

## ORIGINAL ARTICLE

# Do Friendships Change Behaviors, or Do Behaviors Change Friendships? Examining Paths of Influence in Young Adolescents' Alcohol Use

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**Purpose:** This study examined support for models of peer influence, which postulates that young adolescents whose friends use alcohol will also engage in that behavior, and of peer selection, whereby young adolescents seek out friends whose drinking behavior is similar to their own.

**Methods:** Data for this study are from 1804 adolescents participating in Project Northland, a school- and community-based alcohol use prevention trial. Using latent variable structural equation modeling, a series of models examined directions of influence between participant alcohol use and friend drug use over three points in Grades 7, 8, and 9.

**Results:** Findings indicated that higher levels of friends' drug use led to increased participant alcohol use. The reverse-order relationship (i.e., greater participant involvement in alcohol leading to more drug use among friends) was not supported by these data. Finally, best-fitting models supported the notion that both participants' alcohol use and the alcohol and other drug use of friends were highly stable over time.

**Conclusions:** Similarity in drinking behavior among adolescent friends may be more related to processes of peer influence than to processes of peer selection. Findings support the utility of alcohol use prevention programs that equip younger teens with skills to resist peer influences to use alcohol. © Society for Adolescent Medicine, 1999

## KEY WORDS:

Adolescence  
Alcohol use  
Peer influence  
Latent variable structural equation modeling

Peer groups have long been considered to be a key social-environmental factor associated with alcohol and other drug use of adolescents (1,2). Although research has consistently demonstrated high levels of homogeneity between adolescents and their friends with regards to drug use behaviors (1,3–5), the origins of this homogeneity are less well understood (6). Documented cross-sectional associations may reflect processes of peer influence, peer selection, or a combination of both (6,7).

A peer influence model postulates that factors within adolescent peer groups are important antecedents of drug use behaviors. Key processes of peer influence may include friends' modeling alcohol and other drug use, friends making drugs immediately available, and peers creating norms and expectations that support or encourage alcohol and other drug use (8). Previous longitudinal studies provide some evidence supporting both peer use and encouragement to use drugs as antecedents of adolescents' use of alcohol and other drugs (1,9–13).

An alternative model, that of peer selection, posits that homogeneity of drug use behaviors among friends may reflect processes whereby adolescents choose and keep friends whose behavior and beliefs are similar to their own. With regard to drug use,

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selection can occur in several ways including drug users choosing other users as friends, nonusers choosing other nonusers as friends, friendships dissolving when friends' drug use behaviors become dissimilar, and peer groups restricting membership to persons with drug behaviors like their own (6,13). Several longitudinal studies support the notion that processes of peer selection may be relevant to patterns of adolescent alcohol use (1,3).

Employing a longitudinal design, this study aimed to explore models of peer influence and peer selection as they apply to alcohol use behaviors of a cohort of young adolescents involved in an alcohol use prevention trial. Initially, the stability of participants' alcohol use and peers' drug use over a 2-year period beginning at the end of seventh grade was explored. Next, models separating the effects of friendship selection and friendship influence were examined; the relative importance of peer selection and peer influences processes on alcohol use of this cohort of young adolescents was explored. Finally, differences in paths between adolescent alcohol use and friends' drug use among intervention and reference groups were investigated.

## Method

### Overview of Project Northland (PN)

Data for this study were derived exclusively from a school- and community-based intervention trial, PN, funded by the National Institute on Alcoholism and Alcohol Abuse for 9 years (1990–1999). The goals of PN are to prevent or delay the onset of alcohol use among young adolescents, and to reduce the prevalence of use among adolescents who are already drinkers. Twenty-four school districts and adjacent middle- and lower-middle-class communities from northeastern Minnesota agreed to participate in PN; districts were randomly assigned to either intervention or reference conditions. Students in the class of 1998 from these districts ( $N = 2351$ ) formed the study cohort. Students, parents, and community members from the intervention condition had been exposed to intervention components since the beginning of the students' sixth-grade year (14). By the end of eighth grade, analyses controlling for baseline alcohol use revealed that significantly fewer adolescents in the intervention condition than in the reference condition reported using alcohol (15).

**Table 1.** Demographic Characteristics of Study Participants and Full PN Baseline Sample

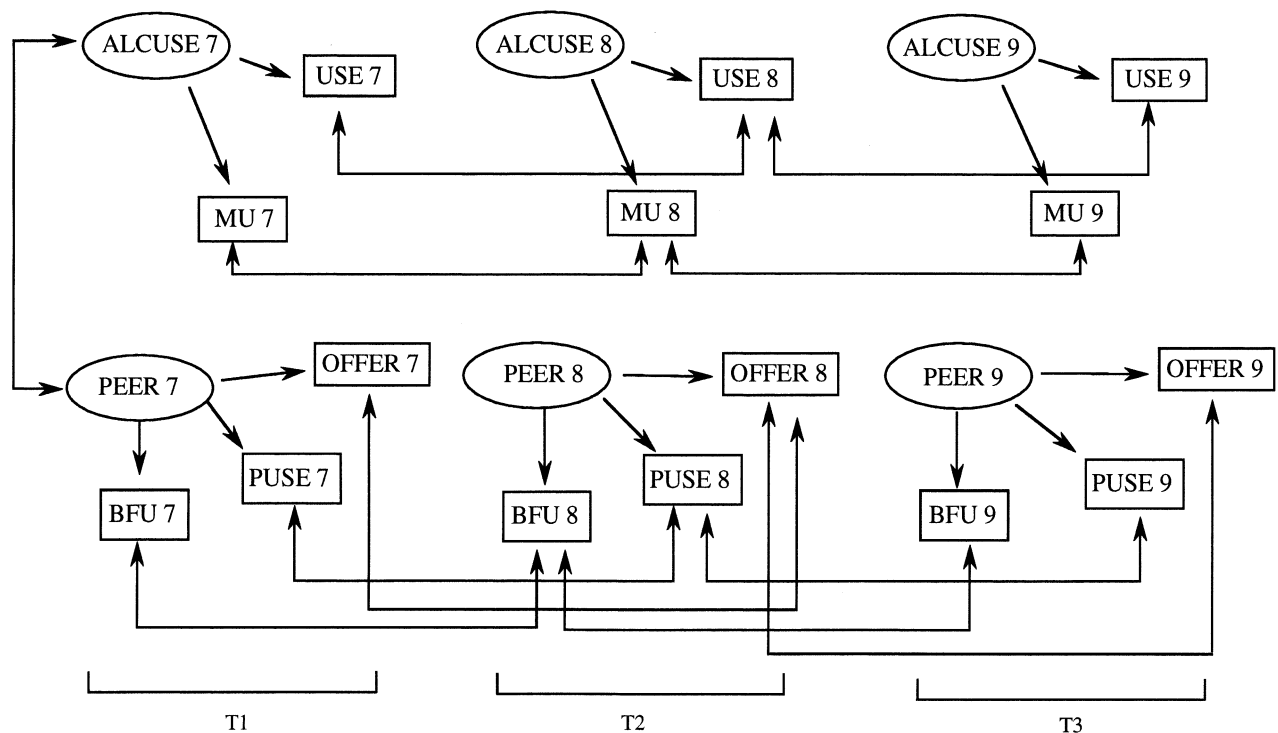
	Study Participants ( $N = 1804$ ) (%)	Full PN Baseline Sample ( $N = 2456$ ) (%)
Ethnicity		
Caucasian	95.5	94.7
Native American	3.7	4.5
Other	0.8	0.8
Gender		
Female	49.8	48.25
Male	50.2	51.75
Parents in home		
Two biologic parents	72.6	68.6*
Other	27.4	31.4
T1 alcohol use status, 7th grade		
No lifetime use	42.3	40.3
Some lifetime use	57.7	59.7
T3 alcohol use status, 9th grade		
No lifetime use	24.7	NA
Some lifetime use	75.3	NA

\*  $p < .05$ .

### Research Design and Sample

The current study consists of data collected from the cohort of PN students at the end of seventh, eighth, and ninth grades (T1, T2, T3). Samples for this study include students who completed surveys at each of these time points. Of the 923 adolescents who fit these criteria, 30 (1.6%) were removed from analyses owing to response inconsistencies (16), and 89 adolescents (4.7%) were removed because they lacked data on one or more of the measures used in these analyses. To test whether pathways to initial alcohol use differed between PN study conditions, the remaining group of adolescents was divided into intervention and reference samples. The final study samples consisted of 863 adolescents from the reference condition and 941 adolescents from the intervention condition. As seen in Table 1, by the end of seventh grade (T1), 57.7% of the students in the combined study samples reported some lifetime history of alcohol use. At the end of ninth grade (T3), 75.3% of this same group reported some lifetime alcohol use.

In addition to alcohol use history, Table 1 contains baseline demographic characteristics as well as comparisons between the study samples and the larger PN student cohort who completed T1 surveys. Adolescents included in final study samples were significantly more likely than those from the full T1 cohort to live with both biologic parents ( $\chi^2_{1df} = 7.96$ ,  $p <$

**KEY:**

T1 = 7th Grade; T2 = 8th Grade; T3 = 9th Grade

PEER = Peer Alcohol and Drug Use/Offers, measured by (PUSE = Peer Drug Use), (OFFER = Peer Drug Use Offers) and (BFU = Best Friend Use). ALCUSE = Alcohol Use, measured by (USE = Alcohol Use Frequency) and (MU = Alcohol Misuse).

**Figure 1.** Baseline model for examining relations between peer drug use and adolescent alcohol use.

.025). Distributions of other demographic characteristics were similar across groups. Both groups were largely of European descent, with small numbers of Native Americans.

### Instrument

Data were derived from a self-report survey instrument that includes information on adolescents' expectancies associated with drinking, alcohol use norms, alcohol refusal self-efficacy, future intentions to use alcohol, perceived parental expectations related to teenage drinking, general family management practices, friends' drug use and offers, and levels of alcohol and other drug use. Alcohol and other drug use items were drawn from the Monitoring the Future survey (17), allowing for comparisons with national samples. Pretested extensively prior to use with the PN cohort, this instrument includes scales with acceptable levels of reliability among normative samples of young adolescents (17). Passive parental consent procedures were used and

surveys were administered in school classrooms by trained research staff. All study protocols were approved by the institution's committee on human subjects.

### Measures

The latent constructs and the measured indicators that comprise etiologic models tested in this study are described subsequently. Items were coded so that high scores represented theoretically high-risk responses. All items were transformed to z scores prior to inclusion in scales/composites to adjust for differing number of response categories between items (18). Relationships between measures and latent constructs are illustrated in Figure 1.

The Peer Alcohol and Drug Use/Offers construct captures normative standards and behaviors among young adolescents' friendship groups and best friends. This construct was defined by three measures of friends' "gateway" drug use (i.e., alcohol, tobacco, and marijuana). Peer Drug Use is a five-item

scale measuring perceived prevalence of alcohol, tobacco, and marijuana use among friends. This scale demonstrated acceptable levels of internal consistency among study samples, with a Cronbach (19) alpha of .84 at T1. Peer Drug Use Offers is a four-item scale measuring level of friends' offers to use alcohol, tobacco, and marijuana (Cronbach  $\alpha$  = .85 at T1). The third measure, Best Friend Use, is a two-item composite describing perceived alcohol and cigarette use of a best friend ( $r$  = 0.67 at T1).

The Alcohol Use construct was defined by two measures. Alcohol Use Frequency is a three-item scale measuring self-reported frequency of alcohol use in the past month, past year, and lifetime (Cronbach  $\alpha$  = .91 at T1). The Alcohol Misuse scale includes three items: episodes of five or more drinks in a row over the past 2 weeks, frequency of being "really drunk so you fell down or got sick," and frequency of alcohol use in the past week (Cronbach  $\alpha$  = .83 at T1).

### Analytic Strategy

The primary analytic strategy employed by this study is latent variable structural equation modeling (LVSEM). Several advantages of LVSEM are particularly applicable to this study. First, unlike multiple regression, LVSEM permits variables included in a model to affect one or more variables and also to be affected by other variables in that model (20). For example, in these analyses T2 Alcohol Use functions both as a dependent variable and as a predictor of T3 variables. Second, LVSEM analyses include a statistical test of overall fit of a model to the data. Thus, as detailed below, it is possible to compare competing conceptual models using this methodology (3).

For each sample of adolescents, LVSEM analyses was used to define: (a) relationships between latent constructs and observed variables (the measurement model), and (b) path coefficients interrelating the latent constructs (the structural model). LISREL 8 software (21) was used to complete LVSEM analyses. Analyses compared the fit between actual covariances among study variables and covariance patterns implied by LVSEM models. An index of absolute model fit, the Chi-square statistic ( $\chi^2$ ) (22), was used to assess plausibility of proposed measurement and structural models. In addition, three relative fit indexes, the nonnormed fit index (NNFI) (23), the incremental fit index (IFI) (24), and the comparative fit index (CFI) (25), were used to provide information on how well a proposed model explained observed relationships in the data in comparison to other possible models.

Two types of relationships between measured variables were incorporated into the measurement model. First, residuals of the same indicators measured across time were allowed to covary, as repeated measurement of the same indicator often results in measure-specific variance (26). Second, to ensure that Peer Alcohol and Drug Use/Offers and Alcohol Use constructs were defined consistently over time, factor loadings associated with indicators of these constructs were constrained to be identical across time. A Chi-square test of difference between this measurement model and a model in which indicators were not constrained across time revealed that including these constraints did not significantly deteriorate model fit for either the reference or the intervention sample.

Guided by *a priori* hypotheses, a series of comparisons between hierarchically nested structural models was completed with data from the reference sample; parallel comparisons were completed with data from the intervention sample. Chi-square tests of model differences were employed as an indicator of whether the more complex of the two models being compared provided a significantly better fit to the data. Figure 1 presents the baseline model used in these comparisons. This model includes a cross-sectional association between the T1 Alcohol Use and Peer Alcohol and Drug Use/Offers constructs. A second model adds longitudinal stability paths to the baseline model (e.g., path from T1 Alcohol Use to T2 Alcohol Use). To test the hypothesis that Alcohol Use and Peer Alcohol and Drug Use/Offers exhibit stability over time, the fit of this second model was compared with the fit of Figure 1. A third model adds cross-sectional associations between Alcohol Use and Peer Alcohol and Drug Use/Offers at T2 and T3 to the second model. The fit of this third model was compared with the fit of the second model to test the hypothesis that Alcohol Use and Peer Alcohol and Drug Use/Offers are significantly associated at any one point in time. A fourth model adds longitudinal paths from Alcohol Use to Peer Alcohol and Drug Use/Offers to the third model (e.g., path from T2 Alcohol Use to T3 Peer Use/Offers); the fit of the fourth model was compared to the fit of the third model to test for peer selection effects. A fifth model adds longitudinal paths from Peer Alcohol and Drug Use/Offers to Alcohol Use to the third model (e.g., path from T2 Peer Use/Offers to T3 Alcohol Use); the fit of this model was compared to the third model to test for peer influence effects. A sixth model includes longitudinal paths both from Alcohol Use to Peer Alcohol and Drug



**Table 2.** Measures of Overall Fit, Measurement Model\*

Sample	$\chi^2$	df	<i>p</i>	IFI	NNFI	CFI
Intervention	308.31	71	.00	0.98	0.97	0.98
Reference	208.43	71	.00	0.99	0.98	0.99

\* Fit indexes included the chi-square test, the incremental fit index (IFI), the nonnormed fit index (NNFI), and the comparative fit index (CFI).

Use/Others and from Peer Alcohol and Drug Use/Others to Alcohol Use. This reciprocal effects model was compared with the fifth model to test the hypotheses that processes of peer selection and peer influence were operating concurrently.

After this series of comparisons identified best-fitting models for each sample, a formal LISREL multisample analysis (27) was conducted to identify significant differences between intervention and reference sample models, which in turn would provide evidence for intervention effects on model-proposed relationships. Using a framework suggested by Bollen (24), a series of comparisons between hierarchically nested models tested the following hypotheses: (a) Relations between latent constructs and observed variables were equivalent across samples; (b) given equivalent measurement models, longitudinal relationships between latent constructs were equivalent across samples; and (c) given the above equivalencies, cross-sectional relationships between latent constructs were equivalent across samples.

## Results

### Measurement Model

Confirmatory factor analyses were completed to evaluate the fit of the proposed measurement model to data from intervention and reference samples. As can be seen by the fit statistics in Table 2, the proposed measurement model provided an acceptable fit to data from both samples. Factor loadings, residual variances, and serial covariances associated

with individual measurement model parameter estimates are available from the authors upon request.

### Structural Models

*Comparison of nested models.* A series of nested model comparisons, described above, began with comparison of Models 1 and 2. As evidenced by the Chi-square tests of difference in Table 3, including longitudinal stability paths significantly improved the fit of the model to data from both reference and intervention groups. The constructs of Alcohol Use and Peer Alcohol and Drug Use/Others both appeared to exhibit some level of stability over the time period from seventh through ninth grades.

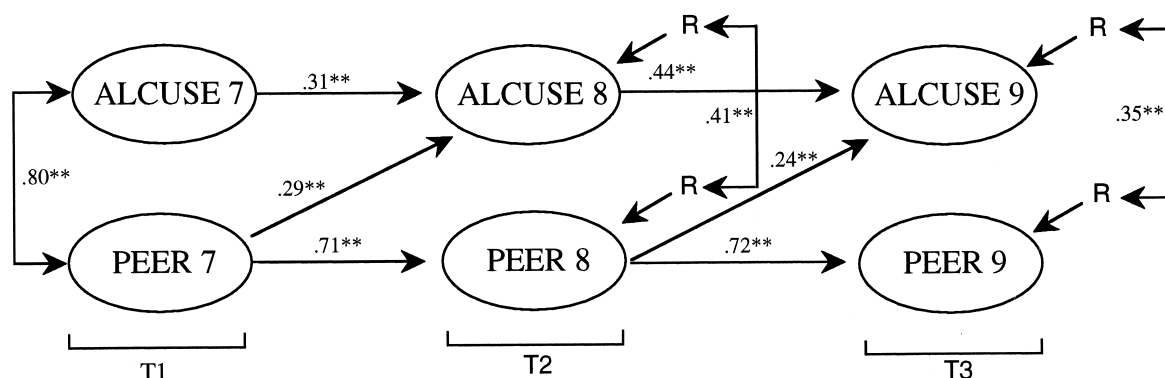
Comparisons of fit between the second and third models indicated that the model including cross-sectional associations between Alcohol Use and Peer Alcohol and Drug Use/Others at T2 and T3 significantly improved the fit to data from both samples (Table 3). Thus, the hypothesis that there are substantive cross-sectional relationships between adolescents' alcohol use and the alcohol and drug use of friends was supported by data from these adolescents.

To test for peer selection effects, the fit of Model 4 was compared with Model 3. As seen by the improvement in fit statistic in Table 3, the peer selection model significantly improved fit for the intervention sample but not for the reference sample. Thus, evidence suggests that some level of peer selection may

**Table 3.** Tests of Differences in Model Fit

Model Comparison	Reference Sample			Intervention Sample		
	Diff $\chi^2$ *	$\Delta$ df	<i>p</i>	Diff $\chi^2$	$\Delta$ df	<i>p</i>
Model 1–Model 2	1482.2	4	<.0005	1554.0	4	<.0005
Model 2–Model 3	798.0	2	<.0005	953.9	2	<.0005
Model 3–Model 4	2.0	2	>.3	13.83	2	<.005
Model 3–Model 5	44.29	2	<.0005	48.46	2	<.0005
Model 5–Model 6	3.97	2	>.1	0.00	2	>.9

\* Diff  $\Delta\chi^2 = \chi^2$  test of model differences.

**KEY:**

T1 = 7th Grade; T2 = 8th Grade; T3 = 9th Grade

PEER = Peer Alcohol and Drug Use/Offers; ALCUSE = Alcohol Use

**Figure 2.** Final model, reference sample.

have been operative among adolescents from the intervention sample.

To test for effects of peer influence, the fit of Model 5 was compared with Model 3. As seen in Table 3, fit statistics indicate that the peer influence model significantly improved model fit for both groups. Thus, processes of peer influence appeared to be operative within both intervention and reference samples.

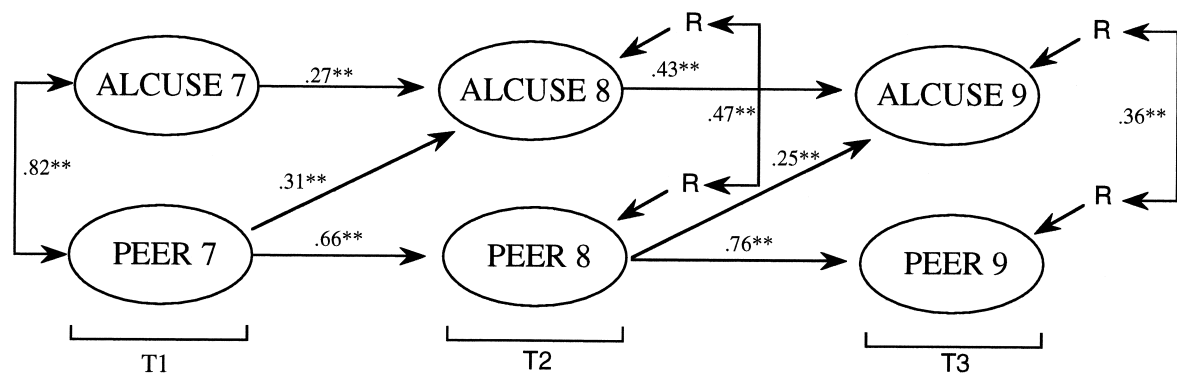
Finally, a sixth model that included paths representing both peer selection and peer influence was compared with Model 5 that included only peer influence paths. As evidenced by fit statistics in Table 3, Model 6 did not improve fit for either the intervention sample or the reference sample. Thus, processes of peer influence appeared to predominate in explaining alcohol use behaviors among these samples of adolescents. Based on this series of comparisons, the peer influence model (Model 5) was selected as the best fitting model for both reference and intervention samples.

*Final model, reference sample.* Overall fit indexes suggested that the structural model depicted in Figure 2 offered a reasonable explanation for data from the 863 adolescents comprising the reference sample. Although the chi-square statistic indicated some discrepancy between predicted and observed covariance matrices [ $\chi^2(77) = 257.73, p = .0$ ], an NNFI of 0.97, CFI of 0.98, and IFI of 0.98 all indicated that the model accounted for a substantial portion of variation among observed measures. Furthermore, this model accounted for 51% of the variance in Peer

Alcohol and Drug Use/Offers and 33% of the variance in Alcohol Use at T2. At T3, the model explained 52% of the variance in Peer Alcohol and Drug Use/Offers and 42% of the variance in Alcohol Use.

All the standardized path estimates illustrated in Figure 2 were significant in the reference sample model. Among this group of young adolescents, constructs representing both Peer Alcohol and Drug Use/Offers and Alcohol Use exhibited stability over time. Cross-sectional associations between Peer Alcohol and Drug Use/Offers and Alcohol Use were significant at all three measurement points. Finally, Peer Alcohol and Drug Use/Offers at T1 and T2 had significant, direct effects on Alcohol Use at T2 and T3, supporting the proposed processes of peer influence.

*Final model, intervention sample.* Overall fit indexes suggested that the structural model depicted in Figure 3 offered a reasonable explanation for data from the 941 adolescents from the intervention sample. As was the case with the reference sample, the Chi-square statistic indicated some discrepancy between predicted and observed covariance matrices [ $\chi^2(77) = 325.84, p = 0.0$ ]. However, relative fit indexes including an NNFI of 0.97, CFI of 0.98, and IFI of 0.98 all indicated that this model accounted for a substantial portion of variation among observed measures. At T2, this model accounted for 44% of the variance in Peer Alcohol and Drug Use/Offers and 30% of the variance in Alcohol Use. The model also explained 57% of the variance in Peer Alcohol and Drug Use/Offers and 41% of the variance in Alcohol Use at T3.

**KEY:**

T1 = 7th Grade; T2 = 8th Grade; T3 = 9th Grade

PEER = Peer Alcohol and Drug Use/Offers; ALCUSE = Alcohol Use

**Figure 3.** Final model, intervention sample.

The model depicted in Figure 3 includes all significant standardized path estimates for adolescents from the intervention sample. Both Alcohol Use and Peer Alcohol and Drug Use/Offers constructs exhibited stability over the time period from seventh to ninth grades for this group. Participants' alcohol use had a significant positive association with friends' alcohol and drug use/offers at each measurement point. Finally, high levels alcohol and drug use/offers among friends at T1 and T2 had direct positive effects on participants' alcohol use at T2 and T3 among this sample.

*Consistency of LVSEM models across samples.* The peer influence model (Figs. 2 and 3) was used to test for comparability of model-specified relations across reference and intervention samples. In an initial comparison, measurement model factor loadings were found to differ across samples. Thus, the hypotheses that all measurement model parameters were identical across samples was rejected. Next, the invariance of a measurement model in which the equality constraint on the T1 Alcohol Misuse factor loading was removed was tested. This partially constrained measurement model provided an acceptable fit to both samples.

The remaining comparisons focused on identifying group differences in relationships among latent constructs. First, the partially constrained measurement model was compared with a model that imposed these constraints plus equality constraints on longitudinal paths between latent constructs. Imposition of this set of constraints did not significantly

worsen model fit. Second, the model which constrained longitudinal structural paths was compared with a model in which equality constraints were placed on both cross-sectional and longitudinal relations between latent variables. Imposition of these additional equality constraints across groups did not significantly deteriorate model fit. Thus, the magnitude of cross-sectional and longitudinal relationships between latent constructs appeared to be equivalent across intervention and reference samples.

### Discussion and Implications

Findings from this study suggest that among two groups of young adolescents, similarity in alcohol use behaviors was related more to processes of peer influence than to processes of peer selection. Multi-group comparisons indicated that friends' drug use behaviors had an equivalent impact on adolescents' alcohol use within intervention and reference samples. Finally, patterns of alcohol use and peer drug use behaviors exhibited substantial levels of stability over the early adolescent period.

Previous research provides additional support for the notion that the drug use of friends is an antecedent of adolescent alcohol use. In a study that controlled for friendship selection, Urberg et al. (7) found that best friends' baseline alcohol use significantly predicted whether adolescents would initiate alcohol use and whether they would transition into patterns of current alcohol use and drinking to intoxi-

cation 1 year later. Similarly, Duncan et al. (9) found that best friends' encouragement of alcohol, cigarette, and marijuana use was associated with increased rates of alcohol use among a cohort of 11- to 18-year-olds.

Findings from this study suggesting that the alcohol use of young adolescents is more related to processes of peer influence than to processes of peer selection are unique. In contrast, Farrell (3) and Farrell and Danish (28) suggested that peer alcohol use was a consequence, but not an antecedent, of alcohol use among a group of adolescents surveyed at three points during seventh and eighth grades. Of the young people included in their research, at T1 35% reported drinking beer at least once; 11% reported drinking hard liquor (29). In contrast to the race and family structure mix of this study's sample, around 92% of the subjects in their research were African-American; 43% were from dual-parent families. Similarly, Fisher and Bauman (1) found that adolescents' baseline alcohol use status (drinker/nondrinker) strongly predicted acquisition of friends with similar alcohol use patterns 1 year later. The reverse-order relationship (i.e., baseline alcohol use status of peers predicting adolescent alcohol use status 1 year later) occurred only among baseline nondrinkers and was relatively small in magnitude. Fisher and Bauman's study sample was composed of students from a rural North Carolina school system who were in seventh grade at baseline. In contrast to baseline alcohol use patterns of the current study samples, only 21.9% of adolescents from the North Carolina sample had ever used beer and 17.6% had consumed hard liquor. Discrepant findings between the present study and these previous reports may reflect differences in key processes of influence within environments where alcohol use among agemates is or is not normative. Specifically, friends' alcohol and other drug use may be an especially potent influence when it occurs within social contexts where drinking among agemates is relatively prevalent, as was the case in the present study in which approximately 58% of the sample reported some lifetime history of alcohol use. Friends' drug use may be less of an influence in contexts where most agemates are not using alcohol, as was the case in cited previous research. Differences in results between current and previous studies may also reflect variations in predominant processes of social influence among adolescents from various ethnic and cultural backgrounds. Finally, differences in measurement and analytic strategies employed may account for some of the variation in findings across studies.

To generalize findings from this study to other groups of adolescents, proposed models need to be cross-validated using data from young teenagers of other ethnic and cultural backgrounds. Future research can also explore variations in pathways between friends' drug use and subjects' alcohol use by examining separate models for adolescents who have and have not begun using alcohol at study baseline and for adolescents who live in social contexts where drinking among agemates is and is not normative.

One of the limitations of the current study is that the Peer Alcohol and Drug Use/Offers construct is defined solely by subject report. Even with the use of this multiple-indicator construct, the potential exists for a gap between the variable as it is operationalized and the theoretical construct it is intended to represent (30). In an earlier study using a pipeline procedure to improve the validity of self-report, adolescents did appear to report their own drug use accurately in situations when confidentiality was assured (31). However, given the limited visibility of alcohol and other drug use during early adolescence, as well as tendency to project one's behavior onto others (32), a peer drug use construct based exclusively on adolescent self-report may provide inaccurate or incomplete descriptions of friends' behaviors (1,7). Thus, future studies that use a combination of subject and friends' reports of peer drug use would provide further evidence to support or refute current findings.

This study has several implications for intervention programs. Findings suggest that addressing peer influence is an essential element of alcohol use prevention programs for young adolescents. Intervention components can promote exposure to peers who model, reinforce, and expect health-enhancing alternatives to alcohol use. Other intervention components can provide skills to resist and/or counter peer influences to use alcohol and other drugs (10). Second, findings that both participants' alcohol use and peer drug use behaviors exhibited stability over time suggest that prevention programs targeting the precursors of young adolescent use need to begin early, prior to the onset of potentially fixed patterns of behavior.

While this study has explored one type of social-environmental factor involved with adolescents' alcohol use, findings from previous research (6,33-37) support the theoretical notion that a broad array of social environmental, intrapersonal, and behavioral influences underlie alcohol and other drug use behaviors of adolescents. To be most effective in preventing adolescent alcohol use and its consequences on a population level, multicomponent approaches



must target changes in normative standards regarding alcohol use. Furthermore, these approaches must include school and community engagement, parental involvement, and peer participation components to address the complex array of factors influence adolescent alcohol use (38).

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