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Developmental Relations Between Alcohol and Aggressive Behavior Among Adolescents: Neighborhood and Sociodemographic Correlates

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Abstract

Throughout adolescence, alcohol consumption and aggressive behaviors are associated with multiple problematic outcomes. Few studies have examined neighborhood-level predictors and individual and family-level sociodemographic variables to describe longitudinal trajectories of these problem behaviors. Therefore, this study investigated the unique contributions of neighborhood and sociodemographic factors in the shared development of aggressive behaviors and drinking in adolescents. We analyzed alcohol consumption frequency and frequency of aggressive behaviors using parallel process latent growth curve models with demographic indicators and neighborhood constructs as predictors. At all ages, alcohol use and aggression positively covaried. Male gender was associated with both aggressive episodes and alcohol use at age 12. African American ethnicity was associated with higher levels of early aggression. Higher neighborhood income was associated with lower levels of early aggression. Findings lend support to current efforts to curb early initiation of alcohol use and aggression.

Keywords

Alcohol; Drinking; Aggression; Adolescence; Neighborhoods; Social capital

Research suggests that alcohol consumption and aggressive behavior co-occur in adolescents (Huang, White, Kosterman, Catalano, and Hawkins 2001; White 1997).

Multiple potential mechanisms may underlie this connection. Alcohol use may predict aggression during adolescence or vice versa. Alternatively, these relations may be reciprocal or both behaviors may be driven by a third factor (White 1997, pp. 82–83). Studying co-occurrence of these problems is important for a variety of reasons; findings have implications for interventions that seek to change both behaviors by targeting one or the other, for policy interventions that may address shared risk factors if these exist, and for refinement of developmental psychopathology models. Understanding neighborhood influences on these behaviors can build knowledge about contextual factors, which could inform targets for intervention.

Aggressive behavior and alcohol use are common during adolescence. Approximately one-third of high school age youth report fighting or other acts of violence, and over 40 % of youth in this age group report drinking alcohol in the previous 30 days (Centers for Disease Control and Prevention 2009). These behaviors have the potential to negatively impact youth and the wider community. Heavy episodic drinking is associated with sexual risk behavior, suicidality, and other drug use (Miller, Naimi, Brewer, and Jones 2007), and adolescent binge drinking may precede alcohol use disorders in adulthood (Lee et al. 2012). Aggressive behavior harms individual victims, but it also affects the broader society in terms of witnessing and paying for its deleterious effects (Herrenkohl, Aisenberg, Williams, and Jenson 2011). The negative impacts on adolescent perpetrators of aggression include diminished academic achievement (Basch 2011) and an increased likelihood of committing violence in adulthood (Jenson 2011).

Studies in this area are marked by inconsistent findings, possibly arising from variation in sample selection, age range, and longitudinal analysis methods used. Delinquency and conduct problems have been found in some research to be a stronger predictor of alcohol use than the reverse (Young, Sweeting, and West 2008). Other research has found the opposite. The Pittsburgh Longitudinal Study found that early alcohol use was associated with later risk of violence, suggesting that early drinking is a risk factor (Wei, Loeber, and White 2004). In distinguishing classes of aggressive behavior, Martino and colleagues (2008) found that alcohol use in grade 7 was a predictor of early aggression.

Associations between alcohol use and aggression may be a function of two pathways, through shared risk factors for alcohol use and aggression that lead to both, and through increased risk of aggression due to intoxication itself. For instance, research by Felson et al. (2008a, b) found that adolescents who drank frequently were more violent than those who did not drink frequently, but also identified a specific effect of intoxication on violence. Similarly, White et al. (2013) found that within-person increases in alcohol use lead to increased aggressive behavior among adolescent boys. The impact of alcohol use on aggression and violence may be a function of the temperament among individuals who may display more or less dispositional traits (Norström and Pape 2010) or who live in high-crime neighborhoods (White et al. 2013).

Alcohol use may be more strongly related to aggression than to other types of youthful offending. A study of drinking and delinquency as simultaneous phenomena found a stronger association of alcohol use with violent delinquency than with theft (Felson,

Savolainen, Aaltonen, and Moustgaard 2008a). Other research findings are less clear about the relation of alcohol use and aggression among youth. Lynne-Landsman et al. (2011) created subtypes of delinquency, aggression, and alcohol use growth patterns. They disaggregated the sample and identified a group of students in middle school with high levels of substance use. High-risk students were evenly divided among classes of aggression, suggesting that early substance use did not place these children at particular risk of high levels of aggression.

Previous literature has also considered the role of gender in aggression and alcohol use. Arrest data for violent offenses indicate a higher incidence of aggressive behavior in male adolescents (Federal Bureau of Investigation 2008; Snyder and Sickmund 2006). When non-violent aggressive behavior (i.e., relational aggression) is included, however, the gender effect is less robust (Frieze and Li 2010). Among girls, early conduct problems are associated with later alcohol use (Loeber, Stepp, Chung, Hipwell, and White 2010), but evidence suggests that levels of alcohol use are higher in males than females during adolescence (Flory, Lynam, Milich, Leukefeld, and Clayton 2004). By early adulthood, males are also more likely than females to appear in heavy-drinking subgroups (Chassin, Pitts, and Prost 2002) and display at-risk or disordered drinking (Schulte, Ramo, and Brown 2009).

The relation between ethnicity and these adolescent risk behaviors is less clear. African American youth are less likely than White or Latino adolescents to drink any alcohol, to display heavy episodic drinking, or to develop alcohol use disorders (Barnes, Welte, and Hoffman 2002; Pemberton, Collier, Robbins, and Gfroerer 2008; Wu, Woody, Yang, Pan, and Blazer 2011). African American youth also start drinking later and their drinking is less likely to persist through adolescence (Malone, Northrup, Masyn, Lamis, and Lamont 2012). African American males report higher levels of aggressive behavior than other groups; aggression levels may be influenced by family and community conditions (Williams, Bright, and Petersen 2011). Similarly, Loukas and colleagues (2005) identified higher levels of verbal and physical aggression among Latino youth in early adolescence. Stresses related to acculturation and perceived discrimination may contribute to aggressive behavior among Latino youth (Smokowski and Bacallao 2006).

Community risk factors may also influence both aggressive behavior and alcohol use among adolescents. Social cohesion and control characterize neighbors' connections to one another and to their place of residence, and their willingness to enforce shared prosocial norms, respectively (Drukker, Buka, Kaplan, McKenzie, and Van Os 2005). In existing research, social cohesion has been found to be associated with adult neighborhood residents' perceptions of youth alcohol and drug problems as well as actual arrests (Duncan, Duncan, and Strycker 2002). Conversely, Buu and colleagues (2009) did not identify greater risk for substance use resulting from neighborhood economic disadvantage in early childhood, and neighborhood disadvantage was not directly associated with violence among girls in a study of juvenile justice involvement (Chauhan and Reppuci 2009). Fagan and Wright (2012) also had mixed findings, in that social control and social cohesion were not associated with violence in boys but were weakly and positively associated with violence in girls.

Regarding the interplay of alcohol use and aggression, existing research is not entirely clear in discerning the relations of these two important risk behaviors as well as the role that individual and neighborhood factors may play in their development. Because of the severity of consequences and frequent co-occurrence of both behaviors, it is important to understand variation in their developmental course during adolescence. In order to inform prevention and intervention, the present study investigated relations between the frequency of alcohol use and growth in aggressive behaviors during adolescence in both the overall trajectory of these behaviors and age-specific relations. We hypothesized that growth in aggression and alcohol use would be related, and that lower levels of neighborhood-level resources (neighborhood social capital and neighborhood income) would predict growth in both aggression and alcohol use, independent of individual and family-level sociodemographic covariates (ethnicity, income, gender, education).

Method

Data Source

This study analyzed data from the Project on Human Development in Chicago Neighborhoods [PHDCN; (Earls, Brooks-Gunn, Raudenbush, and Sampson 2007)], a landmark examination of youth development which explored individual, family and neighborhood influences on delinquency, substance use and other outcomes.

The PHDCN included neighborhood and household-level components. A community survey gathered in-depth information about conditions in different neighborhoods in the city of Chicago. In this survey, the PHDCN investigators measured homogenous “neighborhood clusters” by combining census tracts that were similar on specific census information. Each neighborhood consisted of approximately 8000 inhabitants and the sampling strategy approximated geographic neighborhood boundaries. Using a multi-stage sampling design, the 343 neighborhood clusters were stratified by racial mix and socioeconomic status (Sampson, Raudenbush, and Earls 1997). Within each neighborhood, city blocks were sampled; from within the city block, dwelling units were sampled. Finally, an adult resident was sampled within each unit. Information on neighborhood social, organizational and political factors was collected in a distinct neighborhood survey of adult respondents (Marz and Stamatel 2005).

In the longitudinal phase, a survey was administered to a stratified probability subsample of 80 of the 343 PHDCN neighborhoods. Approximately 6000 participants in seven age cohort groups (ages 0, 3, 6, 9, 12, 15 and 18 at Wave 1), along with their primary caregivers, were randomly sampled from the block groups (Earls et al. 2007) and were surveyed over three waves of data collection [1994–1997, 1997–1999, and 2000–2001; (Marz and Stamatel 2005)]. In order to complete the surveys, youth and caregivers were interviewed in their homes at each time point, and both informed consent (caregivers) and assent (children) were obtained prior to each wave of data collection for each participant (Martin, Gardner, and Brooks-Gunn 2012).

Sample

The present study includes data for youth who were surveyed at ages 12, 15, and 18 during at least one of the three waves. In other words, we used the age 15 and age 18 data for the youth who were 15 years old at Wave 1 and age 18 at Wave 2; we used the age 12, 15, and 18 data for the youth who were 12 years old at Wave 1, etc. Individuals in cohort 18 were excluded, as they were missing information on covariates of interest.

Measures

Alcohol and Aggression—Alcohol consumption was defined based on the number of drinking occasions in the past year reported by the youth during an in-person interview (primary caregiver not present). Ordinal categories included the following: *Never*, *1–2 days*, *3–5 days*, and *6 or more days*. Aggressive behaviors were derived from the Self Report of Offending administered with the child in a confidential in-person interview (Loeber, Stouthamer-Loeber, Van Kammen, and Farrington 1989). We developed a 4-level item based on counts of aggressive behaviors including number of times the youth reported hitting someone, attacking someone with a weapon, using force to rob someone, throwing objects, participating in a gang fight, or forcing someone to have sex. We summed the number of times the participant reported engaging in all of these behaviors. The sum of aggressive behaviors was then used to create an ordinal variable based on the total number of aggressive episodes endorsed. The following categories defined ordinal levels of aggressive episodes: *No episodes*, *1–3 episodes*, *4–10 episodes* and *More than 10 episodes*.

Sociodemographic Covariates—We included the following sociodemographic predictors: ethnicity, income, gender, and caregiver educational attainment. Ethnicity was dummy-coded into the categories White/Caucasian (reference), African American/Black, and Latino/Hispanic. Due to low numbers of other ethnicities, these youth were excluded from the analysis. Caregiver education consisted of the following categories: less than high school, high school graduate/GED, or more than high school. Ethnicity and per-capita household income data were collected from primary caregivers at Wave 1.

Neighborhood Covariates—We utilized a measure of neighborhood social capital developed for the PHDCN study (Earls et al. 2007). Participants were asked the extent to which there were adults in the neighborhood that children can look up to, whether there are adults in the neighborhood that watch out for children's safety, whether parents know their children's friends, and whether parents in the neighborhood know each other. Each of these questions had five potential response options: *strongly agree*; *agree*; *neither agree nor disagree*; *disagree*; or *strongly disagree*. The scale score that was used in the multilevel model was derived as a mean value of the five responses (between 1 and 5) with higher values indicating greater social capital. Models included Empirical Bayes (EB) estimates (Hox 2010, p. 31) of the neighborhood measure of the five-item Social Capital Scale because some neighborhoods were represented by few participants. The neighborhood income variable was derived using the neighborhood cluster means of the income variable (a 7-level variable treated as continuous).

Data Analysis

We used a multivariate approach to model change over time at the individual level using parallel process modeling (Bollen and Curran 2006) with adjusted standard error estimates and fit statistics for within-neighborhood clustering using survey analysis features (i.e. “complex”) in version 7 of the Mplus statistical package (Muthén and Muthén 1998–2012). Parallel process models (PPM) can estimate the relation between one process of change and another (Cheong, MacKinnon, and Khoo 2003; Preacher, Wichman, MacCallum, and Briggs 2008, pp. 38–42). In a PPM, intercept and slope factors are estimated using repeated measures. As with any latent growth model (of which PPM is just one example), intercept factor loadings are constrained to equal one and slope factor loadings can be used to estimate linear, quadratic, or other nonspecific nonlinear trajectories. Individuals’ initial status and growth can then be allowed to covary, shedding light on the relation of the two developmental processes at age 12 intercepts and over time. Additionally, these models can include an assessment of predictors of individuals’ initial status and growth rates of each process.

Due to the ordinal nature of the responses to questions regarding substance use and the distribution of aggressive behavior, both variables were treated as ordered categorical in the analysis. We used mean and variance adjusted weighted least squares (WLSMV) estimation with a probit link to model the ordinal responses. Using this method, correlations among variables are estimated using a polychoric correlation matrix assuming that each variable has an underlying normally distributed latent response. Threshold values are conceptualized as points along a latent continuum, separating response categories (Finney and DiStefano 2006, p. 281). In the WLSMV estimator, missing data were handled using the expectation maximization algorithm based on the assumption of being “missing at random” on exogenous covariates (Asparouhov and Muthén 2010). The accelerated longitudinal design of the PHDCN study yielded planned missingness, as not all youth and caregivers provided data at every time point (Earls et al. 2007). Because missingness on any variable is not associated with values on another variable among these individuals excluded from data collection at specific ages, data points for individuals who were assessed during only one or two waves during adolescence are presumed to be missing completely at random [MCAR, as defined in Schafer and Graham (2002)].

We estimated a series of models starting from unconditional linear growth models computed separately for the two behaviors and then an unconditional PPM. After fitting these models, we estimated a final model that included the covariates ethnicity, income, caregiver education, gender, education, neighborhood income, and neighborhood social capital as predictors of both the behavior intercepts.

Results

In this sample, the frequency of alcohol use increased at each timepoint, from 2.7 % endorsing any alcohol use at age 12, 24 % at age 15, and 53 % endorsing any episodes of past-year alcohol use by age 18. Aggressive behavior showed an increase from age 12 to age 15; 21 % of the youth reported at least one aggressive act at age 12, but at age 15 and age 18

the rate of youth reporting any aggressive episodes was more consistent at approximately 30 % (See Table 1).

Descriptive information on model covariates and outcomes is provided in Table 1. The sample is diverse in terms of gender, ethnicity, income, and caregivers' education. Slightly more than one-half of the adolescent respondents were female and a large proportion of the sample self-identified as Black/African American (36 %) or Latino (48 %). Among caregivers, the distribution of educational achievement was largely bimodal, with higher percentages of individuals with less than a high school education or education beyond high school. The social capital neighborhood mean was 3.5, somewhat higher than the theoretical midpoint (3) of the scale, and the neighborhood income mean was 3.92 suggesting that neighborhood income average was \$20,000–\$30,000.

Model testing

We developed a PPM by estimating a series of models and evaluating fit, similar to current practices in structural equation modeling (Kline 2011). Specifically, we evaluated fit using benchmarks put forward by Hu and Bentler (1999). First, separate models were estimated for each behavioral growth process separately, and then the two processes were modeled together and residuals for each timepoint were allowed to covary (see Table 2 for fit statistics). Finally, a model was estimated on both behavioral processes with the inclusion of individual-level and neighborhood-level covariates.

In the separate models (Unconditional Aggression-Linear & Unconditional Alcohol Linear; See Table 2), fit was poor for linear trajectories and little variation was identified in slope estimates in both the alcohol and aggression trajectories. We therefore constrained the slope variances, intercept, and slope covariances to zero. To address the problem of poor fit to linear models, we freed the third loading (age 18) of the model. For both the aggression and alcohol trajectories, freeing the third loading improved fit considerably and compared models using χ^2 difference tests. In this final model, all fit statistics fell within accepted values including a nonsignificant χ^2 , TLI and CFI near 1.00, an RMSEA<0.02 and WRMR less than 0.80.

Characteristics of Growth of Alcohol Use and Aggressive Behavior

Figure 1 displays the PPM model of unconditional latent mean growth in alcohol use and aggression among youth at ages 12, 15, and 18. In the figure, the horizontal lines represent the points on the latent continuum that are the “thresholds” between the response options that separate categories from each other. The frequency of both these behaviors increased between ages 12 and 18, but past-year aggressive episodes decreased from age 15 to age 18. The values on the right side of the diagram represent points along the latent continuum between 0 and 3 where one reaches the next ordered response on the question scale across the latent continuum. The alcohol frequency line crosses the first alcohol threshold (thick dashed line) at age 18 (1–3 days), indicating that mean alcohol use by age 18 was 1–3 times in the past year. In contrast, the mean trajectory of aggressive episodes never crosses the first threshold (thin dashed line) suggesting that the mean predicted value of aggression remained low across ages. Nonetheless, model intercept variances were significantly

different from zero, suggesting heterogeneity in the initial levels of drinking even though variation in the shape of trajectories was not present. Moreover, frequency of early alcohol use and aggressive behavior were significantly associated with one another as were time-specific residual covariances at each age. The relation between residual alcohol use and residual aggression was strongest at age 12, but present at all three ages. Essentially, early (age 12) drinking and aggressive behaviors were associated with one another, and at all ages, above and beyond the general trajectory, alcohol use and aggression were correlated.

Covariates of Growth of Alcohol Use and Aggressive Behavior

In the case of covariates, some associations were consistent to both behaviors but other covariates were specific to either alcohol use frequency or aggression (see Table 3). Male gender was associated with both aggressive episodes ($b=0.248$; $\beta=0.410$; $p<.001$) and alcohol use ($b=0.079$; $\beta=0.165$; $p<.05$) at the intercept (age 12), although the association between aggression and male gender appears to be stronger. Aside from gender, covariates were not consistent for alcohol and aggression. Although household income was not associated with alcohol use or aggressive behavior, neighborhood income was negatively associated with levels of early aggressive behavior ($b=-0.110$; $\beta=-0.123$; $p<.05$). Social capital was not significantly associated with growth in aggression or alcohol use. African American ethnicity was associated with higher levels of early aggressive behavior ($b=0.285$; $\beta=0.459$; $p<.01$) but lower levels of alcohol use ($b=-0.265$; $\beta=-0.556$; $p<.05$), and Latino/Hispanic ethnicity was associated with lower levels of aggression relative to White/Caucasian youth ($b=-0.151$; $\beta=-0.249$; $p<.05$). In the interest of further exploring potential interactions between race and gender, we conducted a post-hoc analysis of interactions between Black race and gender, and Latino ethnicity and gender on both aggression frequency and alcohol use frequency. Although this model fit the data well, we did not detect a statistically significant interaction of race and gender on either aggression or alcohol use.

Discussion

In our first hypothesis, we suggest that growth in alcohol use and aggression are related, and that gender differences in growth should be observed. Findings only partially support this hypothesis. Models suggest that early (age 12) drinking and aggressive behaviors are associated with one another, but that this association can be attributed to variation in overall level (intercept) of variation, and not variation (slope) in the rate of growth in alcohol use and aggressive behavior. Models also suggest time specific associations between aggressive behavior frequency and drinking frequency at each age (12, 15, & 18) beyond the general trajectory of the two behaviors. Both the intercepts of these constructs are associated, and these behaviors covary at each age. It is possible that aggressive behavior and alcohol use are strongly associated and this association weakens over time as displayed by the time-specific covariations between alcohol use frequency and aggression frequency, which are weaker at later time points. At early ages, drinking is rare and predictive of early psychopathology as well as negative outcomes in emerging adulthood (Ellickson, Tucker, and Klein 2003) and at later ages drinking behavior is somewhat less deviant and behavioral control improves. As youth grow older, their risk of alcohol use increases consistent with

greater exposure to alcohol (Centers for Disease Control and Prevention 2009). Our findings are aligned with Huang and colleagues (2001) who observed a strong relation between drinking and aggression in mid-adolescence that weakened in late adolescence.

Consistent with expectations, however, female youth are less likely to engage in either aggression or alcohol use than male youth. The relatively low incidence of aggression among girls replicates earlier findings on violent behavior (Federal Bureau of Investigation 2008; Snyder and Sickmund 2006), and the intercept for alcohol use is significantly different across genders in the final model. Both gender differences may be attributable to gender-based socialization processes that are more permissive with respect to boys' risk behavior (Liu and Kaplan 1999). Because relational aggression (gossiping, exclusion, verbal assault) is unmeasured in this study, however, it is unknown whether greater convergence in aggression would become apparent with a broader definition.

Contrary to our second hypothesis, neighborhood effects are limited in this model. Living in a higher income neighborhood is associated with lower frequency of aggression but social capital is not significantly associated with drinking frequency or aggressive episodes. The income finding is consistent with literature that suggests that neighborhood poverty is associated with delinquency in general, and aggressiveness in particular (Leventhal and Brooks-Gunn 2000). Recent research suggests that factors such as neighborhood income become important for predicting aggressive behavior as children enter middle school (Vanfossen, Brown, Kellam, Sokoloff, and Doering 2010).

Duncan and colleagues (2002) identified associations among social cohesion (a component of social capital), perceptions of drug and alcohol use, and youth arrests for drug and alcohol use. Our failure to find a direct relation between social capital and alcohol use frequency may be a result of differences in measurement of both alcohol and associated harm, compared to prior research. Moreover, there may be multiple, unmeasured neighborhood factors related to adolescent alcohol use, such as differences in level of supervision and differences in social norms related to drinking. This may account for discrepant findings across studies. Finally, the sample consists only of urban youth; neighborhood effects may be more pronounced in suburban, rural, or geographically mixed samples. Further research into neighborhood effects on alcohol use and aggression may be able to resolve some of the ambiguity on the extent and importance of neighborhood-level mechanisms driving youth risk behavior.

We identify relations between certain ethnic groups and elevated growth in each behavior. African American youth display greater risk for aggression at age 12 compared with the reference group (White/Caucasian youth) but lower levels of risk related to alcohol use. This finding is consistent with research on African American youth who are less likely than either Latino or Caucasian youth to use or misuse alcohol (Pemberton et al. 2008), start drinking later, and are less likely to drink on an ongoing basis than White youth (Malone et al. 2012). Youth identifying as Hispanic or Latino, in this sample, are not significantly different from White youth in their risk for or growth in alcohol use, but do display lower levels of aggressive behavior. It is possible that protective factors, such as familism and connection to

one's culture of origin, may protect against aggressiveness in Latino youth (Smokowski and Bacallao 2006).

Although this study has effectively described growth in alcohol frequency and aggressive behavior among youth, it is limited in several ways. First, inclusion of data at three ages constrains the shape of growth estimates and limits ability to characterize variability. Second, the use of ordinal measurement of behavioral indicators does not take into account the severity of alcohol use (i.e., amount consumed per episode) or aggression. Third, unmeasured covariates, such as neighborhood-level crime, availability of alcohol, and parenting practices may have predictive value but are not included in this model. Additionally, this study utilized an accelerated longitudinal design approach, which meant that a substantial number of youth were missing at each timepoint. Although research suggests that this is a sound approach for analyzing developmental data (Duncan, Duncan, and Hops 1996; Miyazaki and Raudenbush 2000), the presence of age by cohort interactions could affect findings (Collins 2006). Lastly, we are limited in our ability to generalize these findings to communities dissimilar to Chicago, such as rural communities or other regions, and to other racial or ethnic groups.

Because of the relation between aggression and alcohol use at age 12 (i.e. the association between intercepts), our findings lend support to current efforts to curb early initiation of alcohol use and aggression. In the case of African American youth, however, the connection between the two behaviors is significantly less evident, suggesting that other factors may be important. White and colleagues (2013) conducted analyses of alcohol use and aggression among male youth, and found reciprocal relations, without any moderating effect of race. Still, the authors noted the importance of neighborhood crime on aggression. In the PHDCN sample, African American youth are more commonly exposed to violence than White youth (Zimmerman and Messner 2013). In other words, unmeasured neighborhood contextual variables may more directly influence aggression in African American youth. Importantly, our study adds further evidence to the idea that early alcohol use may be less of a problem for African Americans than for other youth.

In terms of prevention, these findings reinforce the need for activities that address both alcohol use and aggression with early adolescents who are at-risk, with the idea that, although they are related, reduction in one will not necessarily address the other. The element of timing is important. It is notable that aggression tends to decrease during adolescence, when alcohol use increases. Therefore, prevention of aggressive behavior might be best targeted to early adolescents, with alcohol prevention being a focus throughout high school age. Nonetheless, recognizing the strong association between these behaviors, especially in early adolescence, can be helpful in designing comprehensive strategies for prevention.

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Fig. 1.
Trajectories of alcohol and aggression at age 12, 15, and 18 among PHDCN participants (n=2820)

Table 1Sample and neighborhood characteristics of model covariates and outcomes ($n=2820$)

	Number	Percent	<i>M</i>	<i>sd</i>
Male gender	1400	49.65		
Family income (missing = 146)				
1: <\$5000	297	10.53		
2: \$5000–\$9999	285	10.11		
3: \$10,000–\$19,999	531	18.83		
4: \$20,000–\$29,999	513	18.19		
5: \$30,000–\$39,999	370	13.12		
6: \$40,000–\$49,999	251	8.90		
7: >\$50,000	427	15.14		
Education of primary caregiver (missing = 95)				
Less than high school	1212	42.98		
High school	347	12.30		
More than high school	1166	42.30		
Race of the youth (missing = 7)				
White/Caucasian	428	15.18		
Black/African-American	1027	36.42		
Latino/Hispanic	1358	48.16		
Alcohol use – age 12 (missing = 1380) ^b				
None in past year	2143	97.23		
1–2 days in past year	45	2.04		
3–5 days in past year	7	0.32		
6+ days in past year	9	0.41		
Alcohol use – age 15 (missing = 1641) ^b				
None in past year	1473	75.81		
1–2 days in past year	239	12.30		
3–5 days in past year	116	5.97		
6+ days in past year	115	5.92		
Alcohol use – age 18 (missing = 1847) ^b				
None in past year	747	43.01		
1–2 days in past year	302	17.39		
3–5 days in past year	205	11.80		
6+ days in past year	483	27.81		
Aggression – age 12 (missing = 1380) ^b				
None in past year	1748	79.31		
1–3 episodes in past year	249	11.30		
4–10 episodes in past year	114	5.17		
11+ episodes in past year	93	4.22		
Aggression – age 15 (missing = 1641) ^b				

	Number	Percent	<i>M</i>	<i>sd</i>
None in past year	1241	63.87		
1–3 episodes in past year	386	19.87		
4–10 episodes in past year	184	9.47		
11+ episodes in past year	132	6.79		
Aggression – age 18 (missing = 1870) ^b				
None in past year	1129	65.87		
1–3 episodes in past year	355	20.71		
4–10 episodes in past year	144	8.40		
11+ episodes in past year	86	5.02		
Neighborhood social capital ^a			3.54	0.23
Neighborhood Income			3.92	0.86

Note: sample values reflect simple means/percentages.

^a Empirical Bayes Estimates.

^b Reflects missingness by design

Table 2Model fit statistics for growth models ($n=2820$)

Model	χ^2	df	p	TLI	CFI	WRMR	RMSEA	$D\chi^2$	p
Unconditional Aggression – linear	54.982	4	.000	0.914	0.885	1.709	0.067	–	–
Unconditional Aggression - nonlinear	1.566	3	.667	1.00	1.00	0.239	0.00	72.971	<.000
Unconditional Alcohol - linear	13.809	3	.003	0.961	0.961	0.701	0.036	–	–
Unconditional Alcohol nonlinear	3.212	2	.201	0.993	0.996	0.283	0.015	7.957	.005
Unconditional Dual Process	19.795	13	.100	0.993	0.994	0.669	0.014	–	–
Full Model with covariates	70.568	53	.053	0.985	0.993	0.607	0.011	–	–

Note: "type = complex" command used in Mplus. Models estimated using WLSMV with probit link. Changes in chi-squared values are changes in scaled chi-squared obtained using the DIFFTEST command in Mplus. Residual covariances of alcohol and aggression items were allowed to covary at each time point in the dual process and full models

Table 3

Unconditional and covariate model estimates ($n=2820$)

Unconditional latent means, variances, and residual covariances					
	Intercept (alcohol)	Slope (alcohol)	Intercept (aggression)	Slope (aggression)	Residuals
Mean	0 ^d	1.484***	0 ^d	0.564***	
Variance	0.250***	0 ^b	0.304***	0 ^b	
Conditional parallel process growth model of alcohol use frequency and aggressive behavior					
Covariance of intercepts	0.154***				
Time specific covariances (alcohol frequency with aggressive episodes)					
Age 12					0.249***
Age 15					0.147***
Age 18					0.087***
Intercept (alcohol) Intercept (aggression)					
Male gender	0.079*	0.248***			
Family income	0.017	-0.001			
Education of primary caregiver (reference: Less than HS)					
High school	-0.067	-0.032			
More than high school	-0.023	-0.027			
Race/ethnicity of the youth (reference: White/Caucasian)					
Black/African-American	-0.265*	0.285**			
Latino/Hispanic	-0.108	-0.151*			
Neighborhood income	0.059	-0.110*			
Neighborhood high school education (reference: <HS)	0.215	0.513			
Neighborhood more than high school education (reference: <HS)	-0.075	0.191			
Neighborhood Social Capital	0.061	0.082			

^aConstrained to zero by default.^bSlope variance constrained to zero;* $p < .05$;

100>*d*

; 10>*d*
**

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