Adolescent Deviant Peer Clustering as an Amplifying Mechanism Underlying the Progression from Early Substance Use to Late Adolescent Dependence

Mark J. Van Ryzin[1] and **Thomas J. Dishion**[2]

[1]Child and Family Center, University of Oregon, OR, USA

[2]Prevention Research Center, Arizona State University, AZ, USA

Abstract

Background—Early substance use co-occurs with youths' self-organization into deviant peer groups in which substance use is central to social interaction. We hypothesized that the social dynamics of deviant peer groups amplify the risk of progressing from early use to later dependence, and that this influence occurs over and above escalations in use that typically accompany early substance use and membership in deviant groups.

Methods: Our study used a longitudinal, multimethod dataset consisting of 998 adolescents and their families. Participants were recruited from middle schools in a large metropolitan area in the Pacific Northwest. The sample was 47.3% female and ethnically diverse (42.3% European-American, 29.1% African-American, and 28.6% other, including biracial). We examined deviant peer clustering as a mediator between early substance use and later dependence, controlling for proximal levels of use, SES, early antisocial behavior, and parental monitoring. Tobacco, alcohol, and marijuana use were assessed at ages 12, 13, and 16–17. Past-year nicotine, alcohol, and marijuana dependence (DSM-IV) was assessed at age 19. Youth and parent reports and observational data were used to assess deviant peer clustering at age 16–17, and youth reported on antisocial behavior and parental monitoring at ages 12 and 13.

Results: Early substance use predicted increased likelihood of dependence on tobacco, alcohol, and marijuana by late adolescence. Deviant peer affiliation mediated these links, even when accounting for proximal levels of substance use.

Conclusions: Early substance use not only promotes escalations in use across adolescence but also provides entry into a deviant social context that contributes to increased risk of dependence. Our results emphasize the importance of identifying and intervening in early substance use before it becomes an organizing factor in friendship selection and interaction. Deviant peer clusters are clearly an important avenue for intervention when seeking to interrupt the progression to substance dependence.

Correspondence Mark J. Van Ryzin, Child and Family Center, University of Oregon, 6217 University of Oregon, Eugene, Oregon 97403-6217 USA; markv@uoregon.edu..

Keywords

substance dependence; deviant peer clustering; early substance use; mediation; prevention

Introduction

Adolescence is a developmental period during which many youths begin to experiment with alcohol, tobacco, and marijuana. Results from a recent national survey indicated that among eighth grade students, 36.6% had tried alcohol and 15.7% had used marijuana (Johnston, O'Malley, Bachman, & Schulenberg, 2010). These early users can be at elevated risk for substance abuse and dependence in late adolescence or adulthood (Grant, Stinson, & Harford, 2001; Hingson & Zha, 2009; Pitkänen, Lyyra, & Pulkkinen, 2005). For example, alcohol use before age 14 or 15 has been linked to elevated risk for later abuse and dependence (Dawson, Goldstein, Chou, Ruan, & Grant, 2008; Hingson, Heeren, & Winter, 2006), and similar results have been found for tobacco and marijuana use (Behrendt, Wittchen, Höfler, Lieb, & Beesdo, 2009; Vega & Gil, 2005). Substance dependence, in turn, is linked to a variety of maladaptive long-term outcomes, including impaired neurological functioning and greater likelihood of psychiatric disorders and involvement in violent crime (Brown, Tapert, Granholm, & Delis, 2000; Soyka, 2000). Diagnosis of substance dependence in adolescence is often quite stable over time, with epidemiological studies showing little evidence of remission (Nelson & Wittchen, 1998; Perkonigg et al., 1999). Further, adolescent-onset dependence implies more negative long-term outcomes that adult-onset dependence, including higher lifetime levels of use and higher rates of disruptive behavior disorders and major depression (Clark, Kirisci, & Tarter, 1998).

An accurate developmental model of the progression from early use to later dependence is needed to inform prevention and intervention efforts. Although considerable research has been conducted on the etiology of substance use in adolescence, researchers have rarely examined the specific developmental dynamics involved in the progression from early use to diagnosable substance use disorders. In one recent example, Guttmannova and colleagues (2012) sequentially examined multiple potential mediators (e.g., deviant peer affiliation, school functioning, elevated substance use) and found no evidence for mediation. We wished to expand upon that study, which was limited to alcohol use, by adding both early tobacco and marijuana use as predictors and including consideration of nicotine and marijuana dependence as outcomes. We also wished to focus more centrally on the issue of deviant peer affiliation as a potential mediator.

From early adolescence to adulthood, youth develop peer networks that compete with the influence of parents and family (Steinberg & Monahan, 2007). Research suggests that youth with a history of problem behavior and peer rejection self-organize into deviant peer clusters in early adolescence (Dishion, Ha, & Véronneau, 2012; Dodge et al., 2009). These clusters engage in daily social interactions that promote increases in deviant behavior by means of social modeling, peer pressure, and various types of reinforcement (Dishion & Owen, 2002; Patterson, Dishion, & Yoerger, 2000; Van Ryzin & Dishion, 2013). Beyond simply promoting an increase in deviant behavior, however, these deviant peer clusters often rely on

substance use as a core component of social interaction (Dishion & Tipsord, 2010), which can ingrain substance use as a necessary prerequisite to social integration and acceptance. This substance-centric social climate may amplify the risk of later substance dependence.

To evaluate this hypothesis, we examined deviant peer affiliation as a mediator between early use of tobacco, alcohol, and marijuana (before age 14) and later diagnosable substance dependence (age 19). Since some research has linked early use of one substance with later dependence on others (Ellickson et al., 2003; Vega & Gil, 2005), we included early use of tobacco, alcohol, and marijuana in a latent construct predicting all measures of later dependence. Our outcome variables included dichotomous indicators of past-year nicotine, alcohol, and marijuana dependence as determined by DSM-IV criteria.

Simultaneously, we evaluated the possibility that substance dependence is merely an extension of the link between early use and elevated use later in adolescence. In other words, although we hypothesized that the deviant peer group was the key mechanism promoting increased risk of dependence, we also examined the possibility that dependence was a function of the escalation in use across adolescence that often accompanies early use and membership in deviant groups. The hypothesized model is shown in Figure 1.

Method

Participants

Participants were 998 adolescents and their families who enrolled in a randomized, controlled trial of a family-based intervention delivered in the context of the public school. A core component of the intervention was the Family Check-Up (FCU; Dishion & Stormshak, 2007), which was offered to all families randomized to the family support condition. Families were recruited from three middle schools in the Pacific Northwest. Parents of all sixth grade students in two cohorts were approached for participation and 90% provided informed consent. Approval for all processes related to consent and data collection was obtained from the University of Oregon IRB.

The sample included 472 females (47.3%). By youth self-report, there were 423 European-Americans (42.3%), 291 African-Americans (29.1%), 68 Latinos (6.8%), 52 Asian-Americans (5.2%), and 164 (16.4%) of other ethnicities, including biracial. Biological fathers were present in 585 families (58.6%). Annual family income ranged from $5,000 to more than $90,000, with the median family earning between $30,000 and $40,000. Youths were randomly assigned at the individual level to either the intervention ($n = 500$) or control ($n = 498$) condition during the sixth grade. Approximately 80% of youths were retained across the 11-year span of the study.

Measures

Substance use—Youth reports of substance use (tobacco, alcohol, marijuana) were collected at age 12, 13, and 16–17. Adolescents were asked to indicate the number of occasions they had used each substance during the past month. Because rates of substance use were very low before age 14, early use was derived by combining dichotomous indicators of use at age 12 and 13; participants were designated as users (1) if they reported

any level of use at either age 12 or 13; otherwise they were designated as nonusers (0). Before age 14, 184 out of 995 (18.5%) participants were designated as tobacco users, 286 out of 995 (28.7%) participants were designated as alcohol users, and 119 out of 995 (12.0%) participants were designated as marijuana users in our sample.

Substance dependence—At age 19, participants completed an interviewer-administered version of the Composite International Diagnostic Interview (CIDI; World Health Organization, 1997), a standardized mental health assessment that collects diagnostic information about multiple mental health disorders using DSM-IV criteria. For our study, we used past-year diagnoses of nicotine, alcohol, and marijuana dependence. Each of these was a dichotomous indicator (i.e., no = 0, yes = 1). Our sample included the following numbers of individuals classified in each category: nicotine dependence (48 out of 789, 6.1%), alcohol dependence (37 out of 788, 4.7%), and, marijuana dependence (34 out of 788, 4.3%).

Deviant peer affiliation—We used a combination of mother, father, and youth reports and observational measures of deviant peer affiliation. The four data sources were combined into a single measure of deviant peer affiliation at age 16–17 using a latent construct; baseline measures were also collected from youth.

At ages 12 and 13 (the baseline measures) and at age 16–17, youth used four items to report the number of times in the past week that they had spent time with peers engaged in problem behavior (e.g., "get into trouble," "smoke cigarettes or chew tobacco," and "take things that don't belong to them"). Responses ranged from 0 (*never*) to 7 (*more than seven times*). Good internal reliability was found for this scale (α = .80–.83). Youth reports of deviant peer affiliation at ages 12 and 13 were averaged (r = .38, p < .001) to create a single baseline measure.

Mothers and fathers used four items to report on the percentage of the youth's friends who engaged in problem behavior (e.g., "misbehaved or broke rules," "experimented with smoking or other substances," and "dressed or acted like gang member"). Responses ranged from 1 (*very few, < 25%*) to 5 (*almost all, > 75%*). Scale reliability was α = .69 for mothers and α = .71 for fathers.

At age 16–17 years, participants took part in a videotaped interaction task with a same-sex, self-nominated friend who was between 14 and 21 years old and had no familial relationship to the participant. The parents of the friend were contacted to obtain informed consent if he/she was younger than 18. Each dyad participated in a 45-minute discussion covering eight topics, including planning an activity together, a currently nominated problem of the participant, a currently nominated problem of the friend, drug and alcohol use, goals for the next year, friends and peer groups, dating, and planning a party. The videotapes were coded by undergraduate trained research assistants who were blind to the participant groupings and experimental hypotheses. Coders used a defined system (Piehler & Dishion, 2005) to code specific aspects of the interaction. Approximately 15% of the data were randomly sampled and dual coded to assess reliability and ensure that interrater agreement remained at 80% or more.

Our measure of deviant peer affiliation was based upon the concept of "deviancy training" among peers (i.e., positive reinforcement for deviant behavior). Previous research has revealed that duration of a deviancy training episode provides a normally distributed index for the deviancy training process (Dishion, 2000; Granic & Dishion, 2003). Thus, deviancy training was measured using the average length of rule-breaking bouts, that is, the percentage of the total time a dyad engaged in conversation about deviant topics. Deviant topics included all verbal and nonverbal behavior that was not appropriate to the setting or that violated community or societal norms (e.g., being involved in illegal activities, substance use, violence, or vandalism).

Parental monitoring (knowledge)—Youth reports of parental monitoring at ages 12 and 13 were measured by averaging across five items. Items reflected the degree to which parents knew of the youth's location, activities, and companions during free time (e.g., "How often does at least one of your parents know where you are after school?" and "How often does at least one of your parents know what you are doing when you are away from home?"). Responses ranged from 1 (*never or almost never*) to 5 (*always or almost always*). Scale reliability was $\alpha = .85$ at age 12 and $\alpha = .86$ at age 13. The two scores were averaged ($r = .49$, $p < .001$) to create a single baseline measure.

Antisocial behavior—Youth reports of antisocial behavior at ages 12 and 13 were measured averaging across nine items. Items assessed youths' reports of the number of times in the past month they had done things such as lied to parents about where they were or who they were with, hit or threatened someone at school, and engaged in theft and vandalism. Responses ranged from 0 (*never*) to 6 (*more than 20 times*). Scale reliability was $\alpha = .83$ at age 12 and $\alpha = .84$ at age 13. The two scores were averaged ($r = .50$, $p < .001$) to create a single baseline measure.

Demographics—SES was measured using a combination of parental employment status, parental education, family housing status, family income, and financial aid status. When data were available for both parents, the highest level of each variable among the two parents was chosen. Regarding gender, we coded females as 1 and males as 0. For ethnicity, we coded European Americans as 1 and other ethnicities as 0.

Analysis Plan

The hypothesized model is shown in Figure 1. Early deviant peer affiliation was included in the model to control for individual differences at baseline; when predicting the outcome measures, we wished to assess change in deviant peer affiliation from age 12-13 to 16-17 as the mediating factor. The dependent variables (i.e., nicotine, alcohol, and marijuana dependence) were modeled separately as dichotomous variables. Depending on the outcome, we controlled for use of the relevant substance in middle adolescence (e.g., when predicting nicotine dependence, we controlled for tobacco use); these measures were count-based. We also controlled for a number of covariates that have been linked to substance use and dependence, including: (1) parental monitoring (Dishion, Nelson, & Kavanagh, 2003); (2) antisocial behavior (Adalbjarnardottir & Rafnsson, 2002); and (3) socioeconomic status (SES; Goodman & Huang, 2002; Luthar & D'Avanzo, 1999). Covariances among variables

at each age were freely estimated, which accounted for within-time covariation that was not pertinent to our analyses (not presented in Figure 1). Finally, given that research has found sex and ethnic differences in patterns of substance dependence (Wallace et al., 2003; Young et al., 2002), we examined whether sex and ethnicity moderated any of the links in our models using a chi-square deviance test. Because this sample was derived from a randomized controlled trial of an intervention, we also applied a chi-square deviance test to evaluate whether the results at each modeling step were different for the intervention and control groups.

A test of mediation traditionally includes an initial direct-effects model that tests the path between the predictor and outcome, followed by a mediation model in which the following paths are tested: (a) the predictor to the presumed mediator, (b) the mediator to the distal outcome, and (c) the combined indirect effect between the predictor and the outcome via the mediator (Judd, Kenny, & McClelland, 2001; MacKinnon & Dwyer, 1993). Thus, we initially fit a model containing only direct effects of early use (< age 14) on later dependence (age 19), and then tested for mediation by means of deviant peer affiliation and substance use in middle adolescence (age 16–17). To evaluate the significance of the indirect effects, we used an analytic technique that is based upon the actual distribution of the indirect effect (PRODCLIN; MacKinnon, Fritz, Williams, & Lockwood, 2007). This technique provides an unbiased assessment of statistical significance even in situations in which the indirect effect is not normally distributed. PRODCLIN provides a 95% confidence interval for the indirect effect; if this interval does not contain zero, the effect is considered to be statistically significant.

All modeling was conducted using Mplus 6.1 (Muthén & Muthén, 2008) with full information maximum likelihood, which can provide unbiased estimates in the presence of missing data. Because of the nature of our outcome variables (i.e., dichotomous), model fit indices were not provided by Mplus.

Results

Descriptive data and intercorrelations are presented in Table 1. In an exploratory analysis, we found that females were significantly more likely to demonstrate nicotine dependence, $\chi^2(1) = 4.80$, $p = .03$; males and females did not differ in terms of alcohol and marijuana dependence, $\chi^2(1) < .47$, $p = .49$, and $\chi^2(1) < .16$, $p = .69$, respectively. We also found that European Americans demonstrated greater risk for nicotine dependence when compared to other ethnicities, $\chi^2(1) = 6.92$, $p = .009$, but not for alcohol or marijuana dependence, $\chi^2(1) < 2.33$, $p = .13$, and $\chi^2(1) < .71$, $p = .40$, respectively. We also found that the FCU intervention condition was unrelated to nicotine, alcohol, and marijuana dependence, $\chi^2(1) < 3.05$, $p = .08$; $\chi^2(1) < 1.57$, $p = .21$; and $\chi^2(1) < .03$, $p = .86$, respectively. At age 16-17, the FCU condition was unrelated to deviant peer affiliation ($\beta = -.03$, $p = .46$) and substance use (Spearman's $r = .02$, .02, and .05, p > .19, for tobacco, alcohol, and marijuana, respectively). We did have a degree of missing data at later waves, but an analysis revealed that missingness at ages 16–17 and 19 was not systematically related to early use of tobacco, alcohol, or marijuana (χ^2 values < 3.0, $df = 1$, $p > .10$).

We initially fit a model in which early substance use predicted nicotine, alcohol, and marijuana dependence at age 19 (see Figure 2); paths to dichotomous measures of dependence are presented as Odds Ratios. Early use was a significant predictor of later dependence on tobacco, alcohol, and marijuana; no other effects were significant. Model fit did not differ for the FCU intervention and control groups, $\chi^2(15) = 6.28$, *ns*. Model fit also did not differ by gender, $\chi^2(15) = 13.32$, *ns*, or ethnicity, $\chi^2(15) = 7.81$, *ns*.

We then fit a mediation model for each substance and found that early use significantly predicted both deviant peer affiliation and substance use in middle adolescence (age 16–17), and both in turn significantly predicted dependence (see Figure 3). Since Mplus does not provide standardized betas for dichotomous outcomes, we initially fit a model that only included baseline measures and deviant peer affiliation at age 16-17; Figure 3 includes the standardized betas and factor loadings from this reduced model (unstandardized values were the same across all models); paths to dichotomous measures of dependence (age 19) are presented as Odds Ratios, and paths to count-based measures of use (age 16-17) are exponentiated betas. There were no significant effects of covariates on dependence or deviant peer affiliation, but there were effects on substance use at age 16-17; these are presented as exponentiated betas in Table 2. Indirect effects of early substance use on later nicotine, alcohol, and marijuana dependence by means of deviant peer affiliation were statistically significant (nicotine: *OR* = 3.03, CI = 1.01|11.25; alcohol: *OR* = 2.92, CI = 1.04|9.97; marijuana: *OR* = 3.32, CI = 1.02|13.60). Additionally, indirect effects of early substance use on later dependence by means of use in mid-adolescence were also statistically significant (nicotine: $e^B = 1.11$, CI = 1.02|1.22; alcohol: $e^B = 1.16$, CI = 1.07|1.26; marijuana: $e^B = 1.16$, CI = 1.05|1.27). Model fit did not differ for the FCU intervention and control groups, $\chi^2(17) < 15.75$, all *ns*. Model fit also did not differ by gender, $\chi^2(17) < 14.00$, all *ns*, or ethnicity, $\chi^2(17) < 11.25$, all *ns*.

Discussion

In our direct effects model (see Figure 2), early substance use emerged as an important predictor of later nicotine, alcohol, and marijuana dependence, even when controlling for early antisocial behavior, deviant peer affiliation, parental monitoring, and SES. Early substance use predicted both an increase in use across time as well as a tendency for youth to self-organize into peer groups that engaged in deviant behavior in mid-adolescence (see Figure 3). In turn, involvement with deviant peers and escalations in substance use were both found to mediate the links between early substance use and later dependence on nicotine, alcohol, and marijuana. Our findings emerged despite relatively low rates for dependence in our sample, and did not differ by sex or ethnicity (European-American vs. non-European-American), suggesting that this process was not unique to specific subpopulations.

We suggest that early substance use has two consequences: first, youth are trained to use substances on a regular basis; and second, use of substances provides a venue for social engagement with a particular group of peers that are favorably inclined toward delinquent behavior. This self-organization into deviant peer groups appears to be a key mechanism in the progression from early use to later dependence across a variety of substances, and the

influence of this process was independent of the escalations in use that typically accompany early use and membership in delinquent groups.

From a theoretical perspective, our results suggest that the development of substance dependence may have a significant social component that is a function of the centrality of substance use in the social interactions of deviant peer groups. Previous research has found that these delinquent groups establish social norms, expectations, and practices centered on substance use and other deviant behavior (Dishion & Tipsord, 2010), which appears to amplify the risk created by early use and leave youth uniquely vulnerable to later dependence. Future research should probe more deeply at the nature of social interactions in deviant peer groups in an effort to determine the exact manner in which these interactions promote substance dependence. Speculatively, a psychological link between regular substance use and positive emotions such as belonging and acceptance could facilitate the later transition from use to dependence; alternatively, a high degree of substance use may serve to establish social status in a context where substance use is viewed very favorably. Researchers could also probe cognitive mechanisms, such as sensation seeking and/or low self-regulatory abilities, that may provide insight into these peer dynamics.

From an applied perspective, these findings suggest that there is room for improvement in our prevention armamentarium. Such improvement could include an emphasis on identifying and intervening in early substance use before it has the opportunity to become an organizing factor in friendship selection and interaction. In addition, prevention programs that could effectively disrupt deviant or substance-centric peer groups would be highly beneficial. This topic remains a noteworthy, if vastly underexplored, avenue for extending the science of substance use prevention.

We did not find effects of the FCU on our dichotomous classifications of dependence at age 19, although previous research that used an intention-to-treat (ITT) design with this sample revealed reduced substance use from age 11 to 14, and these changes were mediated by changes in parental monitoring for the high-risk students (Dishion et al., 2003). Long-term effects of the FCU on substance use were found only when program engagement was included in the modeling (Connell, Dishion, Yasui, & Kavanagh, 2007; Van Ryzin, Stormshak, & Dishion, 2012).

Limitations and Conclusion

Several limitations of this study should temper interpretation of the results. First, we did not have the ability to examine genetic factors in this study that may have predisposed certain individuals to substance use or dependence (McGue & Iacono, 2008). Second, this study did not consider other aspects of parenting that may be related to adolescent substance dependence, such as parental use (although some research suggests that the link between parent and adolescent substance use is mediated by parental monitoring; Chassin, Pillow, Curran, Molina, & Barrera, 1993). Third, early deviant peer affiliation was included in our model to control for individual differences at baseline; however, since our measures begin at age 12, we cannot be completely sure whether substance use preceded deviant peer affiliation or vice versa, and thus a degree of bias may be present. Finally, we did have a degree of missing data at later waves, but exploratory analyses (reported above) suggested

that these data were not missing in a systematic manner, so our results should not be substantially biased.

In conclusion, we found that early substance use can be an entryway into a delinquent social context in which substance use forms the basis for social interaction, increasing the likelihood that an individual will develop substance dependence later in adolescence. Our results emerged even when accounting for escalations in use across adolescence, which similarly mediated the links between early use and later dependence. Prevention programs that attempt to identify early users and disrupt the formation of deviant peer clusters in early adolescence could potentially forestall the escalation to later dependence.

Acknowledgments

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Key Points

- Researchers have rarely examined the developmental dynamics involved in the progression from early substance use to later diagnosable substance use disorder.

- In this study, early substance use (< age 14) demonstrated a significant direct effect on later nicotine, alcohol, and marijuana dependence (age 19).

- Early substance use also predicted a tendency for youth to self-organize into deviant peer groups (age 16-17), which in turn mediated the links between early use and later dependence.

- Escalations in substance use to age 16-17 also served to mediate links between early use and later dependence.

- Our results suggest that participation in deviant peer groups amplified the risk of dependence created by early substance use; further, this influence occurs over and above escalations in use that typically accompany early substance use and membership in deviant groups.
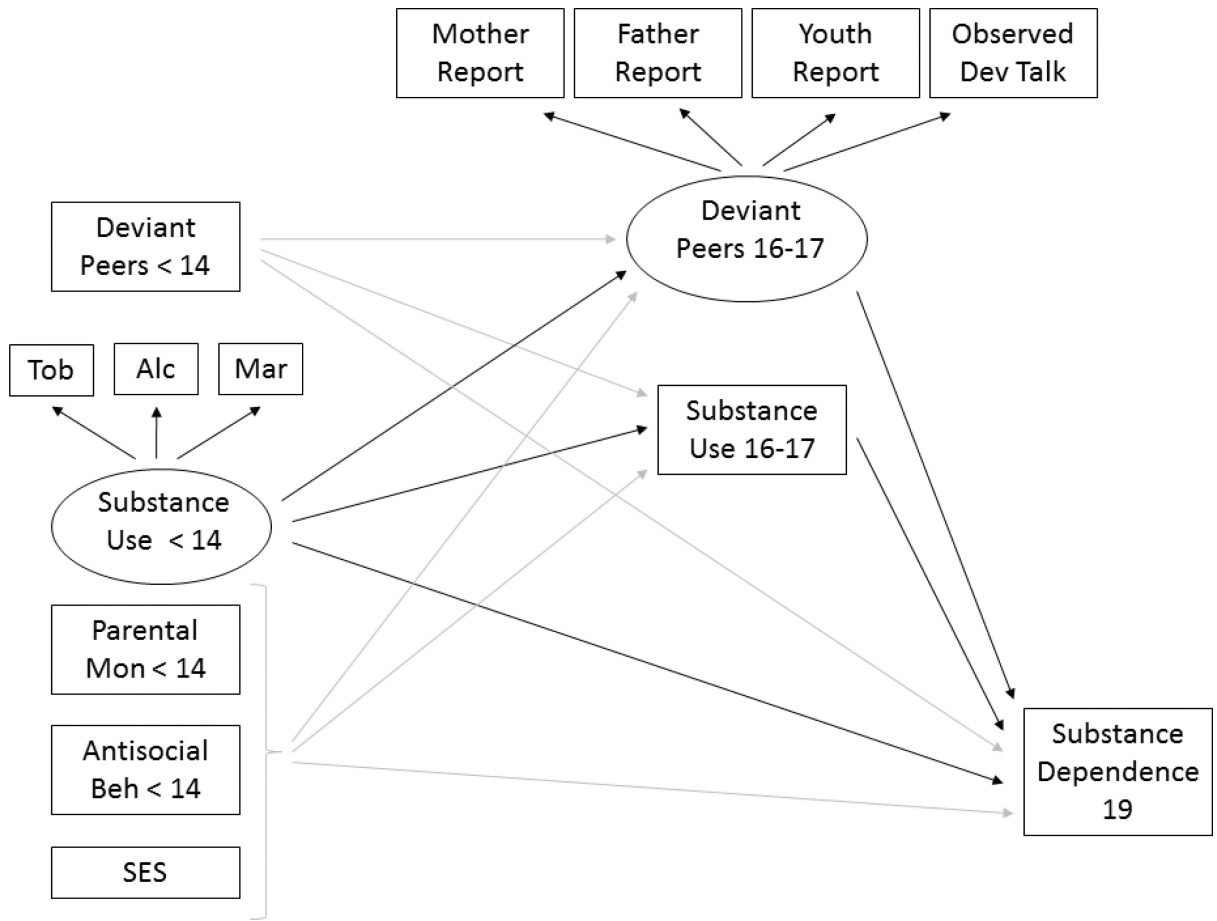
Figure 1.
Hypothesized model. Key model paths (i.e., direct and mediated effects, factor loadings) are in black; other paths are in gray. "Substance dependence" refers to nicotine, alcohol, and marijuana; each are modeled separately, but are presented as a single entity in the figure.
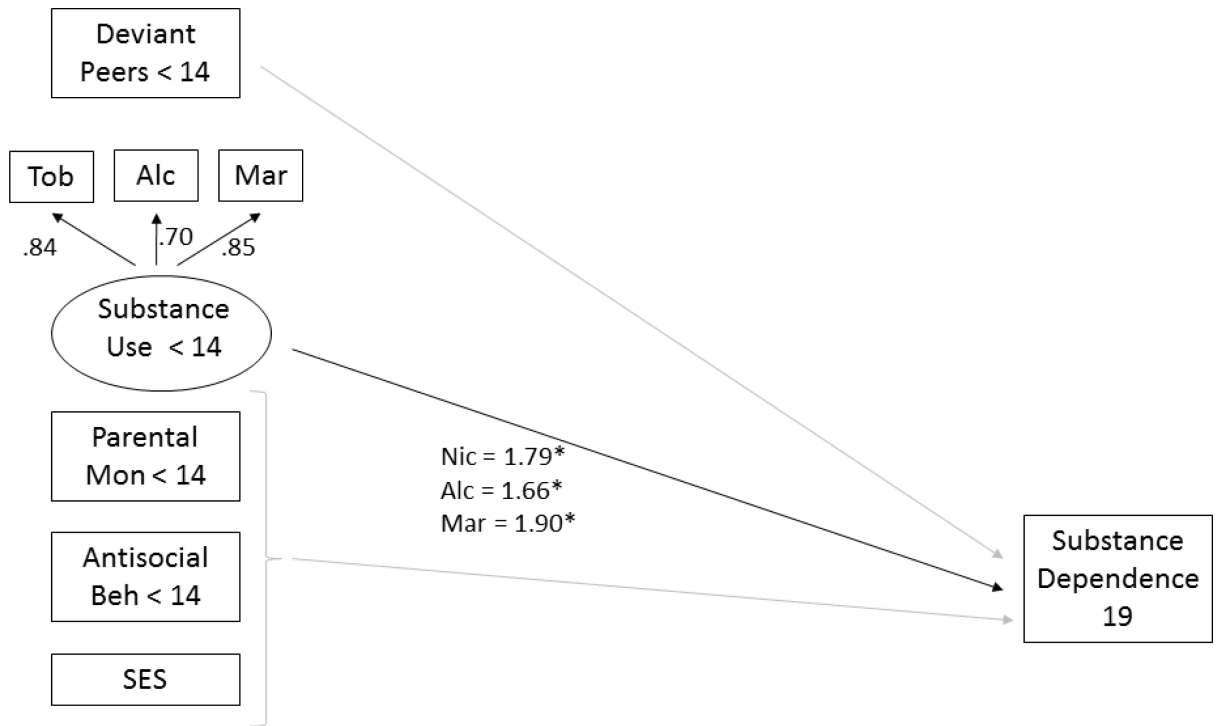
Figure 2.
Direct effects model. Key paths are in black; other paths are in gray. Tob = tobacco use; Nic = nicotine dependence; Alc = alcohol use/dependence; Mar = marijuana use/dependence. Paths to dichotomous measures of dependence are presented as Odds Ratios.
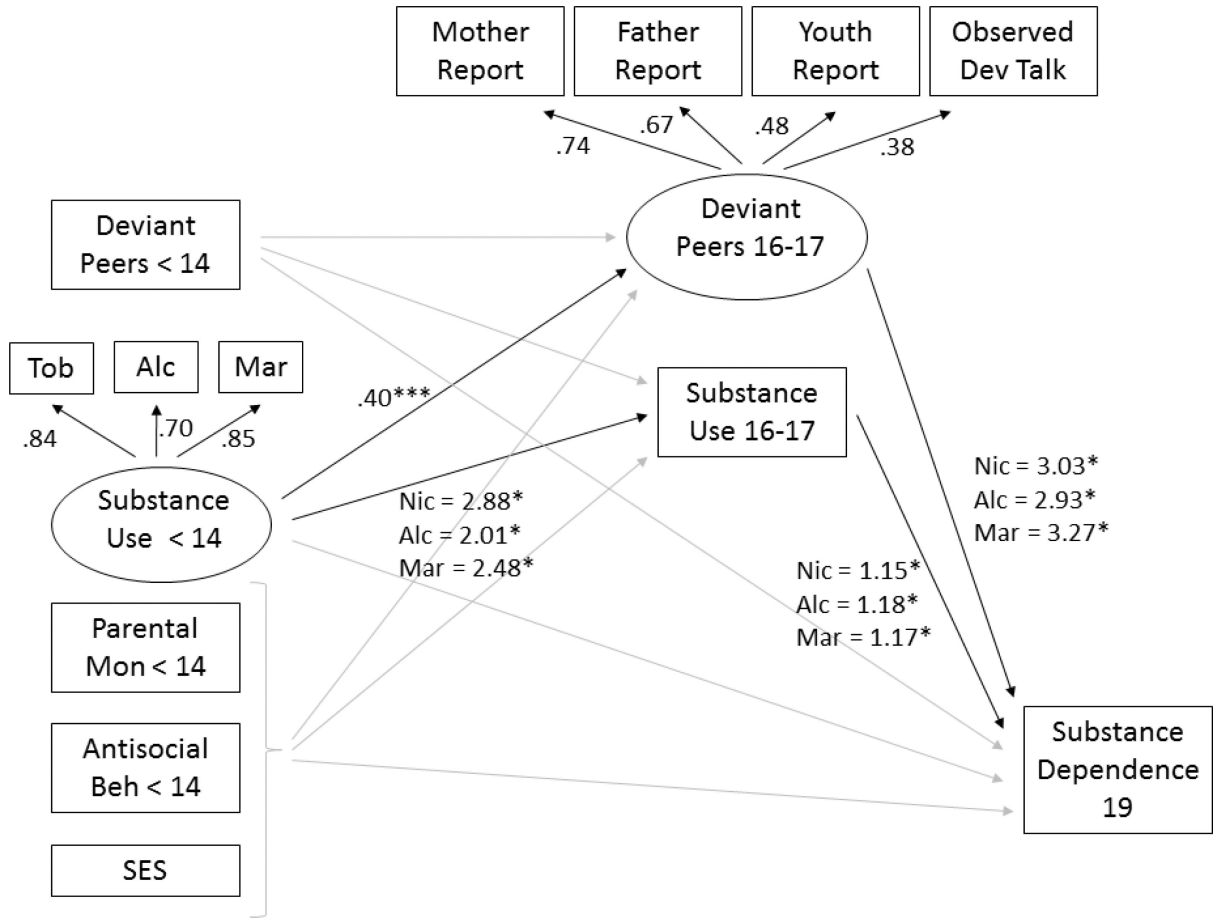
Figure 3.
Mediated model. Key paths are in black; other paths are in gray. Tob = tobacco use; Nic = nicotine dependence; Alc = alcohol use/dependence; Mar = marijuana use/dependence. Standardized betas were obtained in a separate (reduced) model, since these are not provided by Mplus for models with dichotomous outcomes. Paths to dichotomous measures of dependence (age 19) are presented as Odds Ratios; paths to count-based measures of use (age 16-17) are exponentiated betas.

Table 1

Correlations and Sample Descriptives

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Early tob use (< age 14)	—																
2. Early alc use (< age 14)	.42***	—															
3. Early mar use (< age 14)	.46***	.36***	—														
4. Early monitor (< age 14)	−.28***	−.24***	−.29***	—													
5. Early fam rels (< age 14)	−.22***	−.21***	−.19***	.47***	—												
6. Early dev peer (< age 14)	.43***	.30***	.38***	−.35***	−.22***	—											
7. Socioeconomic status	−.11**	.01	−.13**	.17***	.01	−.19***	—										
8. Tob use (age 16–17)	.31***	.15***	.22***	−.13***	−.13***	.22***	.00	—									
9. Alc use (age 16–17)	.17***	.19***	.08*	−.05	−.14***	.11**	.18***	.39***	—								
10. Mar use (age 16–17)	.21***	.13***	.18***	−.11**	−.11	.14***	.06	.43***	.59***	—							
11. Mother DP (age 16–17)	.25***	.13***	.21***	−.23***	−.14***	.21***	−.20***	.37***	.19***	.23***	—						
12. Father DP (age 16–17)	.27***	.18***	.15**	.19***	−.15***	.29***	−.07	.37***	.28***	.26***	.56***	—					
13. Youth DP (age 16–17)	.22***	.17***	.18***	−.16***	−.15***	.24***	.07	.45***	.48***	.47***	.32***	.27***	—				
14. Obs DP (age 16–17)	.18***	.13***	.19***	−.16***	−.11**	.16***	−.08***	.26***	.31***	.30***	.25***	.15**	.23***	—			
15. Nicotine dep (age 19)	.14***	.06	.09*	−.06	−.04	.06	.03	.37***	.16***	.23***	.19***	.19***	.25***	.06	—		
16. Alcohol dep (age 19)	.06	−.03	.01	−.01	−.02	−.03	−.04	.12***	.13***	.10**	.11**	.02	.13**	.09*	.30***	—	
17. Marijuana dep (age 19)	.13***	.08*	.06	−.02	−.08*	.03	.01	.13***	.22***	.25***	.08*	.11*	.20***	.11**	.21***	.22***	—
N	995	995	995	995	995	996	730	793	793	793	643	343	791	711	789	788	788
M/Median	.18	.29	.12	3.92	3.52	.80	.00	.00	.00	.00	1.75	1.71	.79	6.27	.06	.05	.04

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SD/Range	.39	.45	.32	.86	.91	1.00	.72	23.00	13.00	13.00	.71	.76	.91	8.08	.24	.21	.20

Note. tob = tobacco. alc = alcohol. mar = marijuana. DP = deviant peer affiliation. dep = dependence. Spearman's correlations, median, and range provided for count-based data (i.e., substance use at age 16–17, columns 8–10).

*
$p < .05$

**
$p < .01$

***
$p < .001$.

Table 2

Prediction of Mid-Adolescent (Age 16-17) Substance Use as Exponentiated Betas

Predictors	Tobacco use	Alcohol use	Marijuana use
Early deviant peer affiliation	1.21[*]	1.09	1.10
Early monitoring	.94	.89	.85
Early antisocial behavior	1.17	1.07	1.34
Socioeconomic status	1.28[*]	2.01[***]	1.86[***]

**p < .01.

[*]
p < .05.

[***]
p < .001.