

# Social Influences on Adolescent Substance Use

Bruce Simons-Morton, EdD, FAAHB

---

**Objectives:** To assess the over-time relationships between adolescent and peer substance use and parenting practices. **Methods:** Five times from sixth to ninth grade, students (n=2453) in 7 middle schools reported smoking, drinking, and marijuana use; the number of substance-using friends; and parent practices. Relationships were assessed using latent growth curve modeling. **Results:** Adolescent substance use predicted the growth in substance-using friends, and substance-using friends predicted adolescent use, except for

smoking. The negative over-time relationship between parenting practices and adolescent substance use was mediated by the growth in the number of substance-using friends. **Conclusions:** The results are consistent with both selection and socialization effects and provide evidence of the protective effects of positive parenting practices.

**Key words:** latent growth curve modeling; mediation; peer influence; parenting; selection; socialization

*Am J Health Behav.* 2007;31(6):672-684

---

The influence of peers and parents on adolescent substance use has been the subject of numerous studies. The positive relationship between adolescent and peer substance use has been well established for smoking,<sup>1,2</sup> drinking,<sup>3-5</sup> and measures combining multiple substances.<sup>6,7</sup> However, the relative contributions of selection and socialization to adolescent substance use have not been firmly established.<sup>8,9</sup> Surprisingly, the expected relationships between positive parenting practices and the growth

in substance use have been difficult to document.

Adolescent and peer substance use increases from sixth grade at least through high school. Adolescent substance use may coincide with peer substance use because associating with peers who use these substances increases their availability, makes their use seem normative, and reinforces their use.<sup>10-12</sup> However, shared behavior among close peers could be due to socialization (the effect on behavior of friends' attitudes and behavior commonly referred to as peer influence or peer pressure) or to selection (seeking out peers with similar behaviors).<sup>13</sup> Selection, therefore, occurs when adolescents develop or retain friends based on their similarity of beliefs, attitudes, and behavior, whereas socialization occurs when adolescents adjust their beliefs, attitudes, and behavior to conform to that of their friends. Socialization may be overt in the form of actual encouragement or discouragement to engage in a behavior, or subtle and indirect in the

---

Bruce Simons-Morton, Chief, Prevention Research Branch, Division of Statistics, Epidemiology, and Prevention Research, National Institute of Child Health and Human Development, Bethesda, MD.

Address correspondence to Dr Simons-Morton, Prevention Research Branch, Division of Statistics, Epidemiology, and Prevention Research, National Institute of Child Health and Human Development, 6100 Executive Blvd 7B13M, Bethesda, MD 20892-7510. E-mail: mortonb@mail.nih.gov

form of adolescent perceptions about group norms, expectations, social acceptance and status associated with the behavior. Selection and socialization can operate reciprocally, with adolescents selecting friends because of their beliefs and behavior and friends exerting influence on their behavior.<sup>12</sup> Although a great many cross-sectional and a growing number of prospective studies have reported positive associations between peer and adolescent substance use,<sup>14-16</sup> the relative contributions of socialization and selection to substance use progression have been evaluated in a limited number of studies, which have produced inconsistent findings.

Most of the longitudinal studies that have examined the effects of selection and socialization on substance use have addressed either smoking or alcohol use, but several have combined multiple substances into a single variable providing the clear advantage of allowing the formation of interval-level variables. Although the level of use of each substance varies among early adolescents, once initiated, they show similar rates of acquisition.<sup>15</sup> Wills and Cleary<sup>6</sup> assessed a multiethnic population of sixth to eighth graders and found in latent growth modeling analyses that adolescents' perceptions of peer use predicted the rate of change in adolescent substance use, but that initial substance use did not predict an increase in substance-using peers, providing evidence of socialization and not selection. Conversely, Iannotti et al,<sup>7</sup> employing structural equation analyses, found that substance use among fourth to ninth graders predicted their friends' use, indicating an effect of selection, but friends' reported use did not predict adolescents' own use, indicating no effect of socialization. Curran et al<sup>3</sup> and Bray et al<sup>5</sup> reported effects of both selection and socialization on drinking progression among early adolescents, whereas Li et al<sup>4</sup> found an effect of socialization, and Farrell and Danish<sup>17</sup> reported an effect of selection, but not of socialization. In a rare peer network analysis, Ennett and Bauman<sup>18</sup> found that selection and socialization accounted for about equal amounts of the variance in the increase in smoking among eighth graders. On balance, the literature to date does not appear to provide clear evidence about the relative contributions of socialization or selection.

Parenting influences on substance use are less well studied than peer influences. Most studies that have examined both peer and parent influences have found peer influences to be substantially more important.<sup>19</sup> However, a number of studies have found positive parenting behaviors to protect against adolescent substance use<sup>20,21</sup> and progression.<sup>22</sup> The relative importance of various parenting practices is unclear, but in various studies, communication, knowledge and involvement, support, monitoring, and expectations and norms<sup>21-24</sup> have been shown to be protective. Several studies have identified mediators of parenting influences on substance use, including outcome expectations,<sup>24</sup> and peer influence.<sup>25</sup> Cohen et al<sup>23</sup> reported mediation of the effect of positive parent-child relations on alcohol use through friend's drug use. However, Steinberg et al<sup>21</sup> reported no mediation by substance-using peers of the effect of parental monitoring on substance use among high school students. The negative finding by Steinberg et al<sup>21</sup> is particularly surprising because it would seem common for parents to monitor and influence both substance use and peer affiliation. It may be that the relative influence of parents on substance use and friendship development is greater among early than late adolescents.

This paper reports the findings from a series of analyses of data collected from sixth to ninth graders employing latent growth curve analyses to examine the nature of peer and parent influence on substance use progression. The purpose of this research is to examine associations of initial and continuing peer affiliation and parent influences with substance use progression. The following research questions are addressed: (1) Does socialization or selection explain the relationship between adolescent substance use and affiliation with using peers? (2) To what extent are initial and longitudinal measures of peer substance use and parenting behaviors associated with adolescent substance use progression? (3) Are the effects of parenting practices on substance use progression mediated by peer affiliation?

## METHOD

### Study Design

The 7 middle schools in one middle-income suburban Maryland school dis-

trict were recruited and randomized, 3 to the treatment and 4 to the comparison condition. Starting with the 1996 school year, 2 successive cohorts of sixth-grade students were recruited and followed through ninth grade. Students were surveyed at the beginning and end of the sixth, seventh, and eighth grades, and beginning of ninth grade. Students in the treatment schools were exposed to the Going Places Program, consisting of parent education in the form of materials sent home; school media; and a social skills curriculum designed to increase school engagement and prevent multiple problem behaviors, including substance use, and aggression and other antisocial behavior. The curriculum consisted of 18 class sessions in the sixth grade, 10 in the seventh grade, and 6 in the eighth grade. Analyses of treatment group effects showed significant differences, with those exposed to the Going Places Program reporting lower smoking stage, fewer friends who smoked, and lower outcome expectations for smoking.<sup>26</sup> No effects were found for alcohol or other targeted outcomes.

### Participants

The population of interest included 2969 students (72% white, 18% black, and 10% other) eligible to participate in the Time 1 assessment. Of the eligible students parents of 2651 (87.8%) provided consent while students were in the sixth grade. Of these, 9 became ineligible during the study by failing a grade and 110 were newly classified as special education, leaving a sample of 2532, 79 of whom moved out of the school district or missed multiple assessments, leaving a final sample of 2453. Compared with the final sample, study participants lost to follow-up were significantly more likely to be black, live with only one parent, and report drinking.

### Procedures

Questionnaires were administered in classes by trained proctors. As required by the school district, teachers remained to manage the classroom, but were instructed not to circulate around the room or otherwise be involved in the conduct of the survey. To protect confidentiality, students completed and turned in a cover page that included name, survey identification number, birth date, and homeroom teacher's name; this page was kept sepa-

rate from the questionnaires. The actual questionnaires had only a numerical identifier matching the one on the cover page. The study protocol was approved by the Institutional Review Board of the National Institute of Child Health and Human Development.

### Measures

The questionnaire included items on background factors, substance use, and social influences. The development of the measures has been described elsewhere.<sup>27</sup>

**Background variables.** Questionnaire items assessed demographic and contextual factors, including gender and race. Our measure of socioeconomic status was student eligibility for the free or reduced price school lunch program,<sup>28</sup> which, in our sample was significantly associated with being in a single parent family and having less-educated mothers.

**Smoking.** Questions about smoking included the following: "How many times have you smoked a cigarette, even a puff in last 30 days" and "in the last 12 months" (0, 1-2, 3-9, 10-19, 20 or more); and "How often do you think you will smoke cigarettes while in high school?" (never, once or twice, or 3 or more times). Smoking stage was defined as follows: (1) never = no smoking in the past 30 days or past 12 months and no intention of smoking in high school; (2) intent = no smoking in the past 30 days or past 12 months, but intent to smoke in high school; (3) 12-month smoker = smoking in the past 12 months but not in the past 30 days; (4) recent smoker = smoking 1-2 times in the past 30 days; and (5) frequent smoker = smoking 3 or more times in the past 30 days. Self-reports of smoking have been found to produce reliable and valid estimates of substance use when procedures to ensure confidentiality are employed, as in this study, but self-report without verification can result in invalid reporting.<sup>30</sup>

**Drinking.** Questions about drinking included the following: "How many times have you drunk alcohol, even one sip in last 30 days," and "in the last 12 months" (0, 1-2, 3-9, 10-19, or 20 or more); and "How often do you think you will drink alcohol while in high school?" (never, once or twice, 3 or more times). Drinking stage was defined as follows: (1) never = no drinking in the past 30 days or past 12 months and no intention of drinking in

high school; (2) intent = no drinking in the past 30 days or past 12 months, but intent to drink in high school; (3) 12-month drinker = drinking in the past 12 months but not in the past 30 days; (4) recent drinker = drinking 1-2 times in the past 30 days; and (5) frequent drinker = drinking 3+ times in the past 30 days.

**Substance use.** Substance use was assessed with questions for smoking and drinking that asked how many times in the past 12 months and in the past 30 days participants had smoked a cigarette and/or drunk alcohol. Nonoverlapping categories of use were assigned to the adolescent's smoking and drinking in the past 30 days, with a range for each substance of 0 to 4, as follows: 0 = no use; 1 = 1-2 times; 2 = 3-9 times; 3 = 10-19; and 4 = 20 times or more. The combined substance use score was the sum of use categories for smoking and drinking with a range from 0 to 8 that was analyzed as a continuous variable.<sup>29</sup>

**Substance-using friends.** Perceptions about friends' substance use were assessed by asking, "How many of your 5 closest friends smoke?" and "How many of your 5 closest friends drink?" For smoking and drinking, the scores ranged from 0 to 5, and for substance use the scores were added for a range of 0 to 10. We assumed that friendships were likely to be dynamic during the period of assessment from sixth to ninth grades, and assessing the behavior of multiple friends has been shown to improve the variance in behavior explained.<sup>31</sup>

**Parenting practices.** Three youth-reported measures of perceived parental involvement, expectations, and monitoring were developed for the study.<sup>27</sup> Parental knowledge and involvement included 6 items that focused on how much the parent knows (knows almost nothing, knows a little, or knows a lot) about the adolescent's friends, activities, interests, health habits, free time, and school (Time 1-5 coefficient alphas = .76-.81). Parental expectations included 6 items that asked how upset (not at all, a little, somewhat, or extremely) the parent or guardian would be if he or she found out that the teen "...smoked cigarettes, drank alcohol, were sent to the office for misbehavior, did poorly on a test, were disrespectful to at teacher, or got into a physical fight at school" (Time 1-5 coefficient alphas = .77-.80). Parental monitoring was assessed

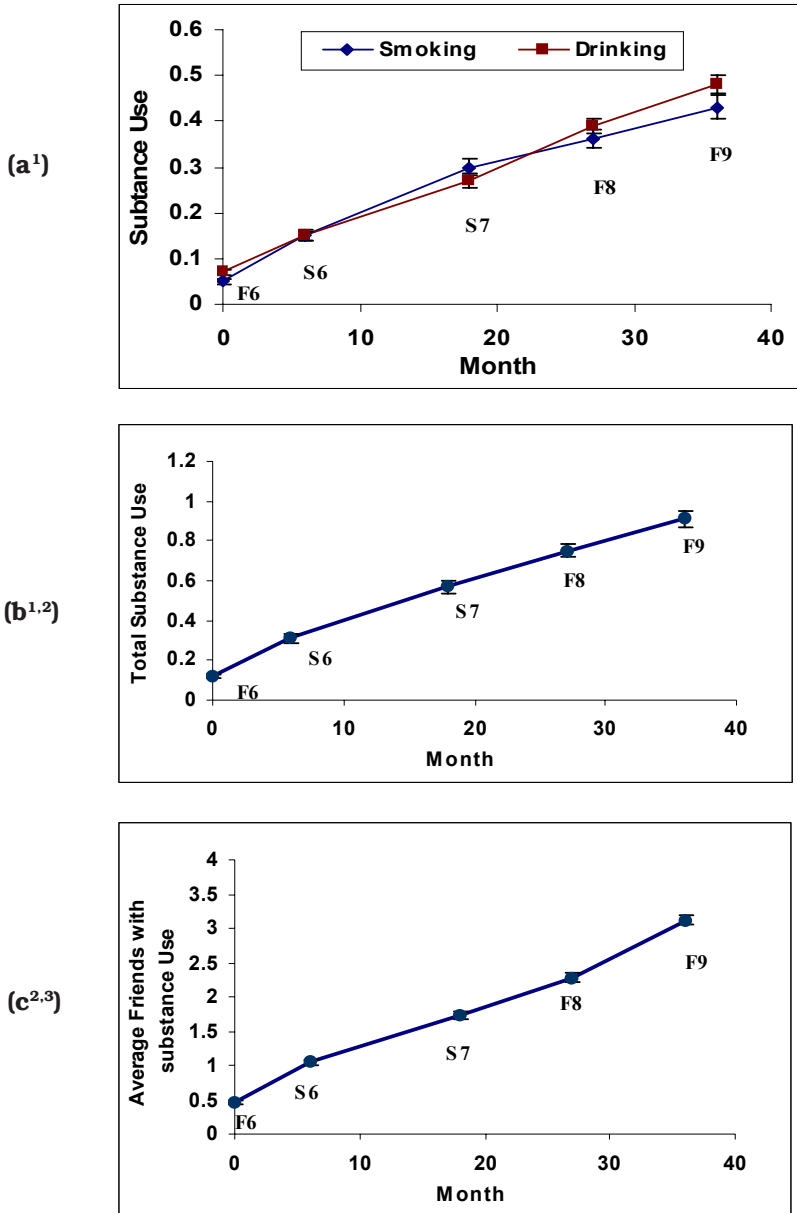
with 4 items asking if teens strongly agree, disagree, agree, or strongly disagree that they have a parent or guardian who "... would find out if I misbehaved at school; checks up to see if I have done what they told me; expects me to work hard at school; and believes in having rules and sticking to them" (Time 1-5 coefficient alphas = .67-.71).

## METHODS

Latent growth curve (LGC) analysis<sup>32</sup> was used to assess the interrelations between adolescent progression in substance use, changes in the number of friends who smoke, and parenting behaviors over time. The LGC approach takes advantages of structural equation modeling, allowing incorporation of latent variables, and hierarchical linear modeling,<sup>33</sup> allowing random coefficients across individual developmental trajectories. Time-invariant and time-varying covariates can be included in LGC analysis to estimate the effects of these covariates on the developmental trajectories. A key advantage of this approach is that it enables the analyses in parallel process models of the associations between the concurrent changes over time in the independent and dependent variables of interest.

Mplus software<sup>34</sup> was used to estimate the LGC models. Mplus allows for analyses of ordinal categorical outcome measures (smoking and drinking) by employing a robust weighted least squares estimator for adjusting standard errors. Smoking and drinking were treated as ordinal variables, whereas substance use was treated as a continuous variable. Unconditional LGC models (without covariates) were first estimated to determine the shape of the developmental trajectory of adolescent progression in substance use over time. In fitting the unconditional LGC models, a significant variance in intercept reveals substantial individual differences in substance-use status at baseline. A significant variation in latent growth factors (such as the slope in a linear model) indicates individual differences in the probability of progressing in substance use over time. Unconditional LGC models were estimated separately for peer affiliation and each parenting practice to determine the shape of the developmental trajectories for these variables, and significant individual differences in the change over time were found

**Figure 1**  
**Line Graphs of Adolescent Smoking and Drinking Use**



Note.

(a) total substance use (b) and number of friends with substance use (c) from sixth grade fall to ninth grade fall (N = 2,453)

1 Ordinal scale; 2 CFI  $\geq$  0.93, TLI  $\geq$  0.93, RMSEA  $\leq$  0.092; 3 Interval scale

for these variables as well. For each of these preliminary models the fit indices were acceptably good.

Conditional LGC models were used to evaluate the relationships of demographic variables, including gender, SES, and race, and the intervention effect as time-invariant covariates to individual differences in substance use at the initial measure and in progression over time. A significant path coefficient from a covariate leading to the latent intercept indicates that this covariate is associated with individual differences in substance use at the baseline. A significant covariate to the growth factors reveals an association between this covariate and individual differences in the probability of progressing in substance use over time.

The parallel process methodology recommended in Muthen and Curren<sup>35</sup> was used to evaluate the effects of the latent growth processes of peer affiliation and, separately, parenting practices on the latent growth process of substance use. The effects of 2 growth processes (peer and parent influences) on substance use were assessed using methodology described in Muthen and Muthen.<sup>34</sup> We followed the approach recommended by Cheong et al<sup>36</sup> for conducting mediation analysis in the framework of LGC. According to this approach, if a variable has a direct effect on the slope of outcome variable and also an indirect effect through a third variable, the third variable is a significant mediator. When the variables are slopes, the mediating effect was interpreted in a dynamic content. The overall fit indices for evaluating LGC models included comparative fit index (CFI) and the Tucker-Lewis Index (TLI), where a value of >0.9 is considered a good fit, and the root mean square error of approximation (RMSEA), for which a value of <.08 is considered a good fit.<sup>37</sup> ANOVA was used to compare the smoking, drinking, and combined substance use at baseline for the 7 schools. The effect of school was not significant and school was not controlled for in subsequent analyses.

## RESULTS

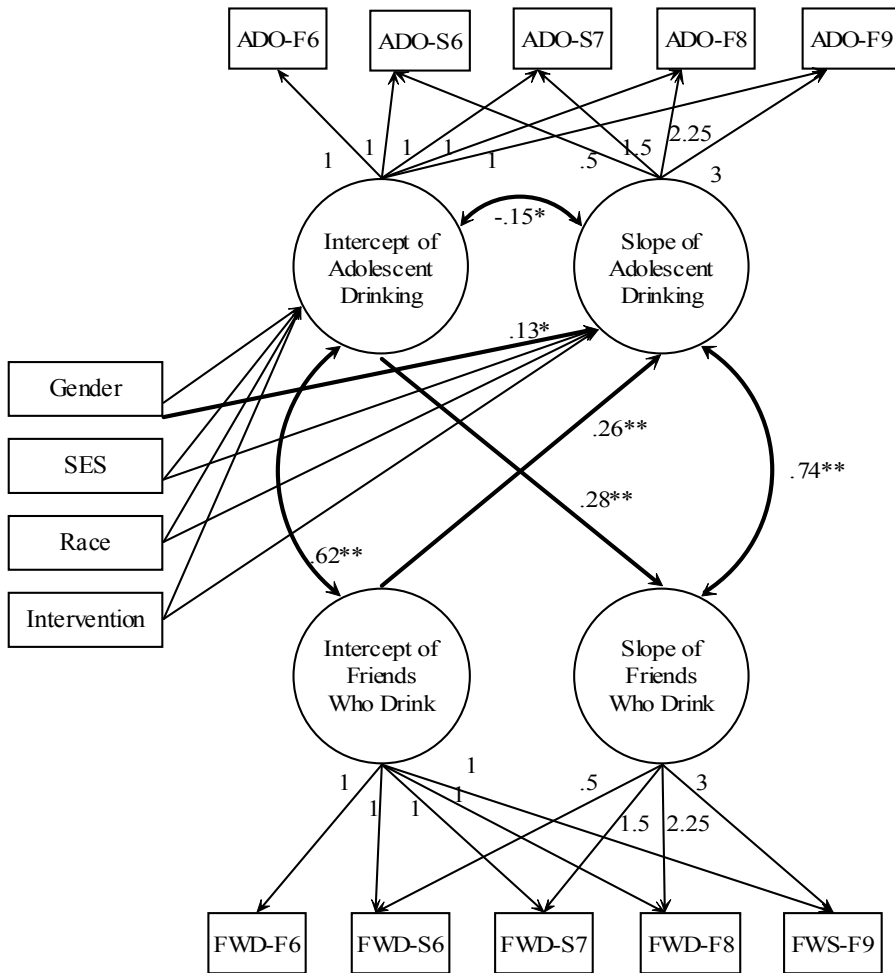
Figure 1 provides line graphs showing the increase in substance use and substance-using peers over time. Drinking and smoking stage, substance use, and the number of substance-using friends increased in linear fashion over time.

Figure 2 shows the parallel process model for adolescent and peer drinking progression, controlling for gender, socio-economic status, race, and treatment group assignment. (School added no variability with treatment group included and therefore was not included as a control variable in the model.) The path coefficient representing the cross-sectional relationships between the intercepts is 0.62 ( $P<.01$ ), indicating a strong positive association. Similarly, the path coefficient representing the relations of adolescent drinking stage over time and the number of substance-using peers over time is 0.74 ( $P<.01$ ), indicating a very strong association. The path coefficient representing the association between the intercept of adolescent drinking stage to the slope of drinking peers is 0.28 ( $P<.01$ ). Similarly, the path coefficient representing the path coefficient between the intercept of drinking peers and adolescent drinking stage is 0.26 ( $P<.01$ ).

Figure 3 presents the LGC model evaluating the mediation by friends who drink of the relationship between the slope of parent expectations and the slope of adolescent drinking stage. As indicated, both direct and indirect relationships are significant, with a path coefficient of -0.34 ( $P<.01$ ) between the slope of parent expectations and the slope of adolescent drinking stage, a path coefficient of -0.63 between the slope of parent expectations and the slope of friends who drink, and a path coefficient of 0.54 ( $P<.01$ ) between the slope of friends who drink and adolescent drinking stage. Although the indirect relationship was greater in magnitude than the direct relationship, the combined indirect and indirect relations were relatively strong.

Table 1 provides a summary of the results of separate LGC analyses of the relationships between adolescent drinking stage, smoking stage, and substance use, and the number of substance-using peers and parenting practices, including the mediation of the relationship between parenting practices over time and adolescent substance use progression mediation by the growth in the number of substance-using peers. The table presents the data shown in Figures 1 and 2 for drinking stage and similar data for smoking stage and data for substance use on the relationship between adolescent and peer substance use (no parent analyses

**Figure 2**  
**Latent Growth Curve Analyses of the Parallel Process Relationships of Adolescent Progression in Drinking Stage and Friends Who Drink From Sixth Grade to Ninth Grade**



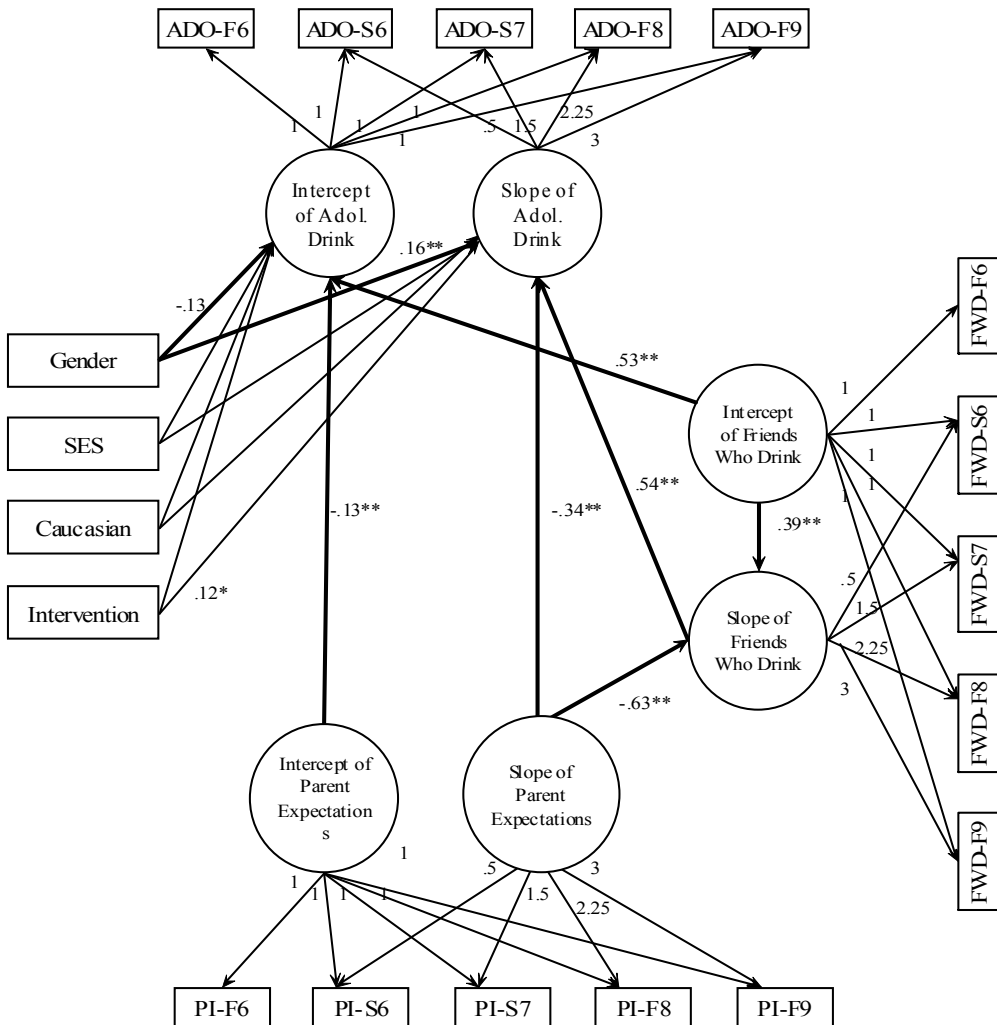
**Note.** CFI = 0.95, TLI = 0.96, RMSEA = 0.06; indicates P < 0.05, \*\* indicates P < 0.01; coefficients standardized; ADO: Adolescent; FWD: Friends Who Drink; Race: white = 1, others = 0

on substance use). Thus it is possible to compare the effects of social influences in this population across 3 categories of substance use.

In general, the cross-sectional and over-time relationships between adolescent and peer substance use were strongly positive

(path coefficients significant and >0.5 in all cases). The relationships between the intercepts of adolescent and peer use and between the slopes of adolescent and peer use were positive and significant; however, the relationships between the intercepts of peer use and the slope of adoles-

**Figure 3**  
**Latent Growth Curve Analyses of Friends Who Drink as a Mediator for the Effect of Parental Expectations on Adolescent Progression in Drinking Stage**



**Note.**  
 CFI = 0.93 TLI = 0.96 RMSEA = 0.06; coefficients standardized; FWD: Friends Who Drink; PI: Parent Involvement; ADO: Adolescents; FWD: Friends Who Drink Social Influences on Adolescent Substance Use

cent use were significant for drinking and substance use, but not for smoking.

The cross-sectional and over-time associations between adolescent substance use and parenting practices were nega-

tive and significant for all parenting practices. However, with the exception of parental expectations for drinking, parenting practices did not predict the growth in smoking or drinking. More-

**Table  
Summary of Relationships Between Adolescent Smoking Stage, Drinking Stage, and Substance Use Progression and Number of Substance-using Friends, and Parenting Practices<sup>a</sup>**

Adolescent Substance Use and Analytic Comparison	# Substance-using Friends	Parenting Practices		
		Knowledge	Expectations	Monitoring
<b>Drinking Stage</b>				
Cross-sectional	.62; P<.01	-.45; P<.01	-.58; P<.01	-.40; P<.01
Prospective (intercept to slope)				
- Peer to adolescent	.26 P<.01	N/A	N/A	N/A
- Adolescent to peer	.28; P<.01	N/A	N/A	N/A
- Parent to adolescent	N/A	-.04; ns	-.12; P<.5	-.07; ns
Over time (slope to slope)				
- Adolescent and peer	.74; P<.01	N/A	N/A	N/A
- Adolescent and parent	N/A	-.42; P<.01	-.58; P<.01	-.48; P<.01
Mediation of parent relation to adolescent use by SU peers		Yes	Yes	Yes
- Parent slope to adolescent slope	N/A	.11; P<.01	-.23; P<.01	-.13; P<.05
- Parent slope to peer slope	N/A	-.55; P<.01	-.65; P<.01	-.56; P<.01
- Peer slope to adolescent slope	N/A	.76; P<.01	.68; P<.01	.75; P<.01
<b>Smoking Stage</b>				
Cross-sectional	.60; P<.01	-.52; P<.01	-.51; P<.01	-.36; P<.01
Prospective (intercept to slope)				
- Peer to adolescent	-.003; ns	N/A	N/A	N/A
- Adolescent to peer	.31; p<.01	N/A	N/A	N/A
- Parent to adolescent	N/A	-.01 ns	.03; ns	-.06; ns
Over time (slope to slope)				
- Adolescent and peer	.74; P<.01	N/A	N/A	N/A
- Adolescent and parent	N/A	-.48; P<.01	-.48; P<.01	-.36; P<.01
Mediation of parent relation to adolescent use by SU peers		Yes	Yes	Yes
- Parent slope to adolescent slope	N/A	-.15; P<.01	-.15; P<.01	-.20; P<.05
- Parent slope to peer slope	N/A	-.46; P<.01	-.49; P<.01	-.48; P<.01
- Peer slope to adolescent slope	N/A	.64; P<.01	.61; P<.01	.67; P<.01
<b>Substance Use</b>				
Cross-sectional	.84 P<.01	-.52 P<.01	-.51 P<.01	-.36 P<.01
Prospective (intercept to slope)				
- Peer to adolescent	.38 P<.01	N/A	N/A	N/A
- Adolescent to peer	.35; P<.05	N/A	N/A	N/A
Over time (slope to slope)				
- Adolescent and peer	.50; P<.01	N/A	N/A	N/A

**Note.**

**a All values are path coefficients; each model adjusted for sex, SES, race, and treatment condition; model fit: CFI $\geq$  0.93; TLI $\geq$  0.95; RMSEA $\leq$  0.07**

over, the relationships between each parenting practice and the growth in adolescent smoking and drinking were mediated by the number of friends who

smoke or drink.

**DISCUSSION**

The assessment of substance use and

social influence variables 5 times during sixth to ninth grades provided an unusual opportunity to examine the dynamic over-time effects on adolescent substance use of parenting practices and peer substance use. Advances in latent growth modeling allowed examination of over-time relationships of the slopes of the variables in parallel process analyses. The results provide evidence for effects of both socialization and selection, suggesting reciprocal influences. The data provide little evidence of predictive effects, but strong evidence of protective effects of parenting practices maintained over time.

The central research question was to determine if the growth in adolescent substance use was due to socialization or selection or reciprocal influencers. The data are largely consistent with an effect of socialization processes and provide inconsistent support for an effect of selection. For each analysis, the relationship between the intercepts of adolescent and peer use was quite high, as were the relationships between the slopes, indicating high correspondence between adolescent use and substance-using peers. The key comparisons were between the intercepts and the slopes. In each analysis, the intercept of adolescent substance use was significantly associated with growth in substance-using friends as indicated by the slope, providing support for an effect of selection. For drinking and combined substance use, the intercept of friends' use was associated with growth in adolescent use over time, providing evidence of an effect of socialization. However, with smoking no effect of socialization was found.

Several other reports have examined peer influences on substance use using LGC or related longitudinal analyses. Notably, Wills and Cleary,<sup>6</sup> using LGC analyses, found an effect of socialization but not selection on substance use among Hispanic and white sixth and seventh graders assessed 3 times over 2 years. Conversely, Iannotti et al<sup>7</sup> assessed African American fourth and fifth graders annually over a 4-year period and in structural equation analyses found an effect on substance use of selection but not socialization. Bray et al<sup>5</sup> found effects in latent growth models of both selection and socialization on alcohol use among seventh to ninth graders. In previous analyses of the data in the current study for

drinking, using time-lagged auto-regressive analyses we found reciprocal effects of selection and socialization, with the effects of socialization somewhat greater than the effects of selection.<sup>38</sup>

Other studies have reported positive associations between progression in adolescent and peer substance use.<sup>12,13</sup> There is little question about adolescent homogeneity with respect to substance use. The question remains how adolescent and peer substance use interact; and a variety of theoretical explanations have been offered, including social cognitive, socialization, and social network theory.<sup>9</sup> It may be that friendships bring youth into contact with other youth who share their attitudes and behavior with respect to substance use, thereby exerting reinforcement for this behavior and becoming important aspects of the friendships. It may also be that adolescents who are interested in experimenting with drug use make friends with those who already use them or are interested in experimenting with their use. Our data indicated that in general the growth in friendships with substance-using peers increased the likelihood of growth in adolescent substance use, and growth in drinking and substance use increased the development over time of friends who also used these substances. It is interesting that an effect of selection and not of socialization was found for smoking uptake.<sup>39</sup>

A better understanding of the dynamic and reciprocal nature of peer influence is important because of the prominence of peer influence as a predictor of adolescent substance use and because useful interventions can be developed only with a clear understanding of the predictors of substance use. It seems clear that both socialization and selection play a role in the growth in adolescent substance use. However we still do not know if adolescents select substance-using friends because of their substance use or for other reasons associated with substance use patterns. Moreover, we do not know the extent to which substance-using peers pressure their friends to use and the extent to which their use mainly provides a normative influence. If selection and socialization processes interact to foster group homogeneity of substance use behavior, as our findings suggest, intervention programs must be developed that

extend beyond peer-pressure resistance training.<sup>40,41</sup> At present, the best intervention approaches may be those that seek to alter individual susceptibility to social influences and shape social norms about substance use. In one of the few effectiveness trials reported, a social norms approach was more effective than the peer-pressure resistance approach.<sup>42</sup> More creative and effective interventions can only be developed as our understanding of social influences on substance use improves.

Our study found that parenting practices were directly protective against growth in substance use. Our findings may be the first to show that the maintenance of positive parenting behavior over time, not initial parenting behavior, protects against substance use. Our use of LGC analyses allowed for the simultaneous examination of change in both parenting practices and drinking stage, thus enabling us to find that sustained but not initial parent involvement, monitoring, and expectations discouraged drinking progression. Other research has shown that each of the parenting practices studied can protect against the uptake of illicit substances throughout adolescence.<sup>20,21,24,43,44</sup> In general, the protective effects for each of the parent practices was similar, and it could not be determined which of these practices might be more important.

Our findings are among the first to identify an indirect protective effect of parenting behavior on substance use uptake through reduced increases in friends who drink. Our findings indicate a greater indirect than direct effect. Logically, parents are aware of the great influence close friends have on adolescent behavior and employ methods as possible to influence friendship formation and continuity. Our findings indicate that parents who are effective at this protect their children from premature growth in substance use. A few other studies have found similar effects. For example, Dielman et al<sup>26</sup> found an indirect effect on alcohol use of parental permissiveness on adolescent susceptibility to peer pressure, and Chassin et al<sup>45</sup> found that children of alcoholic parents with negative affect and impaired parental monitoring tended to associate with substance-using peers. However, Cohen et al<sup>23</sup> and Steinberg et al<sup>21</sup> found no effect of moni-

toring on the number of adolescents' substance-using close friends. Additional prospective research is needed to confirm the mediation of parental influences on substance use by friends who drink, to explore possible indirect effects of parenting behaviors on adolescent attitudes and expectations about substance use, and to determine the specific mechanism of parental influence. Because early adolescence is a period of rapid development that provides great parenting challenges, positive parenting practices sustained over this period may effectively influence adolescent behavior with respect to substance use.

The strengths of the study include a longitudinal design with 5 assessments over 4 years; latent growth curve analyses in which sex, race, and treatment condition were controlled. Generalization of our findings, however, is limited by reliance on self-report data; a study population drawn from a single suburban county, attrition of subjects who were more likely than those included in the analyses to have used substances and to be male, black, and eligible for free or reduced lunch. More needs to be learned about how social influences vary among subgroups of adolescents. Nevertheless, the findings provide new evidence of reciprocal effects of adolescent and peer substance use and the protective effects of positive parenting practices maintained over time.

### Acknowledgment

This research was support by the National Institute of Child Health and Human Development Contract N01-HD-4-3207. The author is indebted to Rusan Chen, PhD, for his contributions to the analyses. ■

### REFERENCES

1. Conrad KM, Flay BR, Hill D. Why children start smoking cigarettes: predictors of onset. *Br J Addict.* 1992;87:1711-1724.
2. Tyus SL, Pederson LL. Psychosocial factors related to adolescent smoking: a critical review of the literature. *Tob Control.* 1998;7:409-420.
3. Curran PJ, Stice E, Chassin L. The relation between adolescent alcohol use and peer alcohol use: a longitudinal random coefficients model. *J Consult Clin Psychol.* 1997;65(1):130-140.
4. Li F, Barrera MI Jr, Hops H, et al. The longitudinal influence of peers on the devel-

- opment of alcohol use in late adolescence: a growth mixture analysis. *J Behav Med.* 2002;25(3):293-315.
5. Bray JH, Adams GJ, Getz JG, et al. Individuation, peers, and adolescent alcohol use: a latent growth analysis. *J Consult Clin Psychol.* 2003;71(3):553-564.
  6. Wills TA, Cleary SD. Peer and adolescent substance use among 6th-ninth graders: latent growth analyses of influence versus selection mechanisms. *Health Psychol.* 1999;18(5):453-465.
  7. Iannotti RJ, Bush PJ, Weinfurt KP. Perception of friends' use of alcohol, cigarettes, and marijuana among urban school children: a longitudinal analysis. *Addict Behav.* 1996;21(5):615-632.
  8. Kiesner J, Kerr M. Families, peers, and contexts as multiple determinants of adolescent problem behavior. *J Adolesc.* 2004;27(5):493-495.
  9. Kobus K. Peers and adolescent smoking. *Addiction.* 2003;98(Suppl 1):37-55.
  10. Oetting ER, Beauvais F. Peer cluster theory: drugs and the adolescent. *Journal of Counseling and Development.* 1986;65:17-22.
  11. Kandel DB. The parental and peer contexts of adolescent deviance: an algebra of interpersonal influences. *Journal of Drug Issues.* 1996;26(2):289-315.
  12. Dishion TJ, Capaldi D, Spracklen KM, et al. Peer ecology of male adolescent drug use. *Developmental Psychopathology.* 1995;7:803-824.
  13. Fisher LA, Bauman KE. Influence and selection in the friend-adolescent relationship: findings from studies on adolescent smoking and drinking. *Journal of Applied Social Psychology.* 1998;18:289-314.
  14. Chassen L, Presson CC, Sherman SJ, et al. Changes in peer and parent influence during adolescence: Longitudinal versus cross-sectional perspectives on smoking initiation. *Dev Psychol.* 1986;22:327-334.
  15. Duncan SC, Duncan TT. A multivariate latent growth curve analysis of adolescent substance use. *Structural Equation Modeling.* 1996;3:323-347.
  16. Elliott D, Huizinga D, Ageton S. Explaining Delinquency and Drug Use. Beverly Hills, CA: Sage 1985.
  17. Farrell AD, Danish SJ. Peer drug associations: causes or consequences of adolescents' drug use? *J Consult Clin Psychol.* 1993;61:327-334.
  18. Ennett ST, Bauman KE. The contribution of influence and selection to adolescent peer group homogeneity: the case of adolescent cigarette smoking. *J Pers Soc Psychol.* 1994;67(4):653-663.
  19. Hawkins JD, Catalano, RF, Miller JY. Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: implications for substance abuse prevention. *Psychol Bull.* 1992;112:64-105.
  20. Ary DV, Tildesley BA, Hops H, et al. The influence of parent, sibling, and peer modeling and attitudes on adolescent use of alcohol. *Int J Addict.* 1993;28(9):853-880.
  21. Steinberg L, Fletcher A, Darling N. Parental monitoring and peer influences on adolescent substance use. *Pediatrics.* 1994;93:1060-1064.
  22. Reifman A, Barnes GM, Dintcheff BA, et al. Parental and peer influences on the onset of heavier drinking among adolescents. *J Stud Alcohol.* 1998;59:311-317.
  23. Cohen DA, Richardson J, LaBree L. Parenting behaviors and the onset of smoking and alcohol use: a longitudinal study. *Pediatrics.* 1994;94:368-375.
  24. Sieving RE, Maruyama G, Williams CL, et al. Pathways to adolescent alcohol use: potential mechanisms of parent influence. *Journal of Research on Adolescence.* 2000;10(4):489-514.
  25. Dielman TE, Butchart AT, Shope JT. Structural equation model tests of patterns of family interactions, peer alcohol use, and intrapersonal predictors of adolescent alcohol use and misuse. *J Drug Educ.* 1993;23(3):273-316.
  26. Simons-Morton BG, Haynie DL, Saylor KE, et al. The effects of the going places program on early adolescent substance use and anti-social behavior. *Prev Sci.* 2004;5(2):101-111.
  27. Simons-Morton BG, Crump AD, Haynie DL, et al. Psychosocial, school, and parenting factors associated with recent smoking among early-adolescent boys and girls. *Prev Med.* 1999;28:138-148.
  28. Hickman CW, Greenwood G, Miller M. High school parent involvement: relationships with achievement, grade level, SES, and gender. *Journal of Research & Development in Education.* 1995;28(3):125-134.
  29. Simons-Morton BG, Chen R. Over time relationships between early adolescent and peer substance use. *Addict Behav.* 2006;31:1211-1223.
  30. Dolcini MM, Adler NE, Ginsberg D. Factors influencing agreement between self-reports and biological measures of smoking among adolescents. *Journal of Research on Adolescence.* 1996;6:515-542.
  31. Kiesner J, Kerr M, Stattin H. "Very important person" in adolescence: going beyond in-school, single friendships in the study of peer homophily. *J Adolesc.* 2004;27(5):545-560.
  32. Curran PJ. A latent curve framework for the study of developmental trajectories in adolescent substance use. In Rose JS, Chassin L, Presson CC, et al., (Eds.) *Multivariate Applications in Substance Use Research: New Methods for New Questions.* New Jersey: Lawrence Erlbaum Association Publishers 2000:1-42.
  33. Raudenbush WR, Byrk AS. *Hierarchical Linear Models: Applications and Data Analysis Methods* (second edition). Thousand Oaks: Sage Publication 2002.
  34. Muthen LK, Muthen BO. *Mplus User's Guide* (third edition). Los Angeles, CA: Muthen &

## Research Laureate Presentation

- Muthen 1998-2004.
35. Muthen LK, Curren PJ. General longitudinal modeling of individual differences in experimental designs: a latent variable framework for analysis and power estimation. *Psychol Methods*. 1997;2:371-402.
  36. Cheong LW, MacKinnon D, Khoo ST. A latent growth modeling approach to mediation analysis. In Collins LM, Sayer AG (Eds.). *New Methods of the Analysis of Change*. Washington, DC: American Psychological Association, 2001:390-392.
  37. McDonald RP, Ho M. Principles and practice in reporting structural equation analysis. *Psychol Methods*. 2002;7:64-82.
  38. Simons-Morton BG, Chen R. Latent growth curve analyses of parent influences on drinking progression among early adolescents. *J Stud Alcohol*. 2005;66(1):5-13.
  39. Simons-Morton, Chen R, Abrams R, Haynie DL. Latent growth curve analyses of peer and parent influences on smoking stage progression among early adolescents. *Health Psych*. 2004;23(6):612-621.
  40. Gua J, Hill K, Hawkins JD, et al. A developmental analysis of sociodemographic, family and peer effects to adolescent illicit drug initiation. *J Am Acad Child Adolesc Psychiatry*. 2002;41(7):838-845.
  41. Gifford-Smith M, Dodge KA, Dishion T, et al. Peer influence in children and adolescents: crossing the bridge from developmental to intervention science. *J Abnorm Child Psychol*. 2005;33:255-265.
  42. Hansen WB. Pilot test results comparing the All Star program with seventh grade D.A.R.E.: program integrity and mediating variable analysis. *Substance Use & Misuse*. 1996;31:1359-1377.
  43. Bauman KE, Carver K, Gleiter K. Trends in parent and friend influence during adolescence. The case of adolescent cigarette smoking. *Addict Behav*. 2001;26(1):25-31.
  44. Mounts N. Parental management of adolescent peer relationships in context: the role of parenting style. *J Fam Psychol*. 2002;16(1):58-69.
  45. Chassin L, Pillow D, Curran P, et al. Relation of parental alcoholism to early adolescent substance use: a test of three mediating mechanisms. *J Abnorm Psychol*. 1993;100:449-463.