Multiple Trajectories of Peer and Parental Influence and their Association with the Development of Adolescent Heavy Drinking

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Abstract

This study used latent growth mixture modeling to identify discrete developmental patterns of heavy drinking, perceived parental disapproval of substance use, and association with peers who drink from early to late adolescence among a sample of 5,591 youth. We also examined associations among these trajectories to determine how the development of heavy drinking relates to the development of perceived parental disapproval of substance use and association with peer drinkers, both separately and jointly. We found that youth who perceived that their parents maintained consistently strong disapproval of substance use throughout adolescence were much more likely to abstain from heavy drinking during this period than were youth who reported that their parents' disapproval for substance use either decreased or was maintained at only a moderate level. Furthermore, we found that across a variety of peer contexts—stable high association with drinking peers, stable low association, and increasing association—youth were at lowest risk for developing problematic patterns of heavy drinking when they perceived that their parents maintained strong disapproval of substance use throughout adolescence.

Keywords

Adolescence; Binge drinking; Developmental trajectory; Heavy alcohol use; Parental influence; Peer influence

1. Introduction

Heavy drinking is one of the most serious public health problems facing youth in the United States. In 2007, 10% of eighth graders, 22% of tenth graders, and 26% of twelfth graders reported at least one episode of heavy drinking (consuming 5 or more drinks in a row) during the past two weeks (Johnston, O'Malley, Bachman, & Schulenberg, 2008). Heavy drinking among adolescents has been linked to a wide range of problem behaviors, including dropping out of school (Hill, White, Chung, Hawkins, & Catalano, 2000), alcohol-impaired driving (Escobedo et al. 1995), illicit drug use (D'Amico, Ellickson, Collins, Martino, & Klein, 2005), and sexual aggression (Abbey, McAuslan, & Ross, 1998; Testa & Parks, 1996). Furthermore, adolescents who are frequent heavy drinkers are at increased risk for cognitive

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impairments and permanent damage to brain structures (Brown, Tapert, Granholm, & Delis, 2000; White, 2004).

Theory and research support the importance of peers and parents in the development of adolescent drinking (Ary, Tildesley, Hops, & Andrews, 1993; Ellickson & Hays, 1991; Jacob & Leonard, 1994; Jessor & Jessor, 1977; Petraitis, Flay, & Miller, 1995). Primary mechanisms involved are modeling of alcohol use, reinforcement of attitudes toward alcohol use, and internalization of alcohol-related values and norms (Ajzen & Fishbein, 1980; Bandura, 1986; Kandel & Andrews, 1987). Consistent with social influence models of alcohol use, many studies have shown a positive link between the number of friends who drink and adolescent drinking (e.g., Scheier, Botvin, & Baker, 1997; Simons-Morton & Chen, 2005). Though socialization effects are known to play a major role in this link (Henry, Slater, & Oetting, 2005; Sieving, Perry, & Williams, 2000), selection effects also contribute, as teens who drink or are inclined to drink seek out peers who are similarly inclined (Bauman & Ennett, 1994; Wills & Cleary, 1999).

Parental attitudes toward alcohol use (and substance use in general) strongly predict adolescent alcohol use (e.g., Ary et al., 1993; Barnes & Welte, 1986). Some studies have shown that parental attitudes are even more important than parents' use of alcohol in explaining adolescent drinking (Ary et al., 1993; Brook, Whiteman, Gordon, & Cohen, 1986; Hawkins, Catalano, & Miller, 1992). The perception by adolescents that their parents would disapprove of their drinking alcohol may affect adolescents' behavior by altering their outcome expectancies (Bandura, 1986) and perceived norms (Ajzen & Fishbein, 1988) regarding alcohol use. Moreover, internalization of parental attitudes toward drinking may facilitate resistance to peer influences or greater self-regulation regarding alcohol use (Bandura, 1986).

An enduring issue in the study of the development of adolescent substance use is the *relative* influence of peers versus parents (Duncan, Duncan, & Hops, 1994; Kandel & Andrews, 1987; Reifman, Barnes, Dintcheff, Farrel, & Uhteg, 1998; Windle, 2000). In several studies, peer and parental influences have been compared to determine which more strongly correlates with adolescent substance use. Research that utilizes this approach typically finds that peer variables associate more strongly with adolescent substance use than parent variables (Aseltine, 1995; Hawkins et al., 1992; Kandel & Andrews, 1987). An alternative approach is to examine parent factors as moderators that may attenuate the relationship between peer factors and adolescent substance use (Jessor, Turbin, Costa, Dong, Zhang, & Wang, 2003; Stacy, Newcomb, & Bentler, 1992; Windle & Davies, 1999). This approach emphasizes the interplay between peer and parent influences in the development of adolescent substance use and seeks to identify ways in which parents may buffer the pro-substance use influence of peers.

A few key studies have investigated the protective role of parents in the development of adolescent alcohol use. In a cross-sectional study of recent high school graduates, Wood and colleagues (2004) found that more stringent perceived drinking limits set by parents are associated with more modest relations between peer alcohol offers and adolescents' heavy drinking compared with less stringent parental limit-setting. In an investigation of the combined effect of parents and peers on alcohol use among adolescents aged 10–15 years, Marshal and Chassin (2000) found that parental support and consistency of discipline moderates the association between affiliation with drug-using peers and adolescents' subsequent alcohol use. Studies like these provide important evidence for the protective role of parents. However, they do not consider how parenting attitudes may change over the course of adolescence and how such change may influence the development of adolescent drinking.

According to developmental theory, there is a shift in the relative importance of parents vs. peers during adolescence that stems from adolescents' emerging sense of independence and

their broadening exposure to extra-familial social influences (Kandel & Andrews, 1987; Windle, 2000). As adolescents begin to establish their independence from the family, extra-familial influences become further integrated into their evolving sense of self. This process has been characterized as a shifting of the relative importance of parents (the dominant social influence in the lives of early adolescents) and peers during adolescence, with peer influences gaining importance and parental influences becoming less salient. Yet, evidence from studies of parent and peer influences on alcohol involvement suggests that, rather than being overshadowed by peer influences, parental factors continue to affect alcohol use and attitudes even as late as the first year of college (e.g., Duncan, Duncan, Hops, 1994; Guilamo-Ramos, Turrisi, Jaccard, Wood, & Gonzalez, 2004; Reifman, Barnes, Dintcheff, Farrell, & Uhteg, 1998).

In summary, more research is needed on the interplay between peer and parental influences in the development of adolescent alcohol use—especially research that considers the evolution of these influences across adolescence—as such research may suggest ways in which parents can most effectively buffer the effects of peer socialization on adolescents' drinking behavior. Our study aimed to address this need. We used longitudinal data from a sample of youth followed from early to late adolescence to examine the development of adolescents' association with peers who drink, the development of their perceptions of parental disapproval of substance use, and how these developmental processes interact to predict the development of heavy alcohol use. If parental factors matter only in early adolescence, youth whose parents lessen their disapproval of substance use over time should not be at greater risk for engaging in problematic patterns of heavy drinking compared with youth whose parents maintain their disapproval throughout adolescence. On the contrary, if parental factors continue to matter throughout adolescence, youth whose parents maintain disapproval of substance use throughout adolescence should be at less risk for engaging in problematic patterns of heavy drinking compared with youth whose parents express disapproval of substance use in early adolescence and then lessen that disapproval over time. Moreover, the relative advantage of adolescents whose parents maintain their disapproval throughout adolescence should be especially evident when association with peer drinkers is high or increasing during adolescence.

To capture heterogeneity in these three developmental processes (heavy drinking, association with peers who drink, and parent disapproval of substance use), we used a growth mixture modeling approach (Muthén, 2001; Muthén & Muthén, 2000) that allows for explicit modeling of disparate patterns of growth. Whereas several prior studies have assessed heterogeneous growth in adolescent heavy drinking (e.g., Chassin, Pitts, & Prost, 2002; Hill, White, Chung, Hawkins, & Catalano, 2000; Muthén & Shedden, 1999;Tucker, Orlando, & Ellickson, 2002), only one (Li, Barrera, Hops, & Fisher, 2002) has modeled heterogeneity in patterns of association with peer drinkers over time and none has modeled heterogeneity in parental attitudes. Based on these existing studies, we expected to identify: 1) several distinct trajectories of heavy drinking as well as a sizeable group of individuals who abstained from drinking throughout adolescence; and 2) at least two distinct patterns of association with peer drinkers, persistent high association and persistent low association. Because no prior study has investigated trajectories of parental attitudes toward substance use, we had little basis for making predictions about the number or shape of these trajectories. Although we expected to find that some youth would perceive consistent disapproval from their parents throughout adolescents and that others would sense diminishing disapproval over time, we could not reasonably speculate about the relative prevalence of such patterns or whether other patterns would emerge.

2. Methods

2.1. Participants

The study sample consisted of 5,591 individuals who participated in a field trial designed to evaluate ALERT Plus, a school-based drug prevention program (Ellickson, McCaffrey, Ghosh-Dastidar, & Longshore, 2003). These individuals were originally drawn from 62 South Dakota middle schools representing a variety of family and community environments and encompassing urban, suburban, and rural school districts. Participants were evenly distributed by sex and were mostly Caucasian (86%) or Native American (9%). The remaining 5% were African-American, Hispanic, Asian, or of other racial/ethnic backgrounds. Approximately one in five reported grades of C or below at grade 7 and sixty-six percent reported living in a household with both biological parents present.

2.2. Procedures

Participants completed yearly written surveys in school at Grades 7 (baseline) through 11 and a follow-up mail survey at age 19. We conducted make-up survey sessions in school and mailed surveys to movers and chronic absentees to minimize attrition. Because sensitive data such as use of alcohol and other substances may be subject to reporting bias, we took several steps to enhance accurate and truthful reporting. These included developing stringent measures to protect privacy and confidentiality, obtaining a Certificate of Confidentiality from the Department of Health and Human Services, using data collectors whom the students did not know, and giving parents and students the opportunity to refuse to participate. To minimize incomplete or inaccurate responses, survey questions had simple, explicit response categories and were pilot tested extensively. The vast majority of participants (>98%) provided consistent reports about alcohol and marijuana use over time (Ellickson et al., 2003).

At baseline (Grade 7), 5857 students completed a survey. Because the baseline survey did not ask about a key study variable (parental approval of substance use), we did not use data from that survey. To be eligible for this study, therefore, participants had to have completed at least one of the five surveys administered between Grade 8 and age 19. Ninety-six percent ($n = 5,649$) of baseline participants met this criterion for inclusion in the study sample. Of these 5,649 students, 4.4% completed 1 survey, 5.4% completed 2 surveys, 9.1% completed 3 surveys, 31.7% completed 4 surveys, and 49.4% completed all 5 surveys. To be included in the study sample, students must also have provided complete demographic information. All but 58 students did so. Thus, the final sample size for this study is 5,591.

2.3. Measures

We measured heavy drinking with a single item that changed slightly over time to remain age appropriate (Ellickson, McGuigan, Adams, Bell, & Hays, 1996). At Grades 8 through 11, respondents reported how often in the past month they had three or more drinks (0 = *none*, 1 = *1 day*, 2 = *2 to 4 days*, 3 = *5 to 8 days*, 4 = *9 or more days*). At age 19, respondents reported how often in the past month they had five or more drinks (0 = *none*, 1 = *1 day*, 2 = *2 to 4 days*, 3 = *5 to 8 days*, 4 = *9 or more days*).

We used two questions at each wave to measure association with peers who drink: "How often are you with kids who are drinking alcohol (0 = *never*, 1 = *hardly ever*, 2 = *sometimes*, 3 = *often*)" and "Do you think your best friend drinks alcohol sometimes (0 = *no*, 1 = *yes*)." Responses to these items were standardized and then averaged at each wave to create a measure of association with peers who drink (α ranged from .52 to .62).

We used three questions at each wave to measure perceived parental disapproval of substance use: "How would your parents feel if they found out you drank alcohol sometimes," "How

would your parents feel if they found out you smoked cigarettes," and "How would your parents feel if you used marijuana (1 = *not at all upset*, 2 = *a little upset*, 3 = *pretty upset*, 4 = *very upset*)." Responses to these items were averaged at each wave to create a measure of perceived parental disapproval of substance use (α ranged from .64 to .77). In preliminary analyses, we found that this 3-item measure predicted heavy drinking as well, and sometimes better, than the single-item measure of parent attitudes toward alcohol use. Hence, including parental attitudes toward other substance use in the measure appears to capture additional aspects of parental disapproval that are relevant to curbing alcohol misuse with potentially serious consequences. Moreover, a three-item measure has the advantage of compensating for some of the measurement imprecision that is to be expected in a single-item measure of disapproval.

At baseline, participants indicated their gender, whether they lived in a household with both biological parents present (0 = *non-intact family*, 1 = *intact nuclear family*), and identified themselves as White, Native American, African American, Asian American, Latino or other race/ethnicity. Because only five percent of participants, in total, self-identified as African American, Asian American, Latino, or other race/ethnicity, we grouped these participants into a single "Other" category and created three dummy-coded vectors that we used to compare Caucasians vs. Native Americans and Others.

2.4. Analytic Approach

To identify discrete subgroups with similar patterns of heavy drinking from Grade 8 to age 19, we used growth mixture modeling (GMM), implemented in Mplus Version 3.12 (Muthén & Muthén, 2004). Like traditional growth modeling (Curran, 2000; McArdle & Epstein, 1987), GMM estimates growth parameters associated with latent variables (growth factors) defined by repeated measures of a univariate outcome over time. Unlike traditional growth modeling which assumes that all individuals are drawn from a single population with common parameters, GMM allows for parameter differences across latent subpopulations. Thus, instead of considering individual variation around a single average growth curve, GMM allows different classes of individuals to vary around different mean growth curves. GMM yields the trajectory shape for each class, estimates of each individual's class membership probabilities (posterior probabilities) and estimates individuals' most likely class membership. One a priori heavy drinking class, *Abstainers* (n = 1,862; 33% of the total sample), included participants who reported no heavy drinking over the five waves of data. Data from the remaining 3,732 participants were used to estimate heavy drinking trajectories. All trajectory models included demographic covariates as predictors of trajectory class membership, as well as an indicator of treatment group status.

From our repeated measures of heavy drinking, we estimated three continuous latent factors corresponding to the three components of quadratic growth (intercept, linear, and quadratic components). Including the quadratic growth factor allowed us to estimate nonlinear trajectory shapes. In the growth model, predicted heavy drinking scores are a function of the product of each model parameter and a variable representing the passage of time raised to the appropriate power (0 for intercept, 1 for slope, and 2 for quadratic). We treated time as a fixed parameter in the models, using the log transformation of the year of data collection (from 1 to 4) to represent the passage of time over the study period and to achieve reasonably scaled parameter estimates. To account for the clustering of students within schools, we used the sandwich estimator (Huber, 1967) to adjust standard errors. Besides specifying an overall growth model, we allowed for a number of latent classes, each with unique growth factor means. To choose the appropriate number of classes, we examined differences in model Bayesian information criterion (BIC) values (Kass & Raftery, 1995; Schwartz, 1978) and considered the average probability of class membership for each estimated class and the interpretability of the estimated trajectory shapes. Smaller BIC values indicate preferred models that optimize the

competing goals of finding good fitting and parsimonious solutions (Nagin, 1999), while higher average posterior probabilities for class membership indicate more precise definition of classes. Trajectories that are too similar or have too few individuals may be uninformative (Muthén & Shedden, 1999).

Using all available data from this sample, we fit growth trajectory models using full information maximum likelihood estimation methods under the assumption that the data are missing at random (Little & Rubin, 2002). This is a widely accepted way of handling missing data (Schafer & Graham, 2002) that uses all available data, including from participants with partially observed outcome measures, to estimate model parameters. MAR assumes independence between outcomes and the probability of response to the survey items conditional on the observed data (e.g., baseline covariates and outcomes measured at early or other waves).

Because MAR assumptions cannot be tested with the data, we analyzed the sensitivity of our results to potential violations of this assumption. We imputed values for missing heavy alcohol use outcomes assuming the data were MAR and using a mixture of normal distributions for the repeated measures from each student. We then added a positive constant equal to 0.1 of a standard deviation unit to each imputed value to create a second imputed dataset. We repeated this process four times adding constants equal to .25, .5 and one standard deviation to each of the original imputed values. Each successive data set assumes the distribution of the missing data is further removed from MAR—i.e., conditional on the observed data the mean outcome for students who fail to report is .1, .25, .5, or 1 standard deviation greater than those of student who completed the survey. Group mean differences of .25 of a standard deviation are moderate for behaviors like drinking; differences of 0.5 or larger would be considered large. We fit our growth mixture model of heavy drinking to each completed dataset and compared the resulting trajectories and group assignments to those obtained using the incomplete data. Results were nearly identical when the deviations were 0.25 or smaller and only started to diverge when deviations were 0.5 or larger. This suggests that our results would be obtained even if the data were not MAR and students who failed to complete the survey differed from other students in ways not predicted by observed data, provided those differences were not large.

After identifying the appropriate number of heavy drinking trajectories, we used GMM to identify trajectories of association with peer drinkers and trajectories of perceived parental disapproval of substance use. Data from all 5,591 participants were used in these analyses.

To examine how the development of adolescents' association with peer drinkers relates to the development of heavy drinking, we calculated the odds of membership in each heavy drinking trajectory and used one-way analysis of variance to test whether these odds differed by membership in the various trajectories of association with peer drinkers. To examine how the development of perceived parental disapproval of substance use relates to the development of heavy drinking, we tested whether the odds of membership in each heavy drinking trajectory differed by membership in the various trajectories of perceived parental disapproval. To assess whether membership in a heavy drinking trajectory was jointly related to peer association and perceived parental disapproval trajectory membership, we calculated the relative odds of membership in each heavy drinking trajectory vs. abstinence, as well as the relative odds of abstinence vs. membership in any of the various trajectories of heavy drinking, conditional on membership in both a peer association trajectory and a perceived parental disapproval trajectory. We then plotted these relative odds to look for evidence of a synergistic influence of parents and peers on the development of heavy drinking.

3. Results

3.1. Estimation of heavy drinking trajectories

Using change in BIC as an initial indicator of the comparative fit of heavy drinking models with different numbers of classes, we noted that BIC values decreased with the addition of each class ($BIC_1 = 49,135$, $BIC_2 = 46,949$, $BIC_3 = 45,485$, $BIC_4 = 45,376$). We were unable to attain convergence for a five-class solution. In further evaluating the relative suitability of these solutions, we inspected the shape of the heavy drinking trajectories and considered the average predicted probabilities of class membership (APCM) for each solution. Again, the four-class solution appeared most appropriate. This solution yielded clearly distinct and interpretable trajectories that had high average probabilities for class membership (range 0.75 – 0.99) and consisted of sufficient percentages of the analysis sample (64%, 24%, 6%, and 6%). Moreover, the trajectory shapes were remarkably consistent with those found in other studies of the development of heavy drinking in adolescence (Tucker et al., 2003). To investigate the stability of this solution, we re-estimated the model with different starting values for the growth parameters. The solution proved robust to differences in starting values, suggesting that optimization was not achieved through identification of a local maximum.

Figure 1 presents the four model-predicted heavy drinking trajectories. Predicted drinking scores for each class are a function of the product of each growth parameter mean and the time variable (log transformation of the year of data collection) raised to the appropriate power. To facilitate discussion, we have added descriptive labels to the classes. *Decreasers* ($n = 234$; 6% of heavy drinkers; 4% of the total sample; APCM = 0.99) started out with a high frequency of heavy drinking at age 14 (close to 9 or more days per month), decreased their use to 2–4 days per month at age 16, and thereafter maintained that moderate frequency of use. *Stable Heavy Drinkers* ($n = 883$; 24% of heavy drinkers; 16% of the total sample; APCM = 0.96) started out at age 14 with a moderate frequency of heavy drinking and maintained this moderate frequency throughout the study period, never engaging in heavy drinking more than 2–4 times per month. *Slow Increasers* ($n = 2,368$; 64% of heavy drinkers; 43% of the total sample; APCM = 0.95) represented the normative class of heavy drinkers. Individuals in this class exhibited no use at age 14 and slowly increased their use in a near linear fashion throughout the study. By age 19, *Slow Increasers* engaged in heavy drinking approximately 2–4 times per month. *Adolescent Heavy Drinkers* ($n = 244$; 6% of heavy drinkers; 4% of the total sample; APCM = 0.75) exhibited no heavy drinking at age 14 (Grade 8), increased their heavy drinking sharply by age 15 (Grade 9), maintained a high frequency of heavy drinking (5–8 times per month) throughout high school, and decreased their heavy drinking considerably thereafter.

3.2. Estimation of trajectories of association with peers who drink

Information criteria were obtained for one-, two-, three-, four-, and five-class models of association with peers who drink. Although BIC values decreased with the addition of each class ($BIC_1 = 39,452$, $BIC_2 = 39,167$, $BIC_3 = 37,347$, $BIC_4 = 36,888$, $BIC_5 = 36,654$), consideration of trajectory shapes for the three-, four-, and five-class models suggested that the three-class model was most appropriate. In moving from the 3- to the 5-class solution, two of the three trajectories from the 3-class solution remained unchanged. The third trajectory from the 3-class solution, a stable high trajectory, also remained mostly unchanged in moving from the 3- to the 5-class solution; however, the 4- and 5-class solutions identified slight variants of the stable high trajectory – one that began slightly lower and one that began slightly higher. Because these three stable high trajectories were not especially distinct, we opted for the more parsimonious 3-class solution. Trajectories from the 3-class solution had high average probabilities for class membership (range 0.83 – 0.92) and consisted of sufficient percentages of the analysis sample (49%, 41%, and 10%). The three class solution was invariant to

differences in starting values, suggesting that optimization was not achieved through identification of a local maximum.

Figure 2 presents the three model-predicted peer association trajectories. Youth in the *Stable High Association* trajectory ($n = 2,758$, 49% of the total sample, APCM = 0.92) frequently associated with peers who drank at age 14 and maintained this high frequency of association throughout the study. Those with *Steadily Increasing Association* with peers who drink ($n = 2,290$; 41% of the total sample; APCM = 0.91) had very little contact with drinking peers at age 14, but then steadily increased their association with drinking peers throughout adolescence. Youth in the *Stable Low Association* trajectory ($n = 543$; 10% of the total sample; APCM = 0.83) had very little contact with drinking peers at age 14, and remained relatively unassociated with drinking peers throughout adolescence.

3.3. Estimation of trajectories of perceived parental disapproval of substance use

Information criteria were obtained for one-, two-, three-, and four-class models of perceived parental disapproval of substance use. BIC values decreased with the addition of each class ($BIC_1 = 37,747$, $BIC_2 = 35,665$, $BIC_3 = 34,853$, $BIC_4 = 33,627$). We were unable to attain convergence for a five-class solution. In moving from the 3- to the 4-class solution, two of the three trajectories from the 3-class solution remained unchanged. The third trajectory from the 3-class solution, a decreasing trajectory, also remained mostly unchanged in moving from the 3- to the 4-class solution; however, the 4-class solution identified a slight variant of the decreasing trajectory – one that began at about the same place but decreased at a slightly slower rate. Because these two decreasing trajectories were not very distinct and because the second decreasing trajectory identified in the 4-class solution accounted for less than 3% of the sample, we opted for the more parsimonious 3-class solution. The 3-class solution yielded clearly distinct and interpretable trajectories that had high average probabilities for class membership (range 0.80 - 0.97) and consisted of sufficient percentages of the analysis sample (81%, 11%, and 8%). The solution was robust to differences in starting values.

Figure 3 presents the three model-predicted trajectories of perceived parental disapproval of substance use. The most common was the *Continued High Disapproval* trajectory ($n = 4,530$; 81% of the total sample; APCM = 0.97), which was made up of youth who said throughout adolescence that their parents would be pretty to very upset if they engaged in substance use. The *High Decreasing Disapproval* trajectory ($n = 600$; 11% of the total sample; APCM = 0.80) consisted of youth who, at age 14, said that their parents would be pretty to very upset if they engaged in substance use. One year later, however, these youth said that their parents would be only a little to pretty upset about their using substances. From age 15–17, expected parental disapproval decreased even further among youth in the *High Decreasing Disapproval* trajectory, and then increased slightly from age 17–19. Finally, the *Stable Moderate Disapproval* trajectory ($n = 461$; 8% of the total sample; APCM = 0.91) was made up of youth who said throughout adolescence that their parents would be a little to pretty upset about their using substances.

3.4. Relationship between patterns of peer association and patterns of heavy drinking

Table 1 presents the probability of membership in each heavy drinking trajectory conditional on membership in each trajectory of peer association. For comparison, the table also shows the overall (unconditional) probability of membership in each heavy drinking trajectory. As can be seen in the table, youth with consistently little association with drinking peers were more than twice as likely to abstain from heavy drinking during adolescence than were youth whose association with peer drinkers increased, and were approximately five times more likely to abstain from heavy drinking than were youth who frequently associated with drinking peers throughout adolescence, $F(2, 5,585) = 639.41$, $p < .001$.

Table 1 also shows that the heavy drinking trajectory of *Decreasers*, i.e., frequent heavy drinking in early adolescence that declined some thereafter, was only seen among youth who associated in early adolescence with peers who drink (i.e., youth with *Stable High Association* with peer drinkers). Similarly, youth who exhibited stable high association with peer drinkers were about ten to twelve times more likely than youth who had stable low or steadily increasing association with peer drinkers to be stable heavy drinkers.

Youth with steadily increasing association with peer drinkers were five times as likely as youth with stable low association and about forty percent more likely than youth with stable high association to be in the *Slow Increaser* trajectory of heavy drinking, $F(2, 5,585) = 167.71$, $p < .001$, demonstrating a close correspondence over time between heavy drinking and association with peers who drink. Finally, only youth with stable high and steadily increasing association with peer drinkers were at risk for adolescent heavy drinking, with youth in the *Stable High Peer Association* trajectory being twice as likely as youth in the *Steadily Increasing Peer Association* trajectory to be adolescent heavy drinkers.

3.5. Relationship between patterns of perceived parental disapproval and patterns of heavy drinking

Table 2 presents the probability of membership in each drinking trajectory conditional on membership in each perceived parental disapproval trajectory. In line with the notion that parents remain important influences throughout adolescence, youth who perceived that their parents highly disapproved of substance use throughout adolescence were more than three times as likely to abstain from heavy drinking as were youth who perceived that their parents disapproval either started high and then decreased (*High Decreasing Disapproval*) or remained moderate throughout adolescence (*Stable Moderate Disapproval*), $F(2, 5,585) = 146.92$, $p < .001$.

Youth whose parents were perceived to be highly disapproving of substance use in early adolescence (i.e., those exhibiting continued high and high decreasing disapproval) were three to ten times less likely to be *Decreasers* than were youth who felt their parents exhibited only moderate disapproval of substance use in early adolescence (i.e., those exhibiting stable moderate disapproval), $F(2, 5,585) = 256.66$, $p < .001$. This may indicate that youth are likely to be at high risk for heavy drinking in early adolescence if they do not think their parents would strongly disapprove of substance use. It is unclear, however, why youth who view their parents as moderately disapproving of substance use over time would decrease their heavy drinking from a high level in early adolescence to a moderate level in late adolescence. Clearly, something other than perceived parental disapproval of substance use drives this downturn.

Stable heavy drinking was least common among youth who perceived consistent high parental disapproval of substance use and most common among youth who perceived stable moderate parental disapproval, $F(2, 5,585) = 169.78$, $p < .001$. Youth were more likely to slowly increase heavy drinking if they felt their parents maintained high disapproval throughout adolescence than were youth who perceived that their parents exhibited high decreasing or stable moderate disapproval, $F(2, 5,585) = 44.36$, $p < .001$. Finally, adolescent heavy drinking was far more common among youth who perceived high decreasing parental disapproval than among youth who perceived either stable moderate or continued high parental disapproval.

3.6 Does the relationship between association with peer drinkers and heavy drinking depend on patterns of perceived parent disapproval?

To assess whether the relationship between trajectories of heavy drinking and trajectories of association with peer drinkers differs depending on patterns of perceived parental disapproval during adolescence, we calculated the relative odds of membership in each heavy drinking

trajectory vs. being an abstainer conditional on membership in both a peer association trajectory and a perceived parental disapproval trajectory. We then repeated this calculation for the odds of being an abstainer vs. being in any of the heavy drinking trajectories. These relative odds are displayed in Figure 4. We did not compute the relative odds of being a *Decreaser* vs. an abstainer under the various peer-parent conditions because the *Decreaser* pattern of heavy drinking was associated exclusively with stable high association with peer drinkers.

Figure 4a shows the relative odds of being a *Stable Heavy Drinker* vs. an abstainer under the various peer-parent conditions. This figure shows that youth are most likely to be stable heavy drinkers when they perceive that their parents have stable moderate disapproval and least likely to be stable heavy drinkers when they perceive that their parents disapproval remains high throughout adolescence. This is the case across all three peer scenarios, but is most clearly evident it the case of stable high association with peers who drink.

Figure 4b shows the relative odds of being a *Slow Increaser* vs. an abstainer under the various peer-parent conditions. The perception of continued high parental disapproval appears to exert a protective influence in the case of both stable low and stable high peer association. In both of these peer scenarios, youth are at lowest risk of being slow increasers when they perceive their parents to maintain high disapproval throughout adolescence. In the case of steadily increasing peer association, youth are at lowest risk for increasing heavy drinking when they perceive that their parents maintain either moderate or high disapproval; they are at greatest risk when perceive that their parents lessen their disapproval of substance use at the same time as they increase their associations with drinking peers.

Figure 4c shows the relative odds of being an *Adolescent Heavy Drinker* vs. an abstainer under the various peer-parent conditions. This figure shows that when parental disapproval is perceived to sharply decrease between early and mid-adolescence, youth are at risk for sharply increasing their heavy drinking at that time (as adolescent heavy drinkers do), provided they are exposed to peers who drink.

Figure 4d shows the relative odds of being an *Abstainer* vs. heavy drinker of any kind. This figure shows that youth are more likely to abstain from heavy drinking when they perceive continued high parental disapproval than when they perceive either stable moderate or high decreasing disapproval. This applies across the three patterns of peer association, but is especially evident in the case of stable low peer association.

4. Discussion

Our results suggest that parents may influence the development of adolescent heavy drinking, that this influence operates throughout adolescence, and that it may serve to offset the countervailing influence of peers who drink. Specifically, we found that youth who perceived that their parents maintained consistently strong disapproval of substance use throughout adolescence were much more likely to abstain from heavy drinking during this period than were youth who reported that their parents' disapproval either decreased or was maintained at only a moderate level. Furthermore, we found that across a variety of peer contexts youth were at lowest risk for developing problematic patterns of heavy drinking when they perceived strong parental disapproval of substance use throughout adolescence. Although youth were consistently at lowest risk for heavy alcohol use when they perceived that their parents maintained strong disapproval throughout adolescence, the relative risk of decreasing vs. stable moderate disapproval depended on the pattern of peer affiliation adolescents displayed. In particular, when youth increased their affiliation with drinking peers, they seemed to be worse off in terms of their risk for heavy alcohol use if they perceived that their parents simultaneously decreased their disapproval than if they displayed moderate disapproval all along. Although

we cannot be certain about the direction of these associations, one possible conclusion from these results is that parents should consistently convey a message of strong disapproval of substance use throughout early and late adolescence.

Our study also affirms the existence of multiple distinct developmental trajectories of heavy drinking during adolescence. The trajectories we identified in our Midwestern sample (from 1999 through 2004) are remarkably similar to those found in a west coast sample from the 1980's (Tucker et al., 2003) and a Northwestern (Seattle area) sample from the late 1980's and early 1990's (Hill et al., 2000). Taken together, the three studies suggest that these patterns may be generalizable across a wide swath of the United States over time.

This study is among the first to examine distinct trajectories of affiliation with peers who drink and the first to look at distinct trajectories of perceived parental attitudes toward substance use. Similar to Li et al. (2002), we found that a majority of youth consistently associates with peers who drink during the adolescent years, while a small minority consistently avoids peers who drink. Unlike Li et al., we also found that a sizable group of youth increases association with drinking peers during adolescence, a pattern that is consistent with the normative increase in alcohol use among youth during this period of development. We also found that although most adolescents report high levels of perceived parental disapproval of substance use throughout adolescence, nearly 20% report decreasing or consistently low levels of perceived parental disapproval. The associations we observed between high perceived parental disapproval of substance use and lower risk for heavy drinking suggest the need for increased efforts to help parents understand the role they can play in substance use prevention. They also underscore the importance of adolescent perceptions of parental attitudes for predicting substance use.

Our findings are based on a sample of youth from a single Midwestern state that is largely white. Although the sample was representative of the population from which it was drawn, our findings may not generalize to highly urban areas with a different population mix. As mentioned above, however, our drinking trajectories closely parallel those found among samples from other geographic areas. We also note that the internal reliability of our peer association measure fell below the common standard; a better measure may have revealed an even stronger association between adolescent heavy drinking and perceived peer alcohol use. In addition, although our study underscores the importance of adolescents' perceptions of parental attitudes about substance use, we have no direct information from parents about those attitudes. Moreover, the weak to moderate correlations between parent and child reports of family environments (Barker et al., 2007; Kerr & Stattin, 2000; Smetana, 1988) suggests that helping parents get a more effective message of disapproval across to their children is not an easy task. More broadly, while our analyses provide a detailed picture of the links between adolescent drinking and social influences over time, they cannot establish the direction of these relationships or support causal claims. For example, although our data suggest that adolescents' heavy drinking is responsive to changes in parental disapproval, it is possible that adolescents who engage in heavy drinking may wear down their parents' opposition to substance use or change their perceptions of their parents' disapproval to rationalize their own behavior. Finally, our study provides little insight into the unique pattern of heavy drinking exhibited by youth who decreased their heavy drinking despite having stable perceptions of their parents' disapproval of substance use and consistent association with alcohol-using peers. Future research on heavy drinking trajectories might ask whether these adolescents begin to substitute other forms of substance use for heavy alcohol use.

Despite these limitations, this study contributes to our understanding of the interpersonal forces that are associated with adolescent drinking and provides new insights into strategies for curbing excessive alcohol use among adolescents. The results confirm the existence of multiple trajectories of heavy alcohol use during adolescence and suggest that these trajectories are

interactively connected to patterns of peer association and perceived parental disapproval over time. In particular, our study provides important, if preliminary, evidence that adolescent drinking behavior is tied to what they believe about their parents' approval of such behaviors. Such findings bolster the argument for sustained parental engagement in substance use issues throughout high school and beyond.

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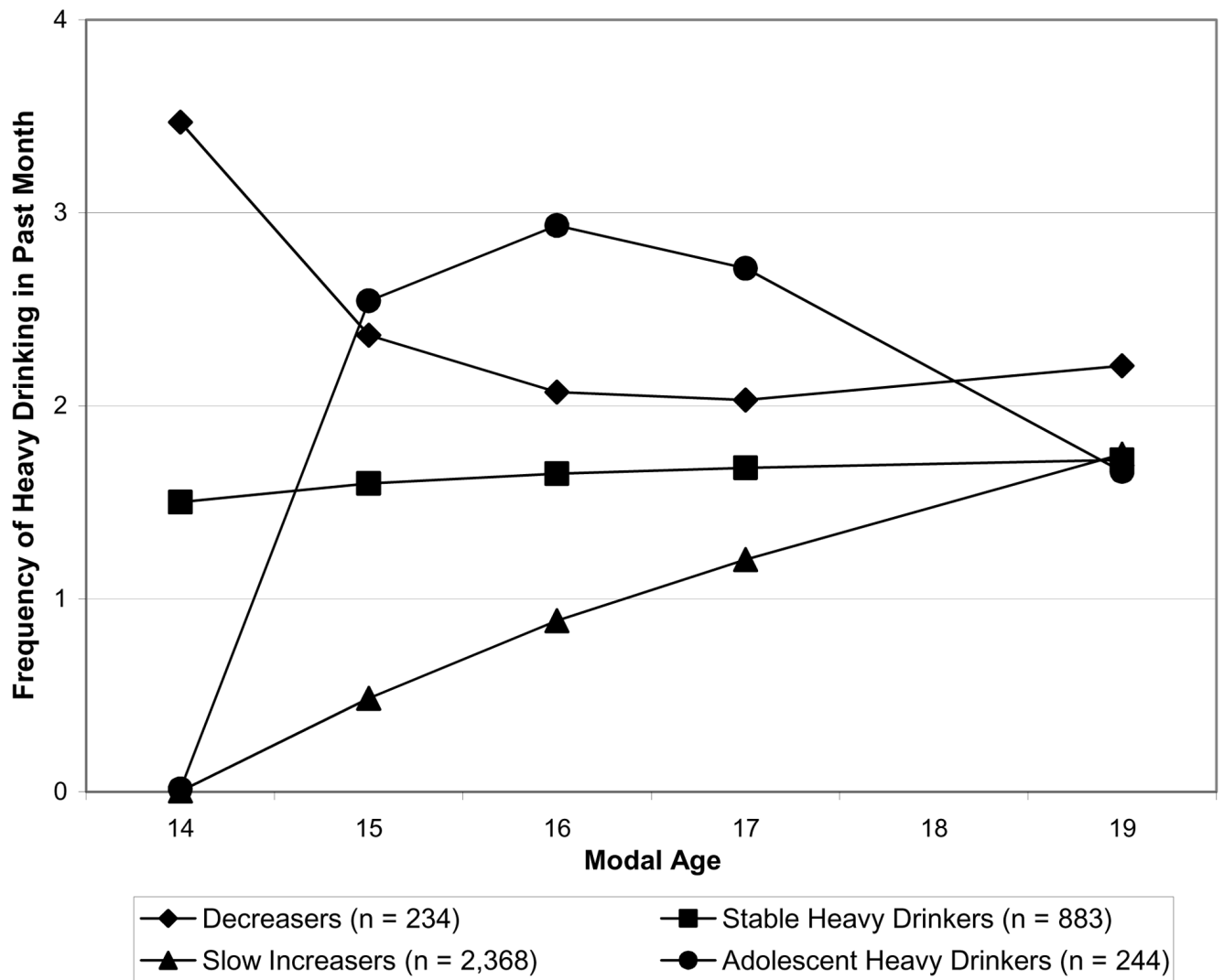
Figure 1.
Model-predicted mean scores on frequency of past month heavy alcohol use from age 14 to age 19 by heavy drinking trajectory class.
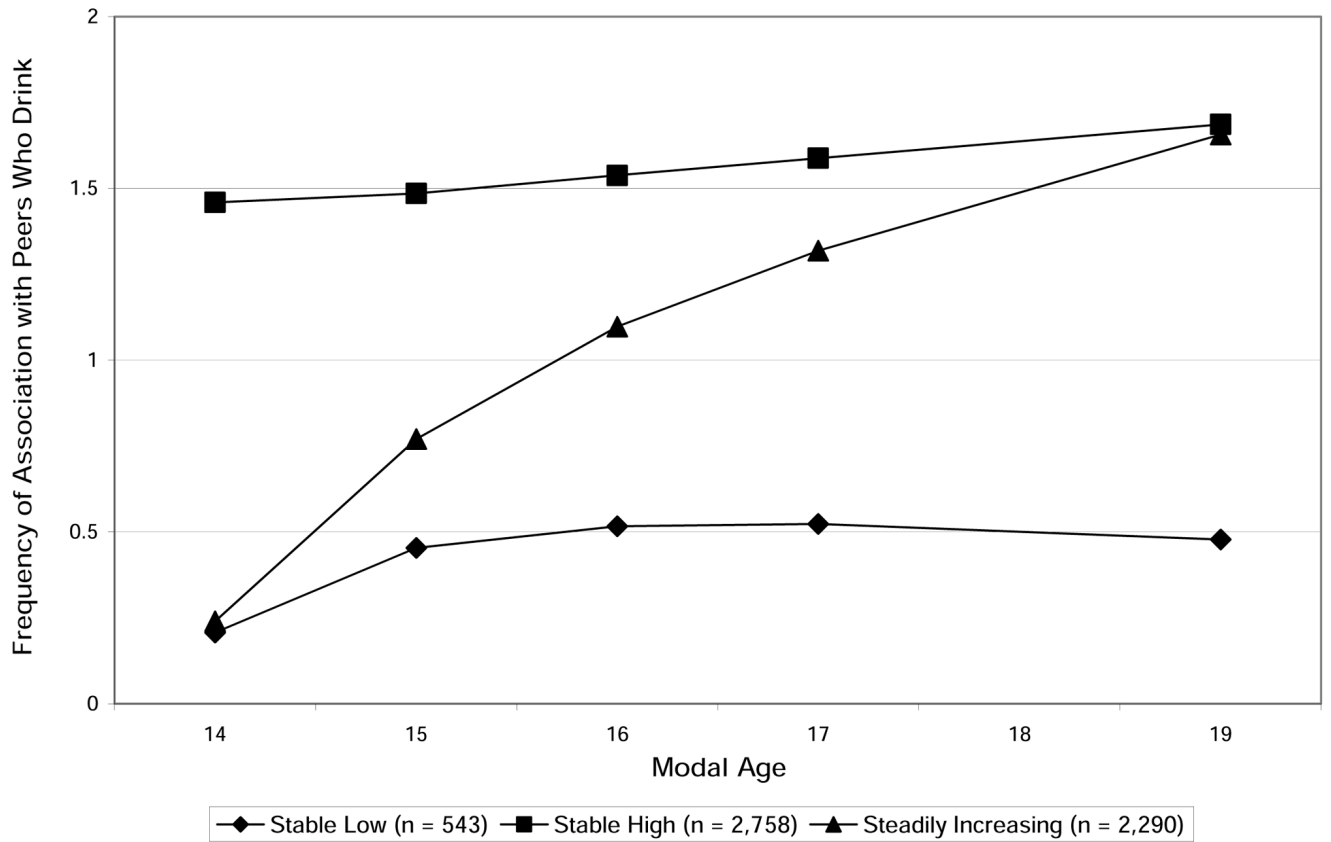
Figure 2.
Model-predicted mean scores on frequency of association with peers who drink from age 14 to age 19 by peer association trajectory class.
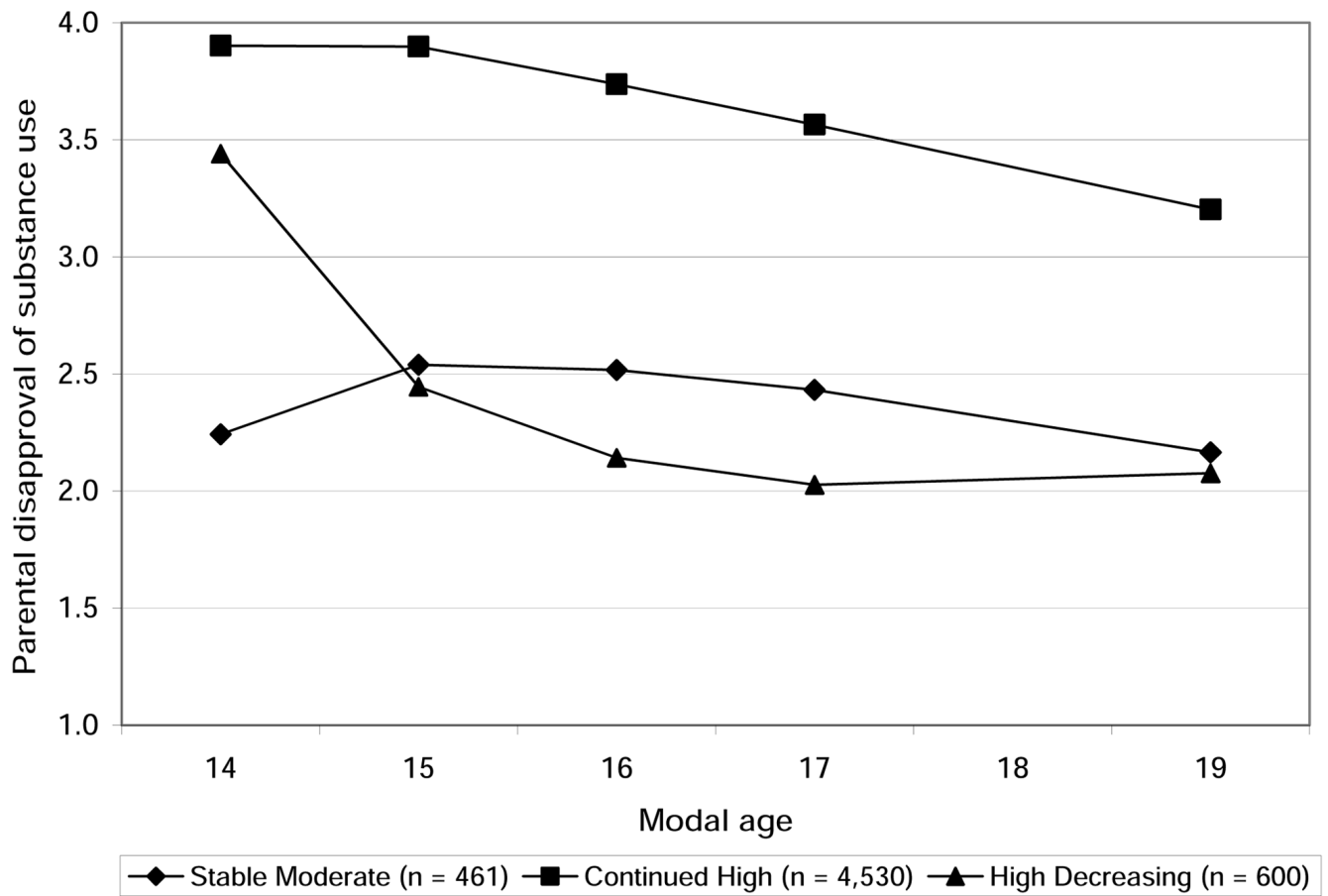
Figure 3.
Model-predicted mean scores of perceived parental disapproval of substance use from age 14 to age 19 by parental disapproval trajectory class.
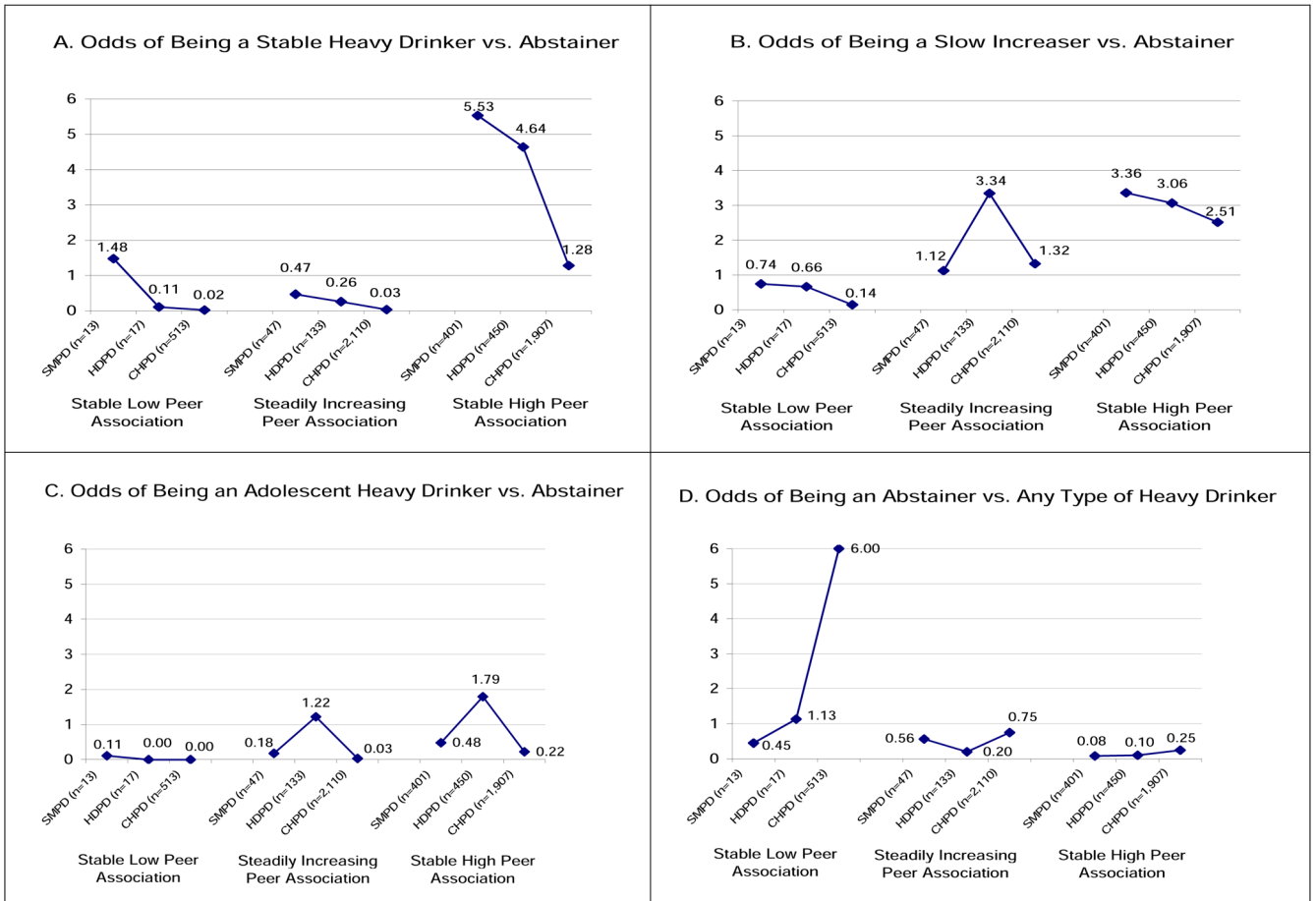
Figure 4.
Relative odds of being (a) a Stable Heavy Drinker vs. an Abstainer, (b) a Slow Increaser vs. an Abstainer, (c) an Adolescent Heavy Drinker vs. an Abstainer, and (d) an Abstainer vs. any type of heavy drinker, conditional on membership in both a peer association trajectory and a perceived parental disapproval trajectory. SMPD = Stable Moderate Parental Disapproval. HDPD = High Decreasing Parental Disapproval. CHPD = Continued High Parental Disapproval.

Table 1

Probability of Membership in Each Heavy Drinking Trajectory Given Membership in Each Peer Association Trajectory

Heavy Drinking Trajectory	Peer Association Trajectory				$F^{\dagger}$
	Stable Low ($n = 543$)	Steadily Increasing ($n = 2,290$)	Stable High ($n = 2,758$)	Overall	
Abstainer ($n = 1,862$)	.84$_a$	.41$_b$	.17$_c$	.33	639.41
Decreaser ($n = 234$)	.00$_a$	.00$_a$	.08$_b$	.04	122.27
Stable Heavy Drinker ($n = 883$)	.03$_a$	.02$_a$	.30$_b$	.16	460.98
Slow Increaser ($n = 2,368$)	.13$_a$	.53$_b$	.39$_c$	.42	167.71
Adolescent Heavy Drinker ($n = 244$)	.00$_a$	.03$_b$	.06$_c$	.04	30.84

Note. Entries in a row sharing the same subscript do not differ at $p < .05$.

[†] Degrees of freedom for this *F*-test equal 2 (between) and 5,585 (within). All *p*-values less than .001.

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Table 2

Probability of Membership in Each Heavy Drinking Trajectory Given Membership in Each Parental Disapproval Trajectory

Heavy Drinking Trajectory	Parental Disapproval Trajectory				$F^{\dagger}$
	Stable Moderate (*n* = 461)	High Decreasing (*n* = 600)	Continued High (n = 4,530)	Overall	
Abstainer (*n* = 1,862)	$.11_a$	$.12_a$	$.38_b$	.33	146.92
Decreaser (*n* = 234)	$.23_a$	$.07_b$	$.02_c$	.04	256.66
Stable Heavy Drinker (*n* = 883)	$.37_a$	$.31_b$	$.12_c$	.16	169.78
Slow Increaser (*n* = 2,368)	$.26_a$	$.34_b$	$.45_c$	.42	44.36
Adolescent Heavy Drinker (*n* = 244)	$.04_a$	$.17_b$	$.03_a$	.04	127.78

Note. Entries in a row sharing the same subscript do not differ at $p < .05$.

$\dagger$ Degrees of freedom for this *F*-test equal 2 (between) and 5,585 (within). All *p*-values less than .001.