Family and Peer Predictors of Substance Use From Early Adolescence to Early Adulthood: An 11-Year Prospective Analysis

Mark J. Van Ryzin[a], **Gregory M. Fosco**[a,1], and **Thomas J. Dishion**[a,2]

Mark J. Van Ryzin: markv@uoregon.edu; Gregory M. Fosco: gmf19@psu.edu; Thomas J. Dishion: dishion@uoregon.edu

[a]Child and Family Center, University of Oregon, 195 W. 12th Ave., Eugene, OR 97401 USA

Abstract

The focus of this study was social (i.e., family and peer) influences on substance use from early adolescence to early adulthood. A large, ethnically diverse sample of early adolescents ($N = 998$) was followed from age 12 to age 23. We tested direct and indirect effects of parental monitoring, family relationship quality, and association with deviant peers on change in substance use across time. Outcomes for tobacco, alcohol, and marijuana use were analyzed as separate pathways within the same overall model. The results suggest that a significant shift in the nature of family influence occurred across adolescence and into early adulthood, but deviant peer influence was relatively consistent across this period. Specifically, parental monitoring and deviant peer association were predictive of substance use in early adolescence, but family relationship quality was a significant predictor across the transition to high school and generally continued to predict use into later adolescence, as did association with deviant peers. Deviant peers were the only significant predictor in early adulthood. Our results also suggested that parental monitoring and family relationship quality indirectly predicted later substance use by way of deviant peers, implying that an important aspect of the family context is its influence on choice of friends and peer group composition. Implications for family-based prevention and intervention are discussed.

Keywords

substance use; adolescence; parental monitoring; family relationship quality; deviant peer association

Correspondence may be directed to Mark J. Van Ryzin, Child and Family Center, 195 West 12th, Eugene, Oregon 97401-3408. ph: 1-541-346-4708; fax: 1-541-346-4858; markv@uoregon.edu.

[1]Present address: Pennsylvania State University, Department of Human Development and Family Studies, 110 South Henderson Building, University Park, PA 16802 USA

[2]Present address: Arizona State University, Prevention Research Center, PO Box 876005, Tempe, AZ 85287-6005 USA

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errorsmaybe discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Contributors

Dr. Dishion designed the study and wrote the protocol. Dr. Van Ryzin conducted the statistical analysis and wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

1. Introduction

Considerable research has been devoted to understanding adolescent use of tobacco, alcohol, and marijuana. Substance use often starts among a small percentage of youth during early adolescence, and the percentage continues to increase throughout adolescence. Results from a recent national survey indicated that among eighth grade students, 36.6% had tried alcohol, 17.4% had been intoxicated in their lifetime, and 15.7% had used marijuana; however, by 12th grade, 56.6% of students had been intoxicated and 42.0% had used marijuana (Johnston, O'Malley, Bachman, & Schulenberg, 2010). These elevations in substance use have both immediate and long-term implications for adolescent health, well-being, and competence in adult roles (Chassin, Pitts & DeLucia, 1999; Kandel, Davies, Karus, & Yamaguchi, 1986; Newcomb & Bentler, 1988). Specifically, substance use before age 17 is a strong predictor of later use and dependence (Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Clark, Kirisci, & Tarter, 1998; Dewit, Adlaf, Offord, & Ogborne, 2000), even when controlling for genetic and family influences (Grant et al., 2006; Lynsky et al., 2003) and the actual number of years of substance use (Anthony & Petronis, 1995). In turn, substance dependence is linked to a variety of maladaptive outcomes, including a greater likelihood of psychiatric disorder and involvement in violent crime (Brook et al., 2002; Lennings, Copeland, & Howard, 2003; Soyka, 2000). Moreover, adolescent substance use is a key component of more general problem behavior, which includes antisocial or delinquent behavior, academic failure, and risky sexual activity (Ary et al., 1999; Barrerra, Biglan, Ary, & Li, 2001; Dishion & Patterson, 2006; Tapert, Aarons, Sedlar, & Brown, 2001). These findings underscore the importance of identifying specific risk and protective factors in the progression of use from early adolescence to early adulthood.

1.1 Social Context of Adolescent Substance Use

Many researchers who explore risk and protective factors related to adolescent substance use emphasize the social context, and key aspects of this context are interactions within the family, such as parental monitoring and parent–youth relationship quality (Dishion, Nelson, & Bullock, 2004). For example, a great deal of this research has linked parental monitoring to reduced adolescent substance use (Barrera et al., 2001; Kumpfer & Alvarado, 2003; Svensson, 2000). Successful parental monitoring involves structuring activities and fostering communication skills to facilitate adolescents' disclosure, which helps reduce youths' exposure to risks for problem behavior (Dishion & McMahon, 1998; Stattin & Kerr, 2000). Family-based interventions typically strengthen parents' family management skills, and research on these programs has linked improved family management practices, and monitoring in particular, to reductions in adolescent substance use (Dishion, Nelson, & Kavanagh, 2003; Dusenbury, 2000; Spoth, Redmond, & Shin, 2001).

The quality of the parent–youth relationship has also been linked to decreased risk for a variety of problem behaviors in adolescence, including substance use (Ackard, Neumark-Sztainer, Story, & Perry, 2006; Herman, Dornbusch, Herron, & Herting, 1997). Relationship quality with parents remains a robust predictor of youth problem behavior even when controlling for parenting styles (e.g., authoritarian, permissive, etc.; Bronte-Tinkew, Moore, & Carrano, 2006) and family structure (e.g., one vs. two parents, biological vs. stepfamilies; Crawford & Novak, 2008). Family theorists posit that youths who have a strong relationship with their parents are more likely to turn to their parents for information and guidance and to internalize parental advice (Allen & Land, 1999; Brody, Moore, & Geli, 1994).

Peer relationships are another critical aspect of the social context that can precipitate adolescent substance use (Barrera et al., 2001; Brook, Brook, Arencibia-Mireles, Richter, & Whiteman, 2001). During this developmental period, youths spend less time with parents, levels of involvement with the family decrease, and the frequency and quality of youth–

parent communication are reduced (Hill, Bromell, Tyson, & Flint, 2007; Larson, Richards, Moneta, Holmbeck, & Duckett, 1996; Loeber et al., 2000). In addition, adolescence is a developmental period of heightened responsiveness to social reward, implying an increasing desire to fit in among peers (Spear, 2000). As a result, peers are hypothesized to become increasingly influential relative to parents during the course of adolescence (Berndt, 1979; Kandel, 1986), and extant research demonstrates that early adolescents are particularly vulnerable to peer influence related to substance use (Kelly et al., 2012). Further, although resistance to peer influence may develop during the course of adolescence (Steinberg & Monahan, 2007), more recent research suggests that peers may continue to exert a socializing influence until at least the age of 20 (Monahan, Steinberg, & Cauffman, 2009). Thus, associating with a deviant peer group in adolescence can be highly prognostic of escalating problem behavior (Dishion, Capaldi, Spracklen, & Li, 1995; Dishion et al., 2004; Patterson, Dishion, & Yoerger, 2000). Affiliation with deviant or substance-using peers can influence individual behavior in a variety of ways, such as social learning, facilitation, peer pressure, and deviancy training, during which peers reinforce each other by endorsing and encouraging deviant behaviors and activities (Dishion & Owen, 2002; Patterson et al., 2000). Early substance use can provide an entry point into a social context where use is accepted and encouraged by peers, which in turn fosters increasing levels of use (i.e., "peer contagion"; Dishion & Tipsord, 2010). At the same time, selection factors may also be in play, in that troubled or antisocial children tend to gravitate toward antisocial peers (Fergusson & Horwood, 1999).

1.2 Overlap of Family and Peer Contexts

When exploring the progression of substance use from adolescence to adulthood, it is important to examine both family and peer contexts simultaneously. Although some consider family and peers to be unique predictors of adolescent substance use (Aseltine, 1995; Bahr, Hoffman, & Yang, 2005; Beal, Ausiello, & Perrin, 2001; Brook et al., 2001; Chassin, Presson, Sherman, Montello, & McGrew, 1986), this perspective ignores the potentially problematic overlap between family and peer contexts, described by Dishion, Poulin, and Medici Skaggs (2000) as *premature adolescent autonomy.* In this developmental process, parents disengage from active involvement and monitoring of child behavior too early in adolescence, which can open the door to influence by deviant peers. In contrast, parents who continue their monitoring of and involvement with their adolescent can reduce the influence of deviant peers by keeping their youth engaged in the family system and by actively managing the composition of peer groups.

Thus, rather than treating parental and peer social contexts as independent, it is useful to consider the ways in which they are linked with each other and with adolescent substance use. For example, parental monitoring and parent–youth relationships can influence not only an adolescent's behavior, but also his or her exposure to deviant or substance-using peers. Some research has found that ineffective parental monitoring is linked with increased association with deviant peers, and deviant peer association in turn partially mediates the relationship between parental monitoring and more general problem behavior (Ary et al., 1999; Barrera et al., 2001). On the other hand, effective monitoring has been linked with reduced likelihood of associating with peers who use substances (Flannery, Williams, & Vazsonyi, 1999). Additionally, although the supporting research is sparse, parent-youth relationship quality has also been linked with deviant peer association, even when controlling for parental monitoring (Fosco, Stormshak, Dishion, & Winter, in press). Youths who have a strong relationship with their parents are more likely to turn to their parents for information and guidance and to internalize parental advice (Allen & Land, 1999; Brody et al., 1994), and as a result, relationship quality may influence the decision to use substances (i.e., a direct effect) as well as the choice of peers, who may then provide access to

substances or exert peer pressure to use substances (i.e., an indirect effect). Recent research supports this hypothesis, finding that the family environment can exert an indirect effect on alcohol use by means of peers (Nash, McQueen, & Bray, 2005). As a result, in addition to direct effects of family and peers on substance use, we also investigated whether deviant peers are an indirect mechanism by which the family context can influence adolescent substance use at different points in development.

1.3 Timing of Family and Peer Influence

To better understand the etiology of adolescent substance use, it is also vital to examine the relative *timing* of family and peer effects. Recently, Dodge and colleagues (2009) tested a cascade model of family and peer influences on substance use initiation. Using longitudinal data from prekindergarten through 12th grade, they found that an early family risk composite was associated with kindergarten behavior problems, early peer rejection and diminished social preference, reduced parental supervision in Grade 5, problem behavior in Grades 6 and 7, and subsequent substance use. However, because parenting and peers were not tested as simultaneous predictors, it is not possible to evaluate the relative influence of each at different stages of development. Other studies have compared family and peer influences on substance use, but these were generally limited in that they were either cross-sectional (e.g., Bahr et al., 2005; Beal et al., 2001; Cleveland, Feinberg, Bontempo, & Greenberg, 2008) or focused on a narrow time period (e.g., Aseltine, 1995; Brook et al., 2001). Even when both family and peer influences on substance use are evaluated over a longer term, the relative influence of the two are usually not examined, nor are potential overlaps (e.g., Guo, Hill, Hawkins, Catalano, & Abbott, 2002). Thus, we find that the extant literature has not systematically examined the relative contribution of parents and peers to adolescent substance use at multiple points across the entirety of adolescence. This is particularly critical given the plethora of family-based intervention programs that exist; it may be, for example, that these programs could realize additional benefits by focusing on particular aspects of parenting at specific ages.

1.4 Moderators of Links

Previous research has found both gender (Jackson, Sher, Cooper, & Wood, 2002) and ethnic (Blum et al., 2000) differences in the progression of substance use across adolescence. These differences extend to the links between family processes and substance use (Kelly, O'Flaherty et al., 2011; Rosay, Gottfredson, Armstrong, & Harmon, 2000), although the exact nature of effects is not always clear. For example, in some research, parental monitoring has been found to be more effective in reducing substance use among girls (Choquet, Hassler, Morin, Falissard, & Chau, 2008), whereas in other research, monitoring is more effective among boys (McArdle et al., 2002). Rosay et al. (2000) argue that, although differences exist, they are not large enough to be consequential. Thus, although we investigated whether gender and ethnicity moderated the links between family and peer processes and substance use, the current state of the literature did not permit the development of *a priori* hypotheses. We treated these aspects of our analysis as exploratory.

1.5 This Study

In this study, we explored family and peer predictors of youth substance use from early adolescence to early adulthood. Using a longitudinal sample, we examined the timing of family and peer influences on individual substance use during key developmental periods, including middle school, high school, and early adulthood. We were also interested in the transition to high school, since this change can create a significant degree of stress in adolescents' lives (Isakson & Jarvis, 1999). The transition requires students to adapt to a larger school and to fit in with a new peer group, and trends in problem behavior that begin in early adolescence can potentially be exacerbated by the transition to high school (Eccles,

Lord, Roeser, Barber, & Josefowicz-Hernandez, 1997; Roeser, Eccles, & Freedman-Doan, 1999).

Previous research has also found that early tobacco use can be a key risk factor for later association with deviant peers (Fergusson & Horwood, 1999) and for later use of other substances (Clark, Kirisci, & Moss, 1998; Ennett et al., 2006; Vega & Gill, 2005). At the same time, other research finds that early alcohol (Jackson et al., 2002) and marijuana (Patton, Coffey, Carlin, Sawyer, & Lynskey, 2005) use may be a contributing factor to later tobacco use. In an effort to disentangle these conflicting hypotheses, we modeled use of tobacco, alcohol, and marijuana independently and examined whether use of a certain substance predicted later use of other substances.

Overall, we tested a longitudinal model in which parenting, deviant peers, and substance use were cross-lagged at ages 12, 13, 15, 17, and 23 (see Figure 1). Our model included pathways of tobacco, alcohol, and marijuana use simultaneously and included cross-over effects among substances (although Figure 1 depicts a generic "substance use" construct to improve readability). The model also considered parental monitoring and parent–youth relationship quality simultaneously (again, Figure 1 depicts a generic "family context" construct to improve readability). We controlled for socioeconomic status (SES) and grade-point average (GPA) throughout the model because they have been shown to influence substance use (Luthar & D'Avanzo, 1999; Diego, Field, & Sanders, 2003). The variables within each time point were allowed to correlate freely (not pictured in Figure 1, for readability). Using this model, we examined the following core research questions:

1. Do family and peer contexts have unique associations with tobacco, alcohol, and marijuana use across adolescence and early adulthood? We tested direct effects of parental monitoring, family relationship quality, and deviant peers simultaneously at ages 13, 15, 17, and 23.

2. Does the relative strength of direct family and peer effects change over the course of adolescence? We evaluated the relative magnitude of the association between family and peer factors and substance use at ages 13, 15, 17, and 23.

3. Is the family context associated with substance use by way of deviant peer association? We tested indirect effects of parental monitoring and family relationship quality on substance use by way of deviant peer association.

4. Do gender and/or ethnicity moderate these links?

We hypothesized that family and peer factors would influence substance use across time, but that peer factors would become stronger during the course of adolescence and into early adulthood. We also hypothesized that parental monitoring would be a stronger predictor in early adolescence, and family relationship quality would be a stronger predictor later in adolescence as youth gain a degree of behavioral autonomy from parents (Allen & Land, 1999). Finally, we hypothesized that parental monitoring and family relationship quality both would exert significant indirect effects on substance use by way of association with deviant peers.

To minimize the chance of model misspecification, we included a consideration of continuity in each construct over time, as well as reciprocal effects among constructs (e.g., adolescent substance use predicting later aspects of parenting and association with deviant peers, deviant peer association predicting later aspects of parenting, etc.). These questions were not central to our study, so we treated these components of the analysis as exploratory.

2. Method

2.1 Participants

Participants were 998 adolescents and their families who enrolled in a randomized controlled trial of a family-based intervention project aimed at reducing adolescent antisocial behavior (the Family Check-Up; Dishion & Stormshak, 2007). Families were recruited in sixth grade from three middle schools in the Pacific Northwest that contained student populations representative of the geographic area (i.e., very diverse from both an ethnic and socio-economic perspective). Parents of all sixth grade students in two cohorts were approached for participation, and 90% consented, suggesting that we did not obtain a biased sub-population from these schools. 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 American families (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 $40,000. Youths were randomly assigned at the individual level to either the control ($n = 498$) or the intervention ($n = 500$) condition during the sixth grade. Approximately 80% of youths were retained across the 11-year span of the study.

2.2 Measures

2.2.1 Parental monitoring (knowledge)—Youth reports of parental monitoring in 6th, 7th, 9th, and 11th grades (ages 12, 13, 15, and 17) 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 ranged from α = .84 to .87.

2.2.2 Family relationship quality—Youth reports of their relationship with parents in 6th, 7th, 9th, and 11th grades (ages 12, 13, 15, and 17) were measured by averaging across six items. Items reflected the degree to which parents and youth shared activities, mutual regard, and positive affect (e.g., "My parents trusted my judgment," "I really enjoy being with my parents," and "There was a feeling of togetherness in our family"). Responses ranged from 1 (*never or almost never*) to 5 (*always or almost always*). Scale reliability ranged from α = .89 to .90.

2.2.3 Deviant peer association—Youth reports of deviant peer association in 6th, 7th, 9th, and 11th grades (ages 12, 13, 15, and 17) were measured by averaging across four items. Items assessed youths' reports of the number of times during the past week they had spent time with peers who, for example, "get into trouble," "fight a lot," and "take things that don't belong to them." Responses ranged from 0 (*never*) to 7 (*more than seven times*). Scale reliability ranged from α = .80 to .83.

2.2.4 Substance use—Youth reports of substance use (tobacco, alcohol, and marijuana) were collected in 6th, 7th, 9th, and 11th grades and in early adulthood (ages 12, 13, 15, 17, and 23). Adolescents were asked to indicate the number of occasions they had used each substance during the past month. Participant responses were strongly skewed, with many individuals reporting no use (i.e., often over 75%), so following recent practice (e.g., Cranford, Eisenberg, & Serras, 2009; Luk, Farhat, Iannotti, & Simons-Morton, 2010), we created dichotomous variables representing use vs. non-use. However, we also conducted a sensitivity analysis in which we fit the model with some of the less-skewed substance use variables in their native count-based format (see Analysis Plan for more details).

2.2.5 Control variables—Socio-economic status (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. Gender was coded with females as 1 and males as 0. The sample included 472 females (47.3%). With regards to ethnicity, we coded European Americans as 1 and other ethnicities as 0. The sample included 423 European Americans (42.3%). We obtained grade point average (GPA) from school official at the end of each school year.

2.3 Analysis Plan

Because our model was complex, we built it iteratively in multiple steps. We first created a simple autoregressive baseline model and in successive steps added cross-lagged paths between parenting, peers, and substance use. At each step, we compared model fit with that of the previous step using a chi-square deviance test to evaluate whether the additional paths resulted in superior model fit. If the additional paths did not improve model fit, they were discarded.

We then used chi-square deviance tests to compare the relative strength of the effects of family and peers on substance use. A model in which the effects of family and peer variables were freely estimated was compared with a model in which the effects were constrained to be equal for each substance (i.e., tobacco, alcohol, and marijuana); these tests were conducted separately for each age. If the freely estimated model demonstrated significantly better fit when compared with the constrained model, we concluded that the strength of the effects (family vs. peers) was significantly different. The sign (i.e., positive vs. negative) of the effect coefficients for deviant peers were expected to be the opposite of that for parents, so they were reversed before comparison.

We compared the fit of the model for males as compared with females, and for European Americans as compared with non-European Americans, again by using chi-square difference tests. If model fit was significantly different, we would then conduct a more detailed analysis in which we selectively constrained individual paths and compared model fit.

Finally, we conducted a sensitivity analysis in which we fit the model with some of the less-skewed substance use variables in their native count-based format. In the first iteration, we allowed alcohol use at age 23 to remain as a count-based variable, and in the second iteration, we allowed all three variables at age 23 to remain as count-based. We noted any deviation of the results from those in the initial analysis.

All modeling was conducted using structural equation modeling with Mplus (Muthén & Muthén, 2008). Substance use measures were declared as dichotomous variables, so logistic regression was used with a log-based link function. With logistic regression, the impact of each predictor on the outcome (i.e., substance use) can be calculated by exponentiating (i.e., antilog) the raw regression coefficients, with the result known as an "odds ratio". An odds ratio less than 1 can be seen as predicting a decrease in substance use, whereas an odds ratio greater than 1 can be seen as predicting an increase in use. Our analysis also contains normally distributed outcomes (e.g., deviant peer association), and these will be reported as unstandardized betas with standard errors (Mplus does not provide standardized betas for this type of analysis). Mplus also does not provide absolute indices of fit (e.g., CFI, RMSEA) for models containing logistic regression, so none are reported. Although not the default for the types of models we wished to run, we specifically requested maximum likelihood (ML) analysis, to ensure that our results were comparable to the existing literature. ML can provide unbiased estimates in the presence of missing data, as long as the data are Missing at Random (MAR). Covariances among variables within each wave were

freely estimated, which accounted for within-time covariation that was not pertinent to our analyses (see Table 2 for a summary of the correlations at each wave). We controlled for SES, GPA, and intervention condition across the model by including them as predictors of each variable.

3. Results

Descriptive statistics for each variable are provided in Table 1, and the correlations within each age are presented in Table 2. The percentage of substance users in our sample appears to be slightly lower than those reported in a recent national survey (Johnston et al., 2010). Although there was a degree of missing data across time, an attrition analysis found that families who did not provide data at later waves were not systematically different from those who did in terms of baseline levels of parental monitoring, family relationship quality, or deviant peer association (Fs < 3.17, ns), with the following exception: families missing substance use data at age 23 were lower in baseline parental monitoring (F's between 4.75 and 5.30, $p < .05$). We also found that substance use itself was related to subsequent attrition in a few cases, although the overall magnitude of the relationship was small. Specifically, marijuana use at age 12 was related to attrition at age 13, $r = .10$, $p < .05$, and tobacco use at age 13 was related to attrition at age 15, $r = .07$, $p < .05$.

Starting with a simple autoregressive baseline model, we inserted effects corresponding to substance use (i.e., predicting change in parenting and deviant peer association) and model fit improved, $\chi^2(27) = 149.56$, $p < .001$. We then added effects corresponding to parental monitoring and family relationship quality (i.e., predicting change in substance use and deviant peer association); again, model fit improved, $\chi^2(30) = 56.70$, $p < .01$. Finally, we inserted the effects of deviant peer association on substance use and family factors, and model fit improved again, $\chi^2(18) = 29.94$, $p < .05$. The results from the final model are presented in Tables 3 and 4. The intervention condition, which was controlled throughout the model, predicted reduced use of marijuana at age 17 ($OR = .62$, $p < .05$). SES predicted lower likelihood of substance use at age 12 (OR between .59 and .71, $p < .05$) but higher likelihood of alcohol use at age 17 ($OR = 1.30$, $p < .05$) and higher likelihood of alcohol ($OR = 1.48$, $p < .001$) and marijuana use ($OR = 1.30$, $p < .05$) at age 23. Similarly, GPA predicted lower likelihood of tobacco and marijuana use at ages 12 and 13 (OR between .55 and .66, $p < .05$), but higher likelihood of alcohol use at age 17 ($OR = 1.19$, $p < .05$); interestingly, GPA also predicted lower likelihood of tobacco use at age 17 ($OR = .73$, $p < .05$) and, marginally, at age 23 ($OR = .81$, $p = .06$). We begin our discussion of the results by examining the predictors of substance use.

3.1 Predicting Substance Use

We found continuity in substance use from age 12 to 13, and found that tobacco use at significantly predicted increased likelihood of marijuana use (see Table 3). Parental monitoring was associated with lower likelihood of tobacco and marijuana use, and deviant peer association was a risk factor for increased likelihood of use of all three substances (although the effect for marijuana use was only marginally significant). Family relationship quality at did not significantly predict age 13 substance use.

When predicting substance use during the transition to high school (age 15), there was again continuity for use of all three substances, and tobacco use predicted increased likelihood of use of both alcohol and marijuana. At this wave, family relationship quality was a consistent predictor of reduced likelihood of use of all three substances, but parental monitoring demonstrated no significant effects. Deviant peer association was linked with increased likelihood of tobacco use but was not significantly associated with alcohol or marijuana use.

Predictions from age 15 to 17 indicated continuity of substance use over time, and both tobacco and alcohol use predicted increased likelihood of marijuana use. Deviant peer association predicted increased likelihood of tobacco and alcohol use, and greater family relationship quality predicted reduced likelihood of use across all three substances. Parental monitoring did not predict substance use.

Finally, when considering early-adulthood use (age 23), we found a significant degree of continuity of use from age 17, and previous alcohol use predicted increased likelihood of marijuana use. Association with deviant peers increased likelihood of use of tobacco and marijuana, but not alcohol; in our sensitivity analysis, however, deviant peers at age 17 did predict increased likelihood of alcohol use at age 23 when this variable was not dichotomized. This suggests that our failure to find a significant effect may have been due to the limited variance in our dichotomous variable. Neither aspect of parenting was a significant predictor of use. A summary of these links is seen in Figure 2. Our sensitivity analysis did not reveal any other differences in the direct effects on substance use.

3.2 Predicting Contextual Variables

From ages 12 to 13, all three contextual variables indicated significant continuity over time; in addition, we found that family relationship quality predicted improved parental monitoring, and parental monitoring predicted lower levels of deviant peer association (see Table 4). Tobacco use predicted higher levels of deviant peer association at age 13.

From age 13 to 15, we again found significant continuity among our contextual variables; we also found that parental monitoring predicted lower levels of deviant peer association and greater family relationship quality. Tobacco use predicted reduced parental monitoring and family relationship quality, as well as increased association with deviant peers; alcohol use was a marginally significant predictor of deviant peer association.

At age 17, we again found significant continuity in contextual factors, and there were bidirectional positive associations among monitoring and family relationship quality. However, at this age, family relationship quality, rather than monitoring, predicted lower levels of deviant peer association. Both tobacco and marijuana use at age 15 predicted greater levels of deviant peer association. A summary of these links is seen in Figure 2. Our sensitivity analysis did not reveal any other differences in the direct effects on the contextual variables.

3.3 Relative Influence of Family and Peers

At ages 13, 15, 17, and 23, we compared the ability of deviant peers, parental monitoring, and family relationship quality to predict substance use. At age 13, we found that the predictive abilities of deviant peers and parental monitoring were not significantly different, $\chi^2(3) = .13$, *ns,* whereas deviant peers were stronger than relationship quality, $\chi^2(3) = 8.18$, $p < .05$. At age 15, we found that family relationship quality was not a significantly stronger predictor than deviant peers, $\chi^2(3) = 4.17$, *ns*; deviant peers were not compared to parental monitoring due to the lack of significant individual effects. At age 17, family relationship quality and deviant peers were equally strong, $\chi^2(3) = .86$, *ns*, but deviant peer association was a stronger predictor than parental monitoring, $\chi^2(3) = 12.16$, $p < .01$. At age 23, deviant peer association was stronger than parental monitoring, $\chi^2(3) = 12.31$, $p < .01$, and family relationship quality, $\chi^2(3) = 13.10$, $p < .01$. Our sensitivity analysis did not reveal any differences in these comparisons.

3.4 Tests of Indirect Effects

We examined indirect effects of family factors on substance use. Parental monitoring during middle school was implicated in several indirect effects on substance use. Monitoring at age 12 was indirectly associated with decreased likelihood of tobacco use at 15 by means of deviant peer association at age 13 ($OR = .97$, $p < .07$). In addition, monitoring at age 13 was indirectly linked with decreased likelihood of tobacco ($OR = .98$, $p < .08$) and alcohol ($OR = .97$, $p < .05$) use at age 17 by means of deviant peer association at 15 ($OR = .98$, $p < .08$). Indirect effects of family relationship quality emerged at age 15 and were associated with decreased likelihood of use of tobacco ($OR = .97$, $p < .05$) and marijuana ($OR = .97$, $p < .05$) in early adulthood. We note that, in a few cases, effects were only marginally significant. Our sensitivity analysis did not reveal any differences in the results, with one exception: the indirect effect of parent-youth relationship quality at age 15 on alcohol use at age 23 by means of deviant peer association at age 17 was marginally significant.

3.5 Gender and Ethic Differences

Finally, we evaluated whether gender and ethnicity were significant moderators of the pathways identified in the model. We divided the sample into two groups (males and females, then European Americans and non-European Americans) and evaluated a model in which all paths were constrained to be equal for both groups as compared the fit to a model in which paths were freely estimated. A model in which all paths were constrained to be equal for males and for females did not fit significantly worse than the freely estimated model, $\chi^2(180) = 182.18$, *ns*, suggesting there were no systematic differences. We similarly found no differences by ethnicity, $\chi^2(180) = 37.89$, *ns*. We also conducted a chi-square difference test for intervention condition, and again found no significant differences, $\chi^2(180) = 153.07$, *ns*. Our sensitivity analysis did not reveal any differences in these comparisons.

4. Discussion

Our study is unique in several ways. First, longitudinal research on substance use that spans adolescence and early adulthood is somewhat atypical. Second, research has only rarely considered the family and peer contexts, as well as their overlap, in the same model. Finally, no research to date has explicitly examined the timing of family and peer influences across the span from early adolescence to early adulthood. Our findings can not only inform developmental theory, but will be highly relevant to substance use prevention and intervention programs that target family functioning and deviant peer involvement.

4.1 Family, Peers, and Substance Use

We found that in early adolescence, parental monitoring and exposure to deviant peers each contributed to substance use by age 13, with greater monitoring related to lower likelihood of use (although monitoring was not a predictor of alcohol use) and greater levels of deviant peer association linked to higher likelihood of use, with the two predictors being equal in magnitude across substances. Quality of family relationships emerged as an important predictor of substance use across the transition to high school. At this age, family relationship quality was a significant predictor of lower likelihood of use of all substances, and deviant peers were a significant predictor for tobacco use only. Later in high school, deviant peers were a significant predictor of higher likelihood of use across all three substances, and family relationship quality remained a significant predictor, with the two being of equal magnitude. Finally, in early adulthood, deviant peer association was the strongest predictor of higher likelihood of use, and neither aspect of the family context was a significant predictor. Although deviant peers at age 17 did not predict increased likelihood of alcohol use at age 23 in our initial analysis, this path was significant when alcohol use at

age 23 was analyzed as a count variable, suggesting that the lack of significance in our initial model may have been a result of the reduction in variance that arose from dichotomizing this variable.

Overall, these findings generally support our hypotheses. We found that both families and peers influenced substance use across adolescence, while peers were the only significant influence on early adult use. The transition to high school appeared to signal a shift during which parents have less behavioral control and must instead rely on trust, caring, and communication to influence youth substance use. In fact, the stressful nature of the transition to high school and the negotiation of new peer networks may cause youth to rely even more strongly on their parents. Although the predictive association between parental monitoring and substance use in high school was not significant, we found that parental monitoring predicted deviant peer association and, indirectly, lower likelihood of use of some substances in high school. In other words, although direct supervision of adolescent behavior and knowledge of adolescent whereabouts are important aspects of parental monitoring, our results suggest that knowledge and supervision of the peer group is also important. This finding is consistent with previous research that linked parental monitoring of adolescent friendships and activities in early adolescence to reduced adolescent engagement with substance-using peers (Dishion et al., 2003; Laird, Criss, Pettit, Dodge, & Bates, 2008) and also echoes research finding that the family environment can exert an indirect effect on alcohol use by means of peer influence (Nash et al., 2005).

In contrast to parental monitoring, we found that family relationship quality predicted lower likelihood of substance use across the transition to high school and again near the end of high school. Although relationship quality did not have a direct effect on substance use in early adulthood, we found that it predicted reduced deviant peer association in high school and, in turn, indirectly predicted lower likelihood of use of some substances in early adulthood. Thus, the ability of families to keep adolescents engaged in the family system appears to discourage, to some extent, the tendency for youth to affiliate with deviant and/or substance using peers.

Finally, we found that the two family dimensions had reciprocal relations, with relationship quality predicting better monitoring and monitoring predicting more relationship quality. Because a significant component of monitoring is the adolescent's willingness to disclose (Stattin & Kerr, 2000), it was not surprising to find that adolescent reports of parental monitoring were enhanced by family relationship quality. By the same token, parental monitoring may reflect a process of ongoing involvement in an adolescent's activities and interests, which could promote greater relationship quality.

4.3 Gender and Ethnic Differences

In contrast to previous research, we found no evidence of systematic differences in relationships among variables by gender or ethnicity (European American vs. other). It may be that the sheer number of paths in our model overwhelmed any individual paths that may have been significantly different among subgroups. In other words, it may be that differences existed but were not detectable in our analysis due to limitations on power that were imposed by the size and complexity of our model. Rosay et al. (2000) have suggested that group differences do exist but are not large enough to be consequential, and our lack of findings is, on the whole, congruent with this hypothesis.

4.4 Effects Among Substances

In our model, tobacco use was able to predict increased association with deviant peers across ages 13 to 17 as well as reduced parental monitoring and parent-youth relationship quality at

age 15. We also found that tobacco was a significant predictor of later alcohol and marijuana use at multiple ages. In this way, tobacco use was particularly noteworthy, as alcohol and marijuana use did not exhibit such wide-ranging negative effects. These findings echo those of prior researchers who have identified tobacco use as a key risk factor for later use of a broader range of substances (Clark et al., 1998; Ennett et al., 2006; Vega & Gill, 2005). We found no evidence supporting the notion that alcohol and marijuana are risk factors for later use of tobacco. Although this contradicts some earlier research (Jackson et al., 2002; Patton et al., 2005), we note that these studies did not control for parental and peer influences.

4.5 Effects of Covariates on Substances Use

We found that SES and GPA predicted lower levels of substance use early in middle school but higher levels of substance use later in high school. This reversal could be due to a shift in peer norms. Although there is little research on this topic, we hypothesize that youth tend to view substance use in early adolescence as a non-normative or deviant activity, such that at-risk youth (i.e., low SES, low GPA) would be more likely to be substance users at this age. In contrast, substance use becomes much more widespread (i.e., more normative) in high school (Johnston et al., 2010), and thus may be more socially acceptable for low-risk (i.e., high SES, high GPA) youth. Indeed, researchers have found positive links between SES and substance use in later adolescence (Luthar & D'Avanzo, 1999). Interestingly, GPA predicted lower likelihood of tobacco use at age 17 ($OR = .73$, $p < .05$) and, marginally, at age 23 ($OR = .81$, $p = .06$), suggesting that tobacco may remain a non-normative or deviant activity throughout this period.

4.6 Clinical Implications

Our research suggests that parental monitoring and family relationships are powerful platforms from which to create lasting suppressive effects on substance use in middle and high school. Our study's findings support the theoretical framework of existing family interventions that enhance parental monitoring in middle school in order to reduce risk for substance use in middle and high school. Similarly, interventions that target parent–youth relationships by fostering effective conflict resolution, communication, and trust may also help reduce adolescent substance abuse both directly and indirectly by means of peer networks.

Clearly, peer groups are also an important avenue for intervention when seeking to reduce adolescent substance use. From a theoretical standpoint, interventions that could effectively disrupt deviant or substance-using peer groups would be highly beneficial. However, from a practical standpoint, this goal is much less straightforward. Once deviant peer groups have formed, they can be very difficult to change. In a previous analysis of high-risk adolescents, the amount of free time spent with substance-using peers predicted change in use (Dishion, Bullock, & Kiesner, 2008). Although this particular variable was not measured in our study, the degree to which youths spend time with substance-using peers would seem to be at least in part a reflection of the quality of parenting. Earlier work with a high-risk component of our study's sample found that random assignment to the intervention was associated with reduced substance use in early adolescence, and the reductions were mediated by changes in parental monitoring (Dishion et al., 2003). In that study, however, parental monitoring was measured using direct observation, as opposed to the survey-based measures used in our study.

Another option when seeking to disrupt negative peer influence on substance use is to focus on prevention programs that target risk factors for exposure to deviant peer processes, such as childhood peer rejection, bullying, and school disengagement (Fosco, Frank, & Dishion,

2012). It may also be possible to develop strategies for organizing school ecologies to minimize peer contagion dynamics and to optimize positive peer influences.

Limitations of our study should temper interpretation of the results. First, similar to many reports of long-term longitudinal research on substance use (e.g., Guo et al., 2002), the measures in this study were limited to adolescent self-report, and as a result, the predictions in our model may in part be the result of shared-method variance or reporter bias. In particular, the measurement of parental monitoring was limited to the youths' perception of parents' knowledge of their whereabouts and activities and did not assess other, more complex facets of the monitoring process, such as the number of unsupervised hours spent with peers. As such, the exact timing of the shifts from monitoring to relationship quality and from parents to peers may not be represented with complete accuracy. It would be helpful to consider more intensive measurement of the key constructs in our model. Second, this study did not consider other aspects of the youth (e.g., temperament) or parents (e.g., parental substance use) that may influence our results, 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, our measure of parent-youth relationships did not differentiate between mothers and fathers, and recent research suggests that the two may play somewhat different roles in the prevention of substance use (Kelly, Toumbourou et al., 2011; Luk et al., 2010). Fourth, timeframes of measurement were not equal across all measures, which may have created an unknown degree of bias in the results. For example, since parenting, substance use, and deviant peer association were measured using different timeframes, the links between these variables and the comparisons of model paths may be biased (although we note that the model results did generally support our hypotheses). Fifth, we did not possess measures of family processes before the age of 12, and family theory suggests that early parenting may also play a role in substance use (Dishion & Patterson, 2006). Controlling for baseline levels of all variables should reduce (but may not completely eliminate) any bias created by differences in early parenting. Finally, we did have a degree of missing data, and the missingness was not completely at random. Thus, our results may be biased to an unknown degree, and replication of our findings is warranted.

5. Conclusions

This study provides new insight into the links between adolescents' social ecology and the pathways of substance use from early adolescence to early adulthood. Our findings suggest that both parents and peers have significant impacts on substance use, but that the most salient aspects of parenting are subject to change during the transition to high school; monitoring appears to be more central in early adolescence, while family relationship quality appears to be more central in middle and late adolescence. These aspects of the family context demonstrated direct effects on substance use and some indirect effects on later use by way of deviant peer association, suggesting that parental monitoring and parent-youth relationships may play a role in an adolescents' choice of peers, which in turn can influence later substance use.

From a prevention and intervention perspective, our results emphasize the importance of family-based interventions in middle school and suggest that use of tobacco may be a key risk factor at this age and thus an attractive target for school-based intervention. Future research should consider examining additional aspects of the social ecology, such as popularity at school (see Allen et al., 2005), which has also been found to influence substance use. Such findings would augment our understanding of adolescent development and enable even more effective prevention and intervention.

Acknowledgments

References

Ackard DM, Neumark-Sztainer D, Story M, Perry C. Parent–child relationship quality and behavioral and emotional health among adolescents. American Journal of Preventive Medicine. 2006; 30:59–66. [PubMed: 16414425]

Allen, JP.; Land, D. Attachment in adolescence. In: Cassidy, J.; Shaver, PR., editors. Handbook of attachment: Theory, research, and clinical applications. New York: Guilford; 1999. p. 319-335.

Anthony JC, Petronis KR. Early-onset drug use and risk of later drug problems. Drug and Alcohol Dependence. 1995; 40:9–15. [PubMed: 8746919]

Ary DV, Duncan TE, Biglan A, Metzler CW, Noell JW, Smolkowski K. Development of adolescent problem behavior. Journal of Abnormal Child Psychology. 1999; 27:141–150. [PubMed: 10400060]

Aseltine RH. A reconsideration of parental and peer influences on adolescent deviance. Journal of Health and Social Behavior. 1995; 36:103–121. [PubMed: 9113137]

Bahr SJ, Hoffmann JP, Yang X. Parental and peer influences on the risk of adolescent drug use. The Journal of Primary Prevention. 2005; 26:529–551. [PubMed: 16228115]

Barrera M, Biglan A, Ary D, Li F. Replication of a problem behavior model American Indian, Hispanic, and Caucasian youth. Journal of Early Adolescence. 2001; 21:133–157.

Beal AC, Ausiello J, Perrin JM. Social influences on health-risk behaviors among minority middle school students. Journal of Adolescent Health. 2001; 28:474–480. [PubMed: 11377991]

Berndt T. Developmental changes in conformity to peers and parents. Developmental Psychology. 1979; 15:608–616.

Blum RW, Beuhring T, Shew ML, Bearinger LH, Sieving RE, Resnick MD. The effects of race/ethnicity, income, and family structure on adolescent risk behaviors. American Journal of Public Health. 2000; 90:1879–1884. [PubMed: 11111260]

Bronte-Tinkew J, Moore KA, Carrano J. The father–child relationship, parenting styles, and adolescent risk behaviors in intact families. Journal of Family Issues. 2006; 27(6):850–881.

Brook JS, Brook DW, Arencibia-Mireles O, Richter L, Whiteman M. Risk factors for adolescent marijuana use across cultures and across time. Journal of Genetic Psychology. 2001; 162:357–374. [PubMed: 11678369]

Brook DW, Brook JS, Zhang C, Cohen P, Whiteman M. Drug use and the risk of major depressive disorder, alcohol dependence, and substance use disorders. Archives of General Psychiatry. 2002; 59:1039–1044. [PubMed: 12418937]

Brody GH, Moore K, Geli D. Family processes during adolescence as predictors of parent-young adult attitude similarity: A six-year longitudinal analysis. Family Relations. 1994; 43:369–373.

Chassin L, Pillow DR, Curran PJ, Molina BSG, Barrera M Jr. Relation of parental alcoholism to early adolescent substance use: A test of three mediating mechanisms. Journal of Abnormal Psychology. 1993; 102:3–19. [PubMed: 8436697]

Chassin L, Pitts SC, DeLucia C. The relation of adolescent substance use to young adult autonomy, positive activity involvement and perceived competence. Development and Psychopathology. 1999; 11:915–932. [PubMed: 10624732]

Chassin L, Presson CC, Sherman SJ, Montello D, McGrew J. Changes in peer and parent influence during adolescence: Longitudinal versus cross-sectional perspectives on smoking initiation. Developmental Psychology. 1986; 22:327–334.

Choquet M, Hassler C, Morin D, Falissard B, Chau N. Perceived parenting styles and tobacco, alcohol and cannabis use among French adolescents: Gender and family structure differentials. Alcohol and Alcoholism. 2008; 43:73–80. [PubMed: 17932077]

Clark DB, Kirisci L, Moss HB. Early adolescent gateway drug use in sons of fathers with substance use disorders. Addictive Behaviors. 1998; 23:561–566. [PubMed: 9698986]

Clark DB, Kirisci L, Tarter RE. Adolescent versus adult onset and the development of substance use disorders in males. Drug and Alcohol Dependence. 1998; 49:115–121. [PubMed: 9543648]

Cleveland MJ, Feinberg ME, Bontempo DE, Greenberg MT. The role of risk and protective factors in substance use across adolescence. Journal of Adolescent Health. 2008; 43:157–164. [PubMed: 18639789]

Cranford JA, Eisenberg D, Serras AM. Substance use behaviors, mental health problems, and use of mental health services in a probability sample of college students. Addictive Behaviors. 2009; 34:134–145. [PubMed: 18851897]

Crawford LA, Novak KB. Parent–child relations and peer associations as mediators of the family structure–substance use relationship. Journal of Family Issues. 2008; 29:155–184.

Dewit DJ, Adlaf EM, Offord DR, Ogborne AC. Age at first alcohol use: A risk factor for the development of alcohol disorders. American Journal of Psychiatry. 2000; 157:745–750. [PubMed: 10784467]

Diego MA, Field TM, Sanders CE. Academic performance, popularity, and depression predict adolescent substance use. Adolescence. 2003; 38:35–42. [PubMed: 12803452]

Dishion, TJ.; Bullock, BM.; Kiesner, J. Vicissitudes of parenting adolescents: Daily variations in parental monitoring and the early emergence of drug use. In: Kerr, M.; Stattin, H.; Engels, RCME., editors. What can parents do? New insights into the role of parents in adolescent problem behavior. Chichester, England: Wiley; 2008. p. 113-133.

Dishion TJ, Capaldi D, Spracklen KM, Li F. Peer ecology of male adolescent drug use. Development and Psychopathology. 1995; 7:803–824.

Dishion TJ, McMahon RJ. Parental monitoring and the prevention of child and adolescent problem behavior: A conceptual and empirical formulation. Clinical Child and Family Psychology Review. 1998; 1:61–75. [PubMed: 11324078]

Dishion TJ, Nelson SE, Bullock BM. Premature adolescent autonomy: Parent disengagement and deviant peer process in the amplification of problem behavior. Journal of Adolescence. 2004; 27:515–530. [PubMed: 15475044]

Dishion TJ, Nelson SE, Kavanagh K. The Family Check-Up with high-risk young adolescents: Preventing early-onset substance use by parent monitoring. Behavior Therapy. 2003; 34:553–571.

Dishion TJ, Owen LD. A longitudinal analysis of friendships and substance use: Bidirectional influence from adolescence to adulthood. Developmental Psychology. 2002; 38:480–491. [PubMed: 12090479]

Dishion, TJ.; Patterson, GR. The development and ecology of antisocial behavior in children and adolescents. In: Cicchetti, D.; Cohen, DJ., editors. Developmental psychopathology: Vol. 3. Risk, disorder, and adaptation. New York, NY: Wiley; 2006. p. 503-541.

Dishion, TJ.; Poulin, F.; Medici Skaggs, N. The ecology of premature autonomy in adolescence: Biological and social influences. In: Kerns, KA.; Contreras, JM.; Neal-Barnett, AM., editors. Family and peers: Linking two social worlds. Westport, CT: Praeger; 2000. p. 27-45.

Dishion, TJ.; Stormshak, EA. Intervening in children's lives: An ecological, family-centered approach to mental health care. Washington, DC: American Psychological Association; 2007.

Dishion TJ, Tipsord JM. Peer contagion in child and adolescent social and emotional development. Annual Review of Psychology. 2010; 62:189–214.

Dodge KA, Malone PS, Lansford JE, Miller S, Pettit GS, Bates JE. A dynamic cascade model of the development of substance use onset. Monographs of the Society for Research in Child Development. 2009; 74 vii-119.

Dusenbury L. Family-based drug abuse prevention programs: A review. Journal of Primary Prevention. 2000; 20:337–352.

Eccles, JS.; Lord, S.; Roeser, RW.; Barber, B.; Josefowicz-Hernandez, D. The association of school transitions in early adolescence with developmental trajectories through high school. In: Schulenberg, J.; Maggs, J.; Hurrelmann, K., editors. Health risks and developmental transitions during adolescence. New York: Cambridge University Press; 1997. p. 283-320.

Ennett ST, Bauman KE, Hussong A, Faris R, Foshee VA, Cai L. The peer context of adolescent substance use: Findings from social network analysis. Journal of Research on Adolescence. 2006; 16:159–186.

Farrington DP. The development of offending and antisocial behavior from childhood: Key findings from the Cambridge study in delinquent development. Journal of Child Psychology and Psychiatry. 1995; 36:929–964. [PubMed: 7593403]

Fergusson DM, Horwood LJ. Prospective childhood predictors of deviant peer affiliations in adolescence. Journal of Child Psychology and Psychiatry. 1999; 40:581–592. [PubMed: 10357164]

Flannery DJ, Williams LL, Vazsonyi AT. Who are they with and what are they doing? Delinquent behavior, substance use, and early adolescents' after-school time. American Journal of Orthopsychiatry. 1999; 69:247–253. [PubMed: 10234390]

Fosco, GM.; Frank, JL.; Dishion, TJ. Understanding the influences of deviant peers on problem behavior: Coercion and contagion in peer, family, and school environments. In: Jimerson, SR.; Nickerson, AB.; Mayer, MJ.; Furlong, MJ., editors. The handbook of school violence and school safety: International research and practice. New York, NY: Routledge; 2012. p. 69-80.

Fosco GM, Stormshak EA, Dishion TJ, Winter C. Family relationships and parental monitoring during middle school as predictors of early adolescent problem behavior. Journal of Clinical Child and Adolescent Psychology. (in press).

Fraley RC, Davis KE. Attachment formation and transfer in young adults' close friendships and romantic relationships. Personal Relationships. 1997; 4:131–144.

Grant JD, Scherrer JF, Lynskey MT, Lyons MJ, Eisen SA, Tsuang MT, Bucholz KK. Adolescent alcohol use is a risk factor for adult alcohol and drug dependence: Evidence from a twin design. Psychological Medicine. 2006; 36:109–118. [PubMed: 16194286]

Guo J, Hill KG, Hawkins JD, Catalano RF, Abbott RD. A developmental analysis of sociodemographic, family, and peer effects on adolescent illicit drug initiation. Journal of the American Academy of Child & Adolescent Psychiatry. 2002; 41:838–845. [PubMed: 12108809]

Herman MR, Dornbusch SM, Herron MC, Herting JR. The influence of family regulation, connection, and psychological autonomy on six measures of adolescent functioning. Journal of Adolescent Research. 1997; 12:34–67.

Hill NE, Bromell L, Tyson DF, Flint R. Developmental commentary: Ecological perspectives on parental influences during adolescence. Journal of Clinical Child and Adolescent Psychology. 2007; 36:367–377. [PubMed: 17658981]

Isakson K, Jarvis P. The adjustment of adolescents during the transition into high school: A short-term longitudinal study. Journal of Youth and Adolescence. 1999; 28:1–16.

Jackson KM, Sher KJ, Cooper ML, Wood PK. Adolescent alcohol and tobacco use: Onset, persistence and trajectories of use across two samples. Addiction. 2002; 97:517–531. [PubMed: 12033653]

Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future national results on adolescent drug use: Overview of key findings 2009. Bethesda, MD: National Institute on Drug Abuse; 2010. (NIH Publication No. 10–7583).

Kandel DB. The parental and peer contexts of adolescent deviance: an algebra of interpersonal influences. Journal of Drug Issues. 1996; 26:289–315.

Kandel DB, Davies M, Karus D, Yamaguchi K. The consequences in young adulthood of adolescent drug involvement. Archives of General Psychiatry. 1986; 43:746–754. [PubMed: 3729669]

Kelly AB, Chan GCK, Toumbourou JW, O'Flaherty M, Homel R, Patton GC, Williams J. Very young adolescents and alcohol: Evidence of a unique susceptibility to peer alcohol use. Addictive Behaviors. 2012; 37:414–419. [PubMed: 22217919]

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

Kelly AB, Toumbourou JW, O'Flaherty M, Patton GC, Homel R, Connor JP, Williams J. Family relationship quality and early alcohol use: Evidence for gender-specific risk processes. Journal of Studies on Alcohol and Drugs. 2011; 72:399–407. [PubMed: 21513676]

Kumpfer KL, Alvarado R. Family strengthening approaches for the prevention of youth problem behaviors. American Psychologist. 2003; 58:457–465. [PubMed: 12971192]

Laird RD, Criss MM, Pettit GS, Dodge KA, Bates JE. Parents' monitoring knowledge attenuates the link between antisocial friends and adolescent delinquent behavior. Journal of Abnormal Child Psychology. 2008; 36:299–310. [PubMed: 17874291]

Larson R, Richards M, Moneta G, Holmbeck G, Duckett E. Changes in adolescents' daily interactions with their families from ages 10–18: Disengagement and transformation. Developmental Psychology. 1996; 32:744–754.

Lennings CJ, Copeland J, Howard J. Substance use patterns of young offenders and violent crime. Aggressive Behavior. 2003; 29:414–422.

Loeber R, Drinkwater M, Yin Y, Anderson SJ, Schmidt LC, Crawford A. Stability of family interactions from ages 6 to 18. Journal of Abnormal Child Psychology. 2000; 28:353–369. [PubMed: 10949960]

Luk JW, Farhat T, Iannotti RJ, Simons-Morton BG. Parent–child communication and substance use among adolescents: Do father and mother communication play a different role for sons and daughters? Addictive Behaviors. 2010; 35:426–431. [PubMed: 20060651]

Luthar SS, D'Avanzo K. Contextual factors in substance use: A study of suburban and inner-city adolescents. Development and Psychopathology. 1999; 11:845–867. [PubMed: 10624729]

Lynsky MT, Heath AC, Bucholz KK, Slutske WS, Madden PAF, Nelson EC, Martin NG. Escalation of drug use in early-onset cannabis users vs. co-twin controls. Journal of the American Medical Association. 2003; 289:427–433. [PubMed: 12533121]

McArdle P, Wiegersma A, Gilvarry E, Kolte B, McCarthy S, Fitzgerald M, Brinkley A, Blom M, Stoeckel I, Pierolini A, Michels I, Johnson R, Quenselet S. European adolescent substance use: the roles of family structure, function and gender. Addiction. 2002; 97:329–336. [PubMed: 11964109]

Monahan KC, Steinberg L, Cauffman E. Affiliation with antisocial peers, susceptibility to peer influence, and antisocial behavior during the transition to adulthood. Developmental Psychology. 2009; 45:1520–1530. [PubMed: 19899911]

Muthén, LK.; Muthén, BO. Mplus user's guide. 6th ed.. Los Angeles, CA: Muthén & Muthén; 2008.

Nash SG, McQueen A, Bray JH. Pathways to adolescent alcohol use: Family environment, peer influence, and parental expectations. Journal of Adolescent Health. 2005; 37:19–28. [PubMed: 15963903]

Newcomb, MD.; Bentler, PM. Consequences of adolescent drug use: Impact on the lives of young adults. Newbury Park, CA: Sage; 1988.

Patterson GR, Dishion TJ, Yoerger K. Adolescent growth in new forms of problem behavior: Macro- and micro-peer dynamics. Prevention Science. 2000; 1:3–13. [PubMed: 11507792]

Patton GC, Coffey C, Carlin JB, Sawyer SM, Lynskey M. Reverse gateways? Frequent cannabis use as a predictor of tobacco initiation and nicotine dependence. Addiction. 2005; 100:1518–1525. [PubMed: 16185213]

Roeser RW, Eccles JS, Freedman-Doan C. Academic functioning and mental health in adolescence: Patterns, progressions, and routes from childhood. Journal of Adolescent Research. 1999; 14:135–174.

Rosay AB, Gottfredson DB, Armstrong TA, Harmon MA. Invariance of measures of prevention program effectiveness: A replication. Journal of Quantitative Criminology. 2000; 16:341–367.

Soyka M. Substance misuse, psychiatric disorder and violent and disturbed behavior. The British Journal of Psychiatry. 2000; 176:345–350. [PubMed: 10827882]

Spear L. The adolescent brain and age-related behavioral manifestations. Neuroscience & Biobehavioral Review. 2000; 24:417–463.

Spoth RL, Redmond C, Shin C. Randomized trial of brief family interventions for general populations: Adolescent substance use outcomes 4 years following baseline. Journal of Consulting and Clinical Psychology. 2001; 69:627–642. [PubMed: 11550729]

Stattin H, Kerr M. Parental monitoring: A reinterpretation. Child Development. 2000; 71:1072–1085. [PubMed: 11016567]

Steinberg L, Monahan KC. Age differences in resistance to peer influence. Developmental Psychology. 2007; 43:1531–1543. [PubMed: 18020830]

Svensson R. Risk factors for different dimensions of adolescent drug use. Journal of Child and Adolescent Substance Abuse. 2000; 9:67–90.

Tapert SF, Aarons GA, Sedlar GR, Brown SA. Adolescent substance use and sexual risk-taking behavior. Journal of Adolescent Health. 2001; 28:181–189. [PubMed: 11226840]

Vega WA, Gill AG. Revisiting drug progression: Long-range effects of early tobacco use. Addiction. 2005; 100:1358–1369. [PubMed: 16128725]

Highlights

- We tested effects of families and peers on substance use from age 12 to 23.

- Outcomes for tobacco, alcohol, and marijuana use were analyzed simultaneously.

- Parental monitoring and deviant peer association were predictive in early adolescence.

- Family relationship quality and deviant peers were predictive in late adolescence.

- Monitoring and family relationships indirectly predicted substance use via peers.
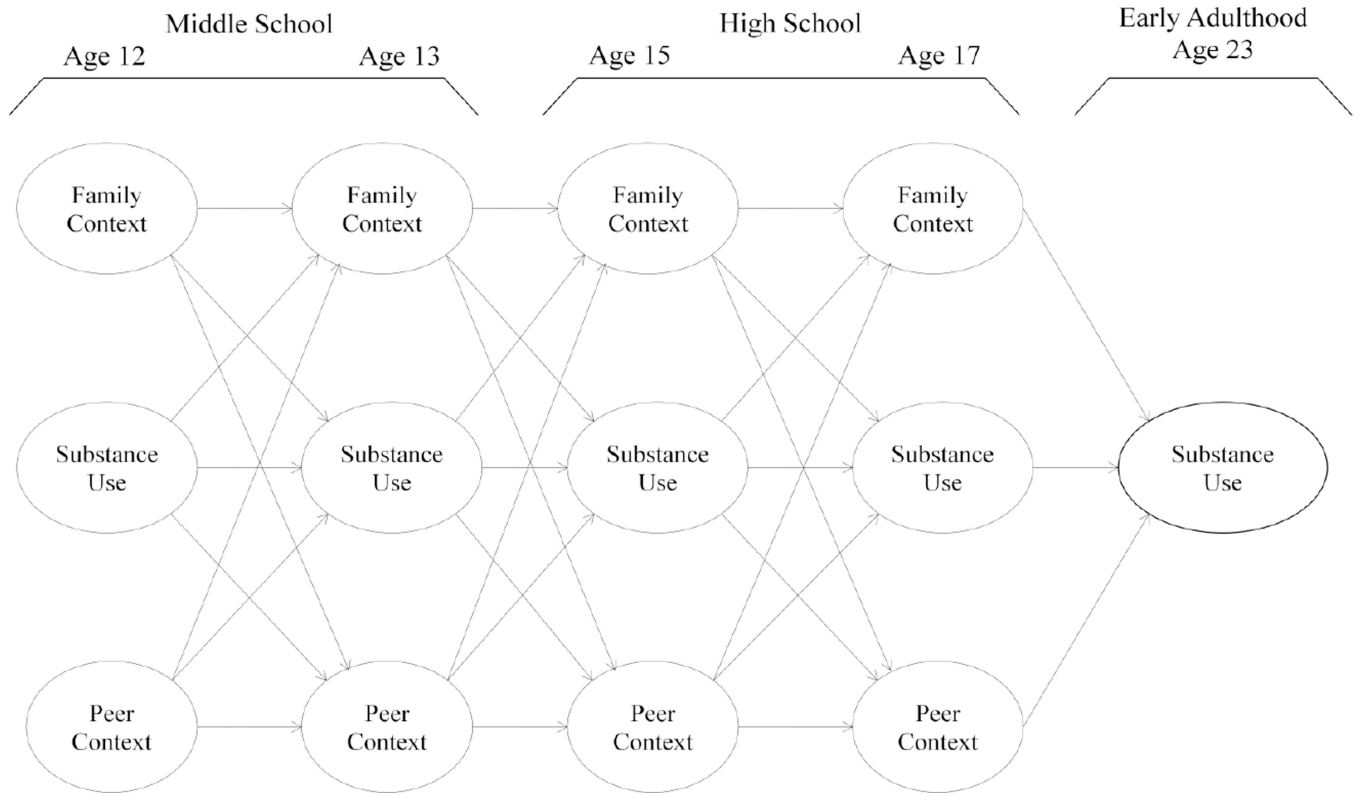
Figure 1.
Hypothesized model. Separate pathways of tobacco, alcohol, and marijuana use considered simultaneously (not pictured). Unique influences of parental monitoring and family relationship quality considered simultaneously (not pictured). Intervention condition, socioeconomic status (SES), and grade-point average (GPA) controlled throughout the model (not pictured). All measures allowed to correlate within each time point (not pictured; see Table 2).
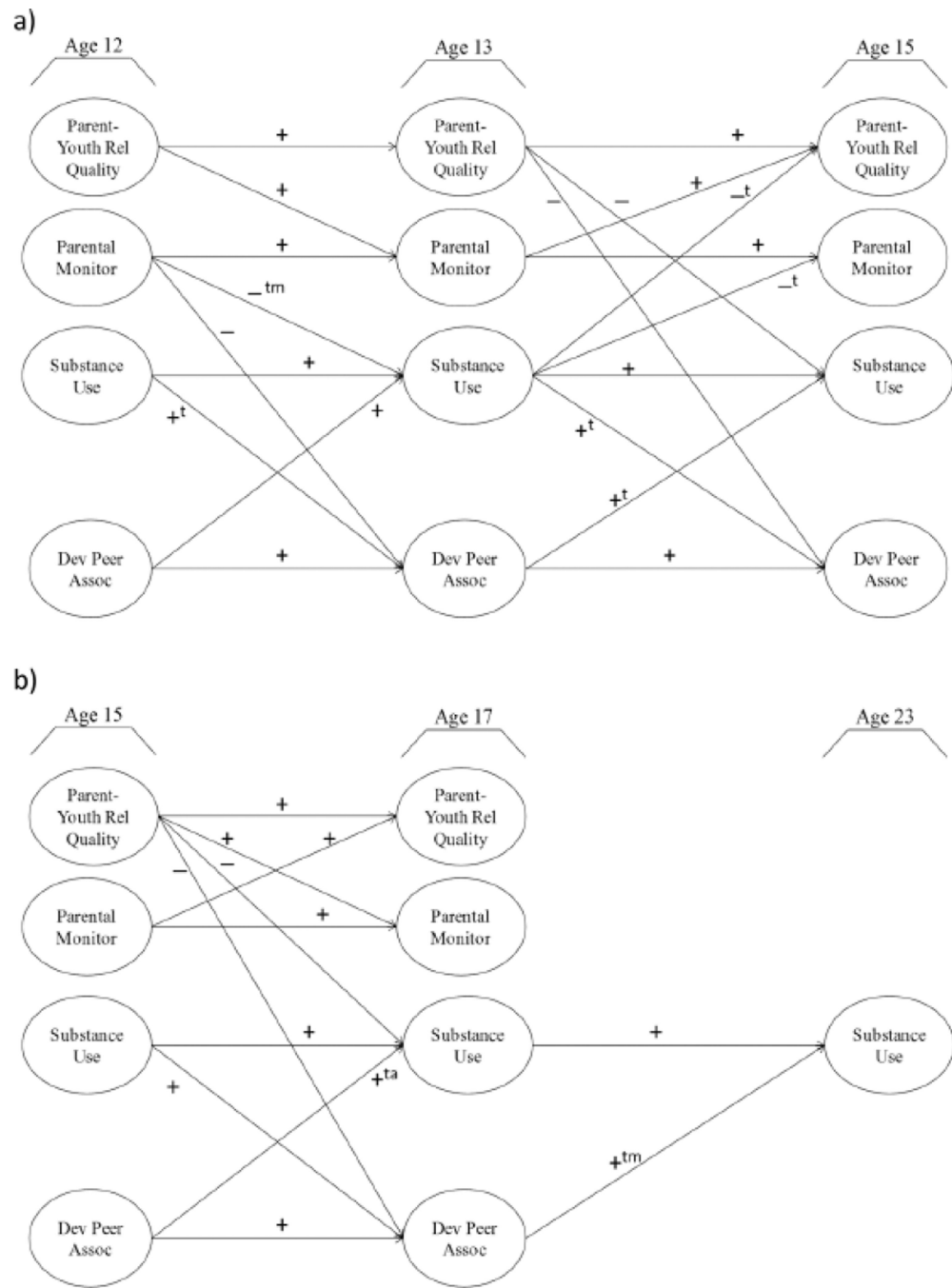
Figure 2.
Fitted model with significant paths. Signs indicate direction of paths. Superscripts indicates that path limited to tobacco (t), alcohol (a), or marijuana (m) use.

Table 1

Sample Descriptives

Variable	N	M/Med	SD/% users
Parental monitoring (age 12)	989	4.00	.96
Family relationship quality (age 12)	989	3.58	1.02
Deviant peers (age 12)	991	.75	1.11
Parental monitoring (age 13)	856	3.97	.92
Family relationship quality (age 13)	855	3.45	.99
Deviant peers (age 13)	855	.84	1.22
Parental monitoring (age 15)	820	3.93	.93
Family relationship quality (age 15)	819	3.27	.99
Deviant peers (age 15)	820	.85	1.18
Parental monitoring (age 17)	791	2.71	1.00
Family relationship quality (age 17)	792	2.46	.92
Deviant peers (age 17)	791	.79	.91
Tobacco use (age 12)	991	.00	11.5
Alcohol use (age 12)	991	.00	18.7
Marijuana use (age 12)	991	.00	6.1
Tobacco use (age 13)	857	.00	12.7
Alcohol use (age 13)	857	.00	20.7
Marijuana use (age 13)	857	.00	9.1
Tobacco use (age 15)	818	.00	13.9
Alcohol use (age 15)	818	.00	19.3
Marijuana use (age 15)	819	.00	14.2
Tobacco use (age 17)	793	.00	22.3
Alcohol use (age 17)	793	.00	39.8
Marijuana use (age 17)	793	.00	25.6
Tobacco use (age 23)	831	1.00	41.4
Alcohol use (age 23)	829	4.00	82.6
Marijuana use (age 23)	838	1.00	31.9

Note. Mean (*M*) presented for parenting and peer variables; median (*Med*) presented for substance use. Standard deviation (*SD*) presented for parenting and peer variables; percent of users presented for substance use.

Table 2

Correlations by wave of measurement (all significant, p < .05)

	Age 12	Age 13	Age 15	Age 17	Age 23
Among measures of substance use	.33 to .39	.35 to .46	.47 to .49	.34 to .53	.20 to .35
Between measures of parenting	.45	.41	.45	.53	n/a
Between substance use and parenting	−.17 to −.28	−.14 to −.26	−.20 to −.30	−.08 to −.20	n/a
Between substance use and deviant peer association	.27 to .33	.24 to .36	.24 to .32	.43 to .46	n/a
Between parenting and deviant peer association	−.20 to −.31	−.20 to −.32	−.27 to −.34	−.22 to −.23	n/a

Table 3

Predictors of Substance Use (exponentiated betas)

	Age 13			Age 15			Age 17			Age 23		
	Tobacco	Alcohol	Marijuana	Tobacco	Alcohol	Marijuana	Tobacco	Alcohol	Marijuana	Tobacco	Alcohol	Marijuana
Prior wave contextual vars												
Parental monitoring	.75*	.94	.70*	.87	.94	.83	1.06	.84	.86	1.09	1.81	1.14
Family relationship quality	.87	.84	1.06	.71*	.66**	.73*	.71*	.79*	.80*	.98	.89	.92
Deviant peer association	1.19*	1.18*	1.19†	1.19*	.94	1.09	1.19*	1.20*	.97	1.36**	1.10	1.32***
Prior wave substance use												
Tobacco	1.10*	1.08	1.11*	7.16***	2.81***	2.92***	7.48***	1.37	1.57*	4.60***	.77	.92
Alcohol	1.01	1.20**	.92	.73	1.74**	1.10	1.33	2.87***	1.92***	1.10	2.24***	1.49*
Marijuana	1.10	.93	1.19†	1.45	1.62	4.04***	.94	1.35	2.13***	1.41	1.61	3.05***

† p .07;

* $p < .05$;

** $p < .01$;

*** $p < .001$.

Table 4

Predictors of Contextual Variables (unstandardized betas with standard errors)

	Age 13			Age 15			Age 17		
	Parental monitoring	Family relationship quality	Deviant peer association	Parental monitoring	Family relationship quality	Deviant peer association	Parental monitoring	Family relationship quality	Deviant peer association
Prior wave substance use									
Tobacco	.01 (.02)	.00 (.02)	.05 * (.02)	−.22 * (.11)	−.27 * (.12)	.29 * (.15)	−.09 (.11)	.13 (.10)	.39 *** (.11)
Alcohol	−.03 (.02)	−.03 (.02)	−.02 (.03)	−.02 (.09)	.01 (.09)	.20 † (.11)	.13 (.10)	.01 (.09)	.17 (.10)
Marijuana	.00 (.03)	.05 (.03)	.04 (.04)	.02 (.13)	.02 (.13)	.22 (.20)	.06 (.11)	.12 (.10)	.40 *** (.11)
Prior wave contextual vars									
Parental monitoring	.40 *** (.03)	−.01 (.04)	−.14 ** (.05)	.37 *** (.04)	.09 * (.04)	−.11 * (.05)	.42 *** (.04)	.08 * (.04)	−.01 (.04)
Family relationship quality	.11 ** (.03)	.46 *** (.03)	−.02 (.04)	.04 (.03)	.40 *** (.04)	−.02 (.05)	.15 *** (.04)	.47 *** (.03)	−.08 * (.04)
Deviant peer association	−.03 (.03)	.00 (.03)	.34 *** (.04)	−.04 (.03)	.02 (.03)	.22 *** (.04)	.02 (.03)	.02 (.03)	.17 *** (.03)

†
p .07;

*
$p < .05$;

**
$p < .01$;

***
$p < .001$.