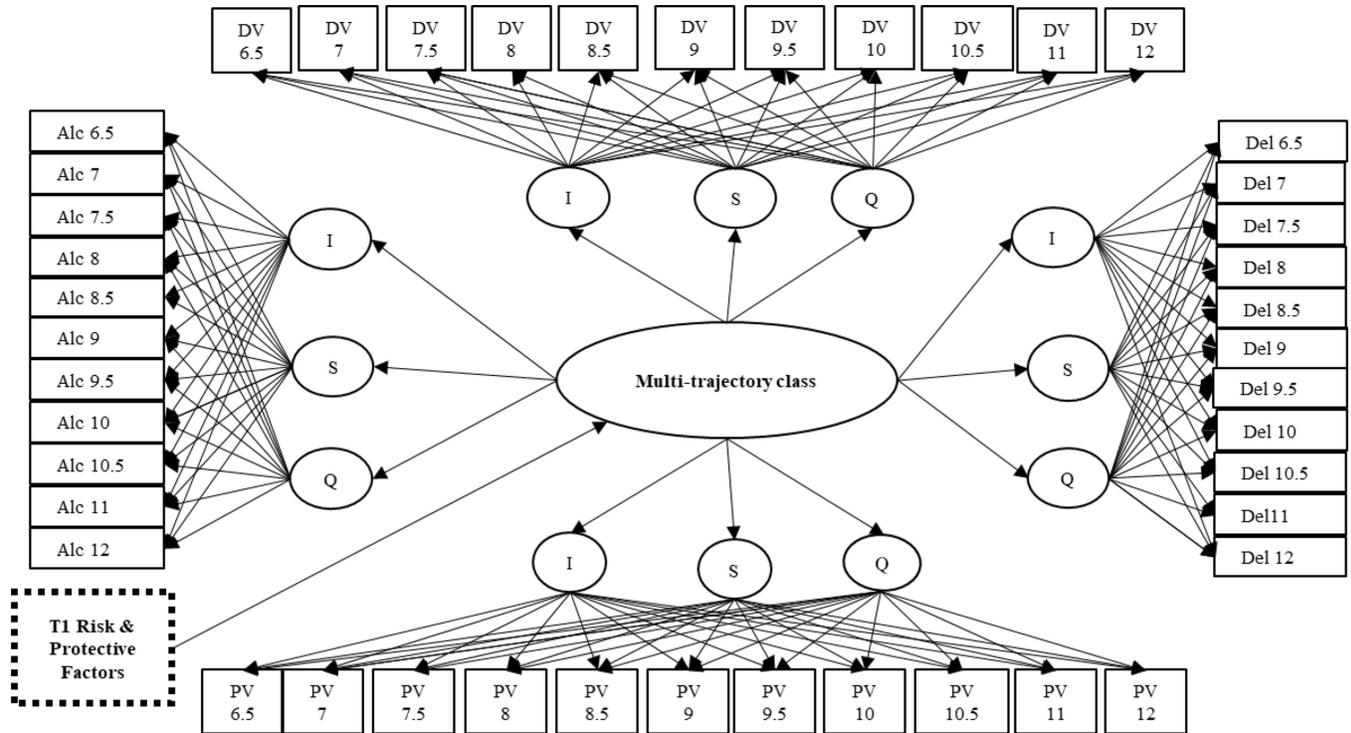
Figure 1.
Hypothesized model of current study

Note. Alc=heavy alcohol use, DV=physical dating violence, Del=delinquency, and PV=physical peer violence. Numbers correspond to the grade-level at time of measurement with ".5" indicating spring semester assessment. I=intercept, S=Slope, Q=Quadratic. T1=baseline assessment wave. As is standard for group-based trajectory models, latent variable (co)variances are fixed to zero and residual variances for the delinquency items were estimated but are not depicted.
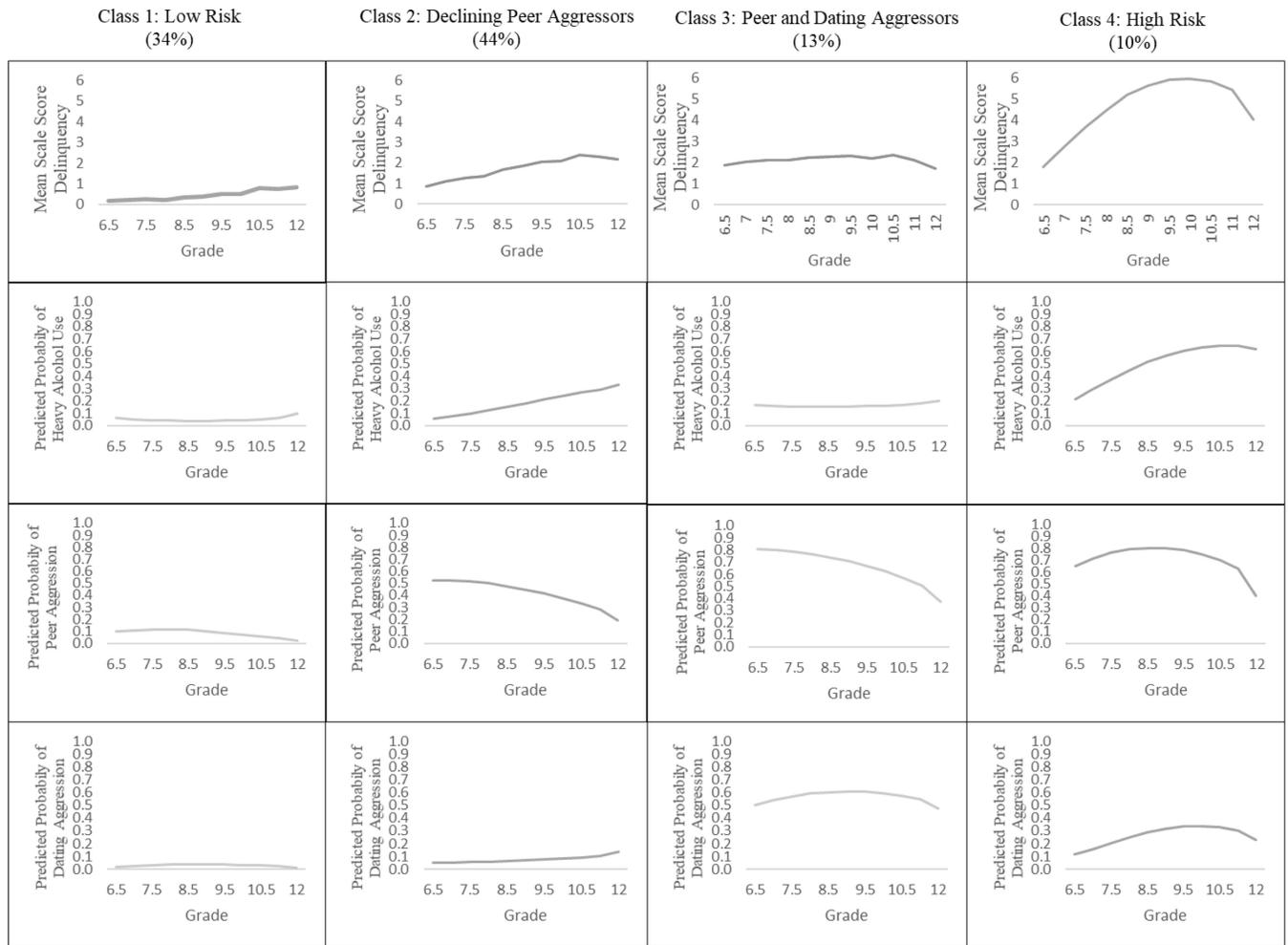
Figure 2.
Problem Behavior Trajectories by Latent Multi-trajectory Class

Table 1.

Descriptive statistics for trajectory outcome measures by grade-level

Grade	n	Delinquency	Heavy alcohol use	Peer Aggression	Dating Aggression
		M (SD)	%	%	%
6.5	1010	0.82 (1.67)	6	40	10
7	835	1.04 (2.09)	22	44	11
7.5	1761	1.29 (2.31)	8	45	14
8	1543	1.26 (2.34)	16	46	16
8.5	2304	1.56 (2.52)	11	45	14
9	1890	1.67 (2.70)	21	39	14
9.5	1352	1.85 (2.96)	17	34	16
10	1815	1.83 (2.68)	20	30	16
10.5	579	2.12 (3.17)	23	32	17
11	1120	1.92 (2.78)	23	25	14
12	467	1.68 (2.42)	25	23	15

Note. The eligible sample size at each grade-level varies due to the cohort sequential design; by design, at some grade-levels all three cohorts contributed data whereas at other grades only one or two cohorts contributed data.

Table 2.

Fit statistics for one to six class multi-trajectory group-based models

N of classes	*N* of free parameters	Loglikelihood	BIC	LMR-LRT	VLMR-LRT	Entropy
1	23	−45059	90301	*NA*	*NA*	*NA*
2	36	−42073	84432	<.001	<.001	0.78
3	49	−41511	83410	<.001	<.001	0.72
4	62	−41148	82789	<.001	<.001	0.74
5	75	−40897	82390	0.16	0.16	0.73
6	88	−40663	82025	0.57	0.57	0.75

Note. BIC=Bayesian information criteria; LMR-LRT= Lo-Mendell-Rubin adjusted likelihood ratio test; VLMR-LRT= Vuong Lo-Mendell-Rubin likelihood ratio test. A lower BIC indicates better fit. A p-value of greater than .05 for the LMR-LRT and VLMR-LRT indicates that an increase in the number of classes does not result in a significant increase in model fit.

Table 3.

Associations between demographic factors and multi-trajectory classes

Class	Demographic Factor		Comparison (Reference) Class	
		Low Risk AOR [95% CI]	Declining peer aggressorsq AOR [95% CI]	Peer & dating aggressors AOR [95% CI]
Multi-domain high risk	Male	1.81 [1.29, 2.54] **	1.76 [1.28, 2.44] **	24.40 [12.18, 48.89] ***
	Parent education	1.17 [0.82, 1.68]	1.23 [0.88, 1.73]	1.04 [0.59, 1.81]
	Black race (vs White)	0.88 [0.62, 1.23]	0.69 [0.50, 0.95] *	0.04 [0.02, 0.12] ***
	Other race (vs. White)	1.73 [1.01, 2.95] *	1.51 [0.91, 2.48]	0.26 [0.08, 0.86] ***
Peer & dating aggressors	Male	0.08 [0.05, 0.13] ***	0.09 [0.05, 0.14] ***	--
	Parent education	0.98 [0.87, 1.09]	1.22 [0.86, 1.72]	--
	Black race (vs White)	13.34 [7.58, 23.50] ***	9.816 [5.79, 16.63] ***	--
	Other race (vs. White)	4.88 [2.14, 11.14] ***	3.89 [1.78, 8.54] **	--
Declining peer aggressors	Male	1.13 [0.90, 1.42]	--	--
	Parent education	0.91 [0.71, 1.17]	--	--
	Black race (vs White)	1.21 [0.96,1.54]	--	--
	Other race (vs. White)	1.10 [0.70,1.73]	--	--

Note.

^
p<.10

*
p<.05

**
p<.01

***
p<.001. AOR=Adjusted odds ratio. Each AOR denotes increase in odds of belonging to the column 1 class compared to the row (reference) class for a one-unit change in the demographic covariate, controlling for the other covariates.

Table 4.

Associations between risk and protective factors and multi-trajectory classes

Class	Risk/Protective Factor	Comparison (Reference) Class		
		Low Risk AOR [95% CI]	Declining peer aggressors AOR [95% CI]	Peer and dating aggressors AOR [95% CI]
Multi-domain high risk	*Personality factors*			
	Low self-control (RF)	1.83 [1.53, 2.18]***	1.23 [1.05, 1.44]*	1.05 [0.82, 1.35]
	Negative emotionality (RF)	1.47 [1.15, 1.89]**	1.07 [0.86, 1.32]	0.76 [0.54, 1.04]^
	Future aspirations (PF)	0.85 [0.54, 1.33]	0.76 [0.54, 1.06]	1.01 [0.61, 1.67]
	Deviance intolerance (PF)	0.36 [0.48, 0.63]***	0.68 [0.57, 0.82]***	0.66 [0.50, 0.87]**
	Environmental factors			
	Family violence (RF)	1.12 [1.31, 1.54]**	1.25 [1.09, 1.43]**	1.23 [1.00, 1.50]*
	Parental monitoring (PF)	0.65 [0.51, 0.83]**	0.82 [0.67, 1.01]^	0.85 [0.63, 1.15]
	Peer substance use (RF)	1.33 [1.74, 2.27]***	1.22 [1.02, 1.47]*	1.04 [0.80, 1.34]
Peer and dating aggressors	*Personality factors*			
	Low self-control (RF)	1.79 [1.51, 2.13]***	1.21 [1.04, 1.40]*	--
	Negative emotionality (RF)	1.86 [1.46, 2.36]***	1.38 [1.13, 1.68]**	--
	Future aspirations (PF)	0.73 [0.41, 1.29]	0.73 [0.45, 1.18]	--
	Deviance intolerance (PF)	0.69 [0.52, 0.91]*	1.05 [0.85, 1.29]	--
	Environmental factors			
	Family violence (RF)	1.17 [0.98, 1.38]^	1.04 [.90, 1.20]	--
	Parental monitoring (PF)	0.74 [0.57, 0.94]*	0.90 [0.73, 1.10]	--
	Peer substance use (RF)	1.80 [1.38, 2.35]***	1.25 [1.03, 1.51]*	--
Declining peer aggressors	*Personality factors*			
	Low self-control (RF)	1.52 [1.34, 1.71]***	--	--
	Negative emotionality (RF)	1.32 [1.10, 1.58]**	--	--
	Future aspirations (PF)	1.35 [0.86, 2.11]	--	--
	Deviance intolerance (PF)	0.66 [0.51, 0.85]**	--	--

		Comparison (Reference) Class		
Class	**Risk/Protective Factor**	**Low Risk AOR [95% CI]**	**Declining peer aggressors AOR [95% CI]**	**Peer and dating aggressors AOR [95% CI]**
	Environmental factors			
	Family violence (RF)	1.05 [0.92, 1.19]	--	--
	Parental monitoring (PF)	0.68 [0.82, 0.99]*	--	--
	Peer substance use (RF)	1.54 [1.20, 1.98]**	--	--

Note.

^
$p<.10$

*
$p<.05$

**
$p<.01$

***
$p<.001$. RF=risk factor. PF=protective factor. AOR=Adjusted odds ratio. Each AOR denotes increase in odds of belonging to the column 1 class compared to the row (reference) class for a one-unit change in the demographic covariate, controlling for the other covariates.