Expectancies as Mediators of the Effects of Social Influences and Alcohol Knowledge on Adolescent Alcohol Use: A Prospective Analysis

Lawrence M. Scheier and Gilbert J. Botvin
Cornell University Medical College

Expectancies play an important role in the generation of adolescent alcohol use. However, few studies have precisely elucidated their role when specified with other prominent measures of social influences, which may also independently promote alcohol use. Three-year panel data and path-analytic techniques were used to test a model positing that social reinforcement expectancies mediate the effects of perceived friends' alcohol use, friends' alcohol attitudes, and knowledge of near-term health effects and alcohol prevalence on both contemporaneous and subsequent alcohol involvement. Evidence of mediation was obtained with both cross-sectional and longitudinal findings. Perceived peer norms had a direct effect on alcohol use, and knowledge of normative alcohol use had a unique long-term protective influence on later alcohol use. Findings are discussed in terms of a 2-pronged prevention model that (a) integrates principles of social learning theory with expectancy-based, cognitive–behavioral change and (b) emphasizes dissemination of age-appropriate alcohol information in programs that aim to reduce alcohol use.

A growing body of literature supports the strength of alcohol-related expectancies as important determinants of adolescent drinking behavior (e.g., see Brown, Creamer, & Stetson, 1987; Christiansen & Goldman, 1983; Goldman, Brown, & Christiansen, 1987; Stacy, Widaman, & Marlatt, 1990). Studies of both youths and adults have demonstrated empirically that perceived outcomes (i.e., anticipated effects) from drinking account for substantial amounts of variation in contemporaneous and

longitudinal drinking patterns (Bauman & Chenoweth, 1984; Jessor & Jessor, 1977; Moskowitz, Schaps, Schaeffer, & Malvin, 1984; Sher, Walitzer, Wood, & Brent, 1991; Stacy, Newcomb, & Bentler, 1991) and predict well to problem drinking among youth (Chen, Grube, & Madden, 1994; Christiansen, Smith, Roehling, & Goldman, 1989) and young adults (Brown, 1985). Most of these studies have involved a central theoretical premise that, in moderate dosages, alcohol has positive reinforcing properties and that the learned contingency between alcohol and reinforcement or "expectance" is largely responsible for generating drinking behavior (Goldman & Rather, 1993; Lang & Michalec, 1990; Stacy, Leigh, & Weingardt, 1994).

In response to this growing body of knowledge, prevention programs have developed strategies to deter youth from drinking that focus on changing beliefs regarding the beneficial effects of alcohol (e.g., Botvin & Botvin, 1992). A central premise underlying these interventions is that effective barriers to alcohol consumption include restructuring the cognitive linkage between expectancy (i.e., attitude) and behavior (e.g., Stacy, Bentler, & Flay, 1994).

One means of changing behavior has been to offer alternative and more enduring coping strategies that obviate the need to dampen stress with alcohol (Pentz, 1985). A short list of these strategies would include improved assertiveness skills (both social and drug refusal), self-reinforcement, and problem-solving confidence, all of which foster development of personal competence and self-efficacy skills. Use of these tactics as part of mainstream prevention efforts has met with considerable success with both nonclinical (Botvin, Baker, Dusenbury, Botvin, & Diaz, 1995) and clinical (Connors, Maisto, & Derman, 1992; Fromme, Kivlahan, & Marlatt, 1986) populations.

Critical Nature of Adolescent Development

Existing models of expectancy theory and empirical findings from studies of adolescent alcohol use indicate that it is important for examinations of the role of expectancies and their linkage to consumption to coincide with the earliest stages of drinking. A majority of youth consume their first alcoholic beverage during adolescence (Kandel, 1980; Newcomb & Bentler, 1986), and many youth will initiate a lifelong history of drinking (Kandel & Logan, 1984). Of particular importance is that most adolescents drink with friends in a social atmosphere and in moderate doses, leading to the perception of immediate positive and socially beneficial consequences. It seems only natural, then, that studies of the etiology of adolescent alcohol use include a dual focus, incorporating memory-based or cognitive-based processes (i.e., expectancies) along with a continued emphasis on peer models for alcohol use.

Peer relations have long been implicated as powerful causal agents in the determination of alcohol use and are a central component of both peer cluster (Oetting & Beauvais, 1986) and self-derogation theories of adolescent alcohol and drug use (e.g., Kaplan, Martin, & Robbins, 1984). In both approaches, peers represent a medium through which information regarding the "beneficial" effects of alcohol is transferred, either vicariously (through observation) or through direct experience. For example, self-derogation theory suggests that deviant and alcohol-abusing peers offer positive reinforcement to already troubled and self-deprecating youth, providing both sanctions for drinking and an emotional climate conducive to increased self-efficacy (i.e., "If I drink I will be popular with my friends"). According to this approach, alcohol consumption is driven in its earliest stages by a need for immediate social reward; at later stages, alcohol becomes a palliative coping mechanism with heightened expectancies for both social rewards and reduced negative emotions (e.g., Cooper, Frone, Russell, & Mudar, 1995; Labouvie, 1986).

Despite the seemingly logical basis accorded to the relationship between peer influences and a wide range of positive expectancies, few studies have tested simultaneously the contribution of social influences and expectancies to the prediction of alcohol. Equally compelling, even fewer studies have elucidated the precise developmental mechanisms that link these processes to subsequent drinking. For instance, if peers represent a primary source of information regarding the effects of alcohol (including both knowledge of immediate consequences and knowledge pertaining to experiential facets of alcohol's effects), then expectancies represent a direct by-product of these peer influences. Conceptually, then, because social facilitation expectancies and their encoding into memory are a natural consequence of observational learning or direct modeling processes, and because social influences help to shape the development of expectancies, expectancies may play a mediational role in the prediction of alcohol use. To test this hypothesis, the present study used path-analytic techniques to examine the direct and indirect relations of peer social influences (both perceived behavior and attitudes), alcohol knowledge, and alcohol-related expectancies for both concurrent and longitudinal alcohol involvement.

Conceptual Support for the Mediational Role of Expectancies

In recent years, several studies have suggested a possible chain of events that connects both social influences and expectancies to drug use (e.g., Abrams & Niaura, 1987; Bauman, Fisher, & Koch, 1989; Webb, Baer, Francis, & Caid, 1993). Most, if not all, of these studies have purported that expectancies mediate a host of risk factors for alcohol and other drugs.

According to Rohsenow, for example, "Drinkers' expectancies about the consequences of alcohol ingestion play a prominent role in mediating both alcohol ingestion and intoxicated behavior" (1983, p. 752). Webb et al. (1993) suggested that expectancies are the "cognitive channels through which important sources of social influence ... have their effects" (p. 128). Goldman, Brown, Christiansen, and Smith (1991) reaffirmed this view when they stated that expectancies are part of a cognitive enterprise representing memory (informational) processes and that "memory processes should be examined as a possible mediational mechanism" (p. 138). Also, according to Goldman et al. (1991), "alcohol expectancies are essentially concepts of if-then relationships between events or objects in the world and their consequences" (p. 139). Stacy et al. (1990) provided a reminder that, historically, "the construct of expectancy is hypothesized to be a dominant and direct mediator of behavior" (p. 918). Unfortunately, one or two factors may cast doubt on the strength of these claims. First, according to Leigh and Stacy (1991), many models of expectancy–behavior relations often do not meet statistical or empirical criteria for mediation. Models that hypothesize expectancies as mediators of other key determinants require specific tests of mediation (i.e., Baron & Kenny, 1986), and many researchers have often not met this challenge. A second concern is the absence of compelling empirical evidence supporting a mediational role for expectancies (Bauman et al., 1989; Ennett & Bauman, 1991).

Empirical Validation of the Mediational Role of Expectancies

In some cases, researchers have relied on appropriate analytic strategies to test the postulated mediational role of expectancies; however, their results have not provided unequivocal support (e.g., Ennett & Bauman, 1991; Webb et al., 1993). Webb et al. (1993) examined the relative role of alcohol expectancies as mediators of personality (sensation seeking and tolerance of deviance), peer influence (normative expectations and attitudes toward alcohol), and parental attitudes toward alcohol use on subsequent alcohol use in a cohort of adolescents. Their findings support the contention that

expectancies influence alcohol use; however, social and intrapersonal influences had substantially large direct effects on alcohol use independent of alcohol expectancies. All told, slightly less than 25% of social risk and 29% of intrapersonal risk were mediated by alcohol expectancies. Thus, the notion that expectancies are a final cognitive channel through which all social influences are processed was not entirely supported.

Bauman and his colleagues have also examined the intervening role of expectancies for both alcohol (Ennett & Bauman, 1991) and tobacco use (Bauman et al., 1989). These studies have included a wide array of peer and parental social influence measures (perceived attitudes and normative expectations) hypothesized to influence intervening "expectancy" measures. Ennett and Bauman reported that perceived peer drinking was significantly mediated through peer norms and several expectancy measures (social consequences and problem behavior related to drinking). However, the introduction of the expectancy measures into the model did not substantially reduce the direct effects of the peer and parental attitudinal measures to alcohol use, reinforcing the significant direct effect exerted by these risk factors.

Using prospective data, Bauman et al. (1989) found little empirical evidence to support the contention that expectancies are a necessary and sufficient condition for mediation of social or psychological (intrapersonal) influences on cigarette smoking or alcohol consumption (beer and hard liquor were analyzed separately). Notwithstanding these findings, other investigators have provided limited support for the mediational role of expectancies in studies of college-aged youth and drinking (Henderson, Goldman, Coovert, & Carnevalla, 1994), drinking among high-risk college-aged youth classified as children of alcoholics (Sher et al., 1991), and substance use among adolescents prospectively followed into young adulthood (Stacy et al., 1991).

Recently, Greenbaum, Brown, and Friedman (1995) reported that expectancies mediated 44% of the effect of delinquency and 31% of the effect of antecedent oppositional symptoms on alcohol consumption among youth with conduct disorders (special education youth with emotional disturbances and youth in residential

mental health treatment facilities). Despite the support for mediation proffered by this study, the select nature of the sample and the fact that expectancies were measured concurrently with the criterion (and may have spuriously inflated the expectancy–drinking relationship) raise some concern regarding the study's generalizability and predictive utility.

Consideration of the Role of Knowledge Factors

Most current school-based drug abuse prevention programs include components that address the deleterious health effects, pharmacologic effects, social liabilities, and legal risk related to consumption of alcohol and other drugs (Botvin & Botvin, 1992; O'Connor & Saunders, 1992; Schaps, Moskowitz, Malvin, & Schaeffer, 1986). Current reviews, and even meta-analyses, have systematically shown that alcohol and drug abuse prevention programs that depend on changing knowledge structures as the primary means of altering behavior have fostered gains in knowledge while not having an impact on behavior. However, knowledge may play an important role when considered in a multivariate framework along with other etiologic factors. For example, knowledge of the deleterious consequences of alcohol and other drug use may act as a protective barrier and, despite strong social influences and peer pressure, attenuate substance use during the early experimental stages. Yet, few models have tested the possible interaction of knowledge and expectancies in the presence of social influences. In the current study, we included two distinct measures of alcohol knowledge: one tapping the perceived effects of alcohol and a second tapping knowledge regarding alcohol facts and perceived prevalence of alcohol use. We expected that knowledge would have a protective influence and would reduce positive alcohol-related expectancies and alcohol involvement. In sum, the current study addressed some of the methodological and conceptual problems in previous research by (a) using appropriate multivariate path-analytic techniques (which correct for bias attributed to measurement error) to test the mediational properties of social reinforcement expectancies, (b) using both cross-sectional and 3-year longitudinal data collected during a critical period of development during which expectancies are likely to develop and be related to increased drinking behavior, and (c) including social influences and measures of alcohol knowledge to ascertain empirically their predictive role as determinants of both expectancies and later alcohol consumption.

Method

Sample

Data for the current study were obtained as part of a 5-year investigation conducted between 1985 and 1991 that was designed to study the etiology and prevention of tobacco, alcohol, and other illicit drug abuse. The study included 56 public schools and was conducted at three suburban sites, including central and eastern upstate New York and Long Island. These rural, suburban, and urban locations are predominantly (91%) White and middle class. Students in the seventh grade (Time 1: pretest; Time 2: 3-month posttest), and annually thereafter (Time 3–Time 6), were randomly administered three forms of a closed-ended, group-administered questionnaire. Students were assured of the confidentiality of their responses in writing (both on the parental consent form and on the questionnaire itself), verbally at the time of administration, and through a certificate of confidentiality from the U.S. Department of Health and Human Services. Unique identification codes were litho-coded onto questionnaires and used to track students longitudinally. Items included in the survey assessed a variety of psychosocial, attitudinal, behavioral, and interpersonal items related to alcohol, tobacco, and marijuana use.

The current analyses were based on a single form that was randomly assigned to one third of the nontreatment students and that included the requisite measures of alcohol use, expectancies, social and normative influences, and alcohol knowledge. There were three waves of data for the panel sample corresponding to the first annual posttest administered in the 8th grade (Time 3) and two subsequent follow-up data collections in the 9th (Time 4) and 10th (Time 5) grades. Two cohorts of data were available for this study, one collected annually in the fall and one collected shortly thereafter in the spring.

Questionnaires were identical, and, for the purposes of the current analyses, the cohorts were combined. Passive consent procedures were used, and less than 1% of the total sample included in the prevention trial refused participation.

Alcohol, Social Influence, Expectancy, and Psychosocial Measures

Alcohol was measured identically at each assessment. Measures included self-reported frequency of alcohol use ("How often, if ever, do you drink alcoholic beverages?"), quantity ("How much, if at all, do you usually drink each time you drink?"), and drunkenness ("How often, if ever, do you get drunk?"). Additional drug use items assessed frequency of cigarette use ("How much do you generally smoke now?") and marijuana use ("How often [if ever] do you usually smoke marijuana?"), and we used these items in subsequent attrition analyses. Responses for the alcohol frequency item ranged from *never tried them* (1) to *more than once a day* (9); responses for the drinking quantity item ranged from *I don't drink* (1) to *more than 6 drinks* (6); and responses for the drinking intensity item ranged from *I don't drink* (1) to *more than once a day* (9). For the purpose of conducting path analyses, we weighted and averaged the three alcohol items using a proportional weighting scheme proposed by Douglass and Khavari (1982). Percentile-based weighting effectively eliminates marked skewness (such nonnormality is often encountered with self-report drug use measures) and centers the distribution on a midpoint corresponding to the 50th percentile. Self-report measures of alcohol consumption have been shown to be reliable and to provide accurate prevalence estimates, particularly under conditions of anonymity and confidentiality (e.g., Gfroerer, 1985; Stacy, Widaman, Hays, & DiMatteo, 1985).

Two five-item scales were used to assess alcohol knowledge, one tapping knowledge of the effects of alcohol (e.g., "Alcohol tends to pep a person up") and one tapping perceived prevalence (e.g., "Most adults drink alcohol every day") and health information (adverse health effects) related to alcohol use (e.g., "A pregnant woman's drinking can affect the health of her baby"). Scoring was based on dichoto-

mous true–false coding; false responses were coded as 0 when incorrect and 1 when correct. A single item assessed perceived friends' attitudes toward alcohol ("How do your friends feel about whether or not you drink?"), with responses ranging from *strongly against it* (1) to *strongly in favor of it* (5). A single item assessed perceived normative expectations for peer drinking ("In your opinion, how many people your age drink alcoholic beverages?"), with responses ranging from *none* (1) to *almost all* (6). A single item assessed perceived friends' alcohol use ("How many of your friends drink alcohol?"), with responses ranging from *none* (1) to *all or nearly all* (5). Finally, a 7-item scale assessed positive social reinforcement expectancies (e.g., "If kids drink alcohol, it proves they're tough"; $\alpha = .88$ at Time 3, $\alpha = .89$ at Time 4, and $\alpha = .90$ at Time 5). Responses for the expectancy items ranged from *strongly disagree* (1) to *strongly agree* (5).

Results

Attrition Analyses

Sample loss across all three waves of the study was similar to that of other large-scale prevention studies (e.g., Hansen, Collins, Malotte, Johnson, & Fielding, 1985; Snow, Tebes, & Arthur, 1992). Sample loss was primarily due to absenteeism (including truancy) and relocation to other school systems, although the field staff implemented an aggressive tracking procedure to locate students not present at the scheduled assessment (three makeup testing sessions were provided for students not present at the regularly scheduled testing session). Overall, 976 control students were available for cross-sectional analyses at Time 3 (eighth grade; 51.4% male), and 918 students were available at Time 4 (51.9% male); the panel sample was composed of 789 students (Time 3–Time 5; 51.1% male; 19.2% loss from Time 3 and 14.1% loss from Time 4). There were no significant differences in gender representation for the continuation and dropout youth.

Analyses of sample attrition comparing students who continued at each subsequent wave of the study (Times 3, 4, and 5) with those who participated only at Time 3 revealed only a

minimal effect of participant loss. Proportional analyses revealed a slight differential loss of alcohol users among the continuing sample with each follow-up wave. Between Time 3 and Time 4, there was a significant loss of self-reported drinkers (71.48% of the panel sample and 85.44% of dropouts reported using alcohol), $\chi^2(1, N = 976) = 9.10$, $p < .05$; for the full three-wave panel sample, this differential loss persisted (70.47% of the panel sample and 85.44% of dropouts), $\chi^2(1, N = 892) = 10.17$, $p < .001$.

We also compared continuation and dropout youth on the complete set of social influence and expectancy measures used in the longitudinal model. Additional psychosocial measures, included in the annual assessment as part of the intervention, were included in the attrition analyses to determine whether there were any systematic differences attributed to retention status that would bias the panel sample. Psychometric properties and a complete examination of the statistical relations of these measures to alcohol and other drug use are contained in Botvin (1993) and Scheier and Botvin (1995).

By comparison, students not present at all three waves of the study reported lower levels of alcohol knowledge (18.14 vs. 19.35), $t(890) = 2.58$, $p < .01$, and perceived more friends as drinking (2.44 vs. 2.18), $t(890) = 2.07$, $p < .05$. Dropouts also reported lower academic esteem (19.7 vs. 20.69), $t(856) = 2.22$, $p < .05$, and more alcohol-related deviance (on a five-item unit-weighted index [i.e., "gotten into trouble with parents"]; 1.76 vs. 0.81), $t(113) = 2.15$, $p < .05$. The regression of attrition status (dropouts were coded as 0, and panel sample members were coded as 1) on the full set of available baseline measures accounted for 5% of the variance and resulted in three significant predictors: cigarette use ($\beta = -.12$, $p < .05$), deviance ($\beta = -.10$, $p < .05$), and marijuana use ($\beta = .10$, $p < .05$).

The overall picture obtained from the attrition analyses is that there were a few significant, albeit small, differences in psychosocial functioning between panel and dropout students. Moreover, as underscored by the regression analyses, these differences accounted for relatively small amounts of variation in retention status. This finding, coupled with the minimal behavioral

and psychosocial vulnerability accorded to the dropout students, suggested that we could still examine the utility and explanatory power of the longitudinal model (i.e., external validity would be minimally affected by the loss of higher end alcohol and drug users).

Gender Differences in Alcohol Use and Psychosocial Functioning

Means and standard deviations for male and female students present at each measurement point are provided in Table 1. The results of these between-groups (male vs. female) analyses underscore significant differences in the behavioral measures and, likewise, in several of the exogenous social influence measures.[1] In terms of the behavioral measures, male students drank more frequently at Time 3, $t(953) = -3.02$, $p < .01$, and reported a greater quantity of alcohol consumed, $t(945) = 2.67$, $p < .01$. There was a trend for male students to report more health information–prevalence knowledge, $t(958) = 1.93$, $p < .06$; more social reinforcement expectancies, $t(974) = 3.06$, $p < .01$; and more positive attitudes of friends toward drinking, $t(974) = 2.72$, $p < .01$. Female students reported more perceived friends' drinking, $t(974) = 2.36$, $p < .05$, and greater peer norms for drinking, $t(974) = 3.87$, $p < .001$.

---

[1] Despite the observation of slight behavioral and psychosocial differences between male and female students, the small sample sizes produced by separate gender analyses and the difficulty of obtaining robust parameter estimation with small samples suggested that we analyze the combined data. Tanaka (1987) provided extensive documentation of the effect of variation in sample size on parameter estimation using structural equations. Further elaboration of the problems of sample variability and estimation procedures with structural equations, particularly the effect of sample size on goodness of fit indexes, has been provided by Marsh, Balla, and McDonald (1988). In a related vein, MacKinnon, Warsi, and Dwyer (1995) conducted second-order Taylor series estimations with simulated data ($N = 500$ replications) and reported that a sample size of 500 was sufficient for accurate point and variance estimates of the proportion mediated (using a dichotomous predictor with continuous mediator and outcome measures). Unfortunately, conducting analyses separately for each sex group would not have met this statistical criterion.

Table 1
Means and Standard Deviations for Control Sample at Time 3, Time 4, and Time 5

Variable	Time 3				Time 4				Time 5			
	Male students		Female students		Male students		Female students		Male students		Female students	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Alcohol: frequency	2.82	1.83	2.49	1.49	3.32	2.02	2.95	1.63	3.83	2.17	3.52	1.74
Alcohol: quantity	2.09	1.48	1.86	1.16	2.67	1.75	2.40	1.45	3.11	1.83	2.87	1.55
Drunkenness	1.88	1.41	1.78	1.16	2.39	1.81	2.15	1.28	2.82	2.03	2.54	1.52
Knowledge of effects	15.53	6.32	15.17	5.77	14.89	6.33	14.92	5.91	15.41	6.34	14.70	5.37
Health information–prevalence knowledge	18.87	4.91	19.42	4.07	18.55	5.05	20.02	4.15	19.31	5.42	21.08	4.06
Expectancies	14.15	5.61	13.09	5.16	15.18	5.72	13.57	5.08	15.62	6.16	13.85	4.98
Friends' drinking	2.14	1.23	2.33	1.25	2.71	1.35	2.81	1.32	3.24	1.34	3.36	1.26
Friends' attitudes	2.51	1.10	2.32	1.02	2.77	1.09	2.56	0.94	2.90	1.01	2.79	0.82
Peer norms	3.86	1.29	4.17	1.19	4.30	1.15	4.55	1.00	4.65	1.13	4.97	0.87

Note.   Means and standard deviations included are for those youth present at Time 3 as well as Times 4 and 5.

At each successive follow-up wave, several differences in the behavioral, social influence, and psychosocial measures persisted. At the first follow-up (Time 4), male students continued to report drinking more frequently, $t(851) = 3.03$, $p < .01$; greater quantities of alcohol consumed, $t(857) = 2.44$, $p < .05$; and more drunkenness, $t(810) = 2.28$, $p < .05$. Reversing an earlier marginal trend, female students reported more prevalence knowledge, $t(855) = 4.71$, $p < .001$, and greater peer normative expectations for drinking, $t(866) = 3.36$, $p < .001$, whereas male students reported more favorable attitudes of friends toward drinking, $t(863) = 2.86$, $p < .01$. Most of these differences continued unabated, and, for the full panel sample, male students reported drinking more frequently, $t(793) = 2.39$, $p < .05$; greater quantity consumed, $t(806) = 2.23$, $p < .05$; more drunkenness, $t(779) = 2.11$, $p < .05$; less health information–prevalence knowledge, $t(775) = 5.31$, $p < .001$; and greater social reinforcement expectancies, $t(794) = 4.89$, $p < .001$. There was also a marginal trend for male students to report more positive attitudes of their friends toward alcohol use, $t(798) = 1.94$, $p < .06$. In contrast, female students reported greater levels of peer normative expectations for alcohol, $t(782) = 4.75$, $p < .001$.

In terms of the psychosocial measures at Time 3, female students also reported lower assertiveness skills, lower self-esteem, less deviance, more decision-making skills, higher locus of control (scored toward externality), higher problem-solving confidence, more depressive and anxious symptoms, and more social concern ($ps < .01$), as well as marginally higher levels of social confrontation and self-management skills ($ps < .06$). With few exceptions, the patterns and magnitudes of these differences persisted across subsequent assessments, indicating that attrition did not systematically bias the sample. Female students reported significantly more behavioral control at Time 4 than at Time 3. Gender differences for the complete merged panel sample that differed from those already reported included more self-management skills for female students ($p < .001$), as well as less external locus of control ($p < .05$).

In addition to gender differences across the three waves, within-group (male students and female students) across-time differences were

also noted (see Table 1). Paired t tests were used in these analyses to account for the dependence in scores across each wave of measurement. For the Time 3–Time 4 analyses, male students showed increases in terms of drinking frequency, $t(449) = 5.78$, $p < .001$; quantity, $t(449) = 7.99$, $p < .001$; self-reported drunkenness, $t(449) = 5.90$, $p < .001$; social reinforcement expectancies, $t(449) = 3.71$, $p < .001$; perceived friends' alcohol use, $t(449) = 9.59$, $p < .001$; positive attitudes of friends toward alcohol, $t(449) = 4.45$, $p < .001$; and perceived peer normative alcohol use, $t(449) = 6.83$, $p < .001$. Female students showed increases in terms of frequency of drinking, $t(424) = 7.24$, $p < .001$; quantity, $t(424) = 10.26$, $p < .001$; drunkenness, $t(424) = 7.12$, $p < .001$; health information–prevalence knowledge, $t(424) = 1.97$, $p < .05$; social reinforcement expectancies, $t(424) = 2.83$, $p < .01$; perceived friends' alcohol use, $t(424) = 9.11$, $p < .001$; positive attitudes of friends toward alcohol, $t(424) = 5.20$, $p < .001$; and perceived peer normative alcohol use, $t(424) = 6.93$, $p < .001$.

The patterns of increased alcohol use, quantity, and drunkenness persisted for male students continuing in the panel sample ($ps < .001$), as did their increased health information–prevalence knowledge, $t(403) = 2.34$, $p < .05$; perceived friends' alcohol use, $t(403) = 8.73$, $p < .001$; positive attitudes of friends toward alcohol, $t(403) = 2.81$, $p < .01$; and peer normative expectations, $t(403) = 5.50$, $p < .001$. Female students continuing in the panel sample also showed increased levels of drinking, quantity, and drunkenness ($ps < .001$), as well as health information–prevalence knowledge, $t(386) = 3.70$, $p < .001$; perceived friends' alcohol use, $t(386) = 9.51$, $p < .001$; positive attitudes of friends toward alcohol, $t(386) = 4.00$, $p < .001$; and peer alcohol norms, $t(386) = 8.01$, $p < .001$.

Prevalence of Alcohol Use and Transitions in Use

At baseline (Time 3), 73% of the control sample reported some use of alcohol. Among these nonabstaining youth, 50% reported drinking alcohol within the past month, slightly less than 25% reported doing so within the past week, and 7% reported doing so the day before

the assessment. Prevalence of alcohol use increased over the 3-year period, and, at the 9th-grade assessment, 82% of the students reported using alcohol. Of these nonabstaining youth, 58% reporting drinking in the past month, 30% reported drinking in the past week, and 11% reported drinking the prior day. At the 10th-grade assessment, 87.4% of the continuing students reported use of alcohol, 63% in the past month, 34% in the past week, and 10% on the day before. Proportional analyses revealed significant increases in the number of alcohol users between Time 3 and Time 4, $\chi^2(1, N = 873) = 230.23$, $p < .001$ (51.5% new users), and also for the longitudinal panel sample (Times 3–5, including all students present at both Time 3 and Time 4), $\chi^2(1, N = 823) = 131.50$, $p < .001$ (66.7% new users). The increased alcohol use patterns were evident for both male and female students ($ps < .001$).

Cross-Sectional Mediational Model

We conducted tests of the mediational properties of expectancies using the EQS structural equation modeling program (Bentler, 1989). Statistical conventions available in EQS allow for decomposition of effects (direct and indirect) when mediational models are posited. Baron and Kenny (1986) suggested path analysis as an appropriate analytic framework for testing mediational models; however, the current model contained multiple exogenous measures, complicating the methods for testing the significance of mediation. As one of many statistical features, the EQS program extended the work of Sobel (1987) by providing an empirical determination of whether indirect effects are significantly different from zero (based on the z-critical ratio of the nonstandard effect to its standard error estimate). A variance–covariance matrix was input for all subsequent modeling.

Figure 1 contains the standardized solution for the Time 3 cross-sectional model (i.e., model variables rescaled to have unit variance). The numbers inside the circles designate residual variances (i.e., net predictive variance unaccounted for by the exogenous variables). As depicted, the model fully explains 49% of the variance ($1.00 - .51$) in alcohol consumption (and adjusts down to 48.6% when all nonsignificant paths are removed). The fit of this final
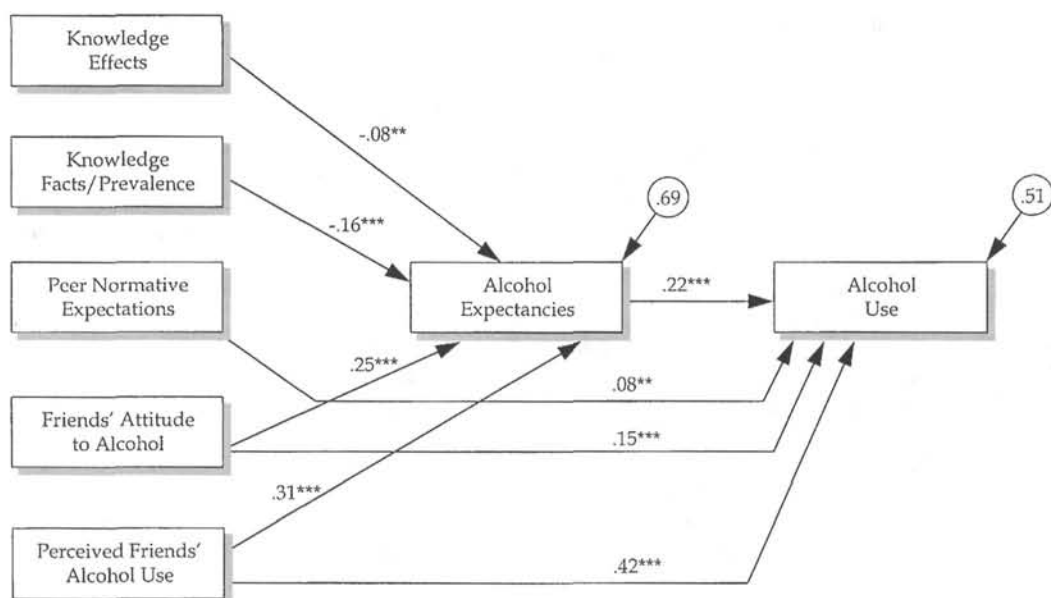
Figure 1. Results of cross-sectional model depicting relations between social influences, expectancies, and alcohol use. All variables are measured, and small circles contain residual variances (net after prediction). Significances are determined by ratio of nonstandard parameter estimate divided by its standard error. (**p < .01; ***p < .001).

model (with nonsignificant paths removed) was adequate, $\chi^2(4, N = 823) = 2.98$, $p = .56$, comparative fit index (CFI) = 1.0. The CFI is an overall index of fit that determines the extent to which sample variances and covariances are reproduced by the hypothesized model structure. This statistic ranges from 0 to 1; benchmarks approaching .90 are indicative of a good fit (Bentler, 1990). The ratio of chi-square value to degrees of freedom was well within the 5:1 ratio suggested by Bollen (1989), providing another indicator of the adequate fit of this model.

As depicted in Figure 1, only three measures directly influenced contemporaneous alcohol use: perceived friends' alcohol use ($\beta = .42$), friends' attitudes toward alcohol ($\beta = .15$), and peer normative expectations ($\beta = .08$). The effects of these measures, other than peer normative expectations, were significantly mediated through expectancies, with the largest of these effects attributed to perceived friends' alcohol use ($\beta = .31$). Both knowledge measures were inversely associated with the expec-

tancy measure, reinforcing the protective effects of factual information and knowledge regarding negative effects of alcohol consumption.[2]

Factor intercorrelations among the exogenous social influence measures for the cross-sectional model are included in Table 2 (and should be read in combination with Figure 1). As indicated, with the exception of knowledge of the effects of alcohol and friends' attitudes toward alcohol, associations between the exogenous measures were significant and in the hypothesized direction. The association between health information–prevalence knowledge and knowledge of the effects of alcohol was inverse and small, albeit significant, underscoring the distinctive nature of alcohol information. The correlative patterns between each of the knowledge

[2] There were direct effects for the exogenous measures on alcohol use that did not involve estimation of the indirect path from expectancies to alcohol use and that differed from the cross-sectional model shown only for health information–prevalence knowledge ($\beta = -.06, p < .05$).

Table 2
Correlations Among Exogenous Measures: Cross-Sectional Model

Variable	1	2	3	4	5
1. Knowledge of effects	—				
2. Health information–prevalence knowledge	−.07*	—			
3. Friends' alcohol use	−.05*	−.19***	—		
4. Friends' alcohol attitudes	ns^a	−.14***	.53***	—	
5. Peer normative expectations	−.06*	−.13***	.54***	.37***	—

Note.   All significant correlations were determined by z-critical tests (one-tailed $z = 1.64$).
[a]Constrained to zero in the final path model.
*$p \leq .05$.   ***$p \leq .001$.

scales and the remaining social influence measures also underscore the conceptual divergence between these two scales. Associations between health information–prevalence knowledge and social influences were of a larger magnitude than the comparable associations between knowledge of the effects of alcohol and social influences. Among the social influence measures, perceived friends' alcohol use, friends' attitudes toward drinking, and peer norms for alcohol use were moderately and significantly associated. Finally, we used MacKinnon's (1994) formula for determining the proportion mediated in each of the models tested. The percentage of the total effect that was mediated was computed only for cases in which there was a nonzero direct path and a significant indirect path (MacKinnon, Warsi, & Dwyer, 1995). The resulting percentages were 14% for perceived friends' alcohol use and 26.8% for friends' attitudes toward alcohol.

Longitudinal Path Analyses

The next step in the analyses included testing a three-wave longitudinal model with alcohol expectancies hypothesized as a mediating variable. We configured this model with three waves of data to permit the simultaneous testing of the generation of expectancies (from social influences), the long-term prediction of alcohol involvement from social influences, and the prediction, over 1 year, of alcohol use from expectancies. In this manner, we were able to test the mechanism by which expectancies "filter" the effects of social influences and drug knowledge on later alcohol use. Figure 2 contains the results of the longitudinal three-wave path model (nonsignificant paths were

removed). In this model, the exogenous measures correspond to the Time 3 assessment, the expectancies correspond to the Time 4 assessment, and alcohol consumption corresponds to the Time 5 assessment. To control for spurious relations, we also included an earlier measure of the consequent (alcohol involvement) at baseline. All of the exogenous measures were allowed to freely covary, primarily because specifications of causal relations among contemporaneous measures are at best tenable (these correlations are included in Table 3).

With few exceptions, results of the longitudinal model replicated the cross-sectional findings, although the diminution of effect sizes suggests some temporal erosion. Fit indexes for this model indicated an adequate fit, $\chi^2(6) = 6.22$, $p = .40$, CFI $= 1.0$, $\chi^2:df < 1.0$, and reinforced that we correctly hypothesized the structural relations among the measures. As depicted, alcohol involvement was moderately stable over the 3-year period ($\beta = .43$), and early-stage alcohol use indirectly influenced alcohol expectancies ($\beta = .27$). Again, both knowledge measures were inversely related to the expectancies measure, with health information–prevalence knowledge more strongly correlated than knowledge of the effects of alcohol. Health information–prevalence knowledge had a small but significant long-term protective effect on later alcohol use ($\beta = -.05$). With the exception of peer norms, which had no significant indirect or direct effects, expectancies significantly mediated the effects of all of the remaining social influence measures. Perceived friends' alcohol use, but not friends' attitudes toward alcohol use, also increased later alcohol consumption ($\beta = .09$). Finally, expectancies
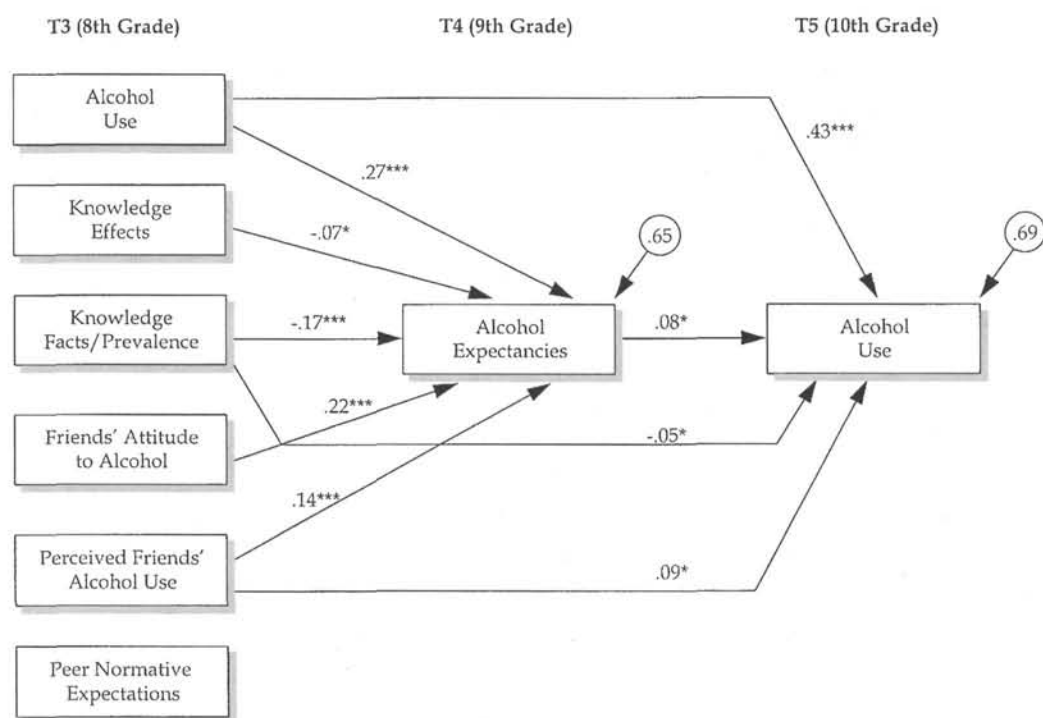
Figure 2. Longitudinal path model depicting mediational properties of expectancies (*$p < .05$; ***$p < .001$). $T3 = \text{Time } 3$; $T4 = \text{Time } 4$; $T5 = \text{Time } 5$.

significantly predicted alcohol use over the 1-year period ($\beta = .08$).[3]

Again, we computed the percentage mediation for the longitudinal model for all conditions in which there was a nonzero direct effect (MacKinnon et al., 1995). Expectancies mediated 4.8% of Time 3 alcohol use, 21.4% of prevalence knowledge, and 11.1% of perceived friends' alcohol use. Despite these relatively small mediated proportions, it is important to remember that the remaining exogenous measures had no significant direct effects on the criterion, and all were indirectly channeled through expectancies, reinforcing the strength of expectancies as an intervening mechanism.

Discussion

During the early stages of adolescence, alcohol consumption is developmentally tied to social reward systems and peer influences. Because perhaps the single most important reason adolescents drink is the need for social

approval, and because this approval is largely conveyed by their immediate peers, it becomes important to investigate the developmental manner in which social learning factors influence cognitive memory systems in a single model. In addition to their immediate role as part of the social influence process, peers also convey substantial knowledge regarding the effects of alcohol and represent an important source of factual information regarding near-term health effects of alcohol. In the current study, we captured the temporal and logical order of these relationships and, using a multivariate framework, tested whether alcohol-related social reinforcement expectancies would

---

[3] There were no effects in the modified model (constraining the indirect path from Time 4 expectancy to Time 5 alcohol use) that differed from the longitudinal model depicted in Figure 2 (the effect sizes for existing paths differed slightly in magnitude).

Table 3
Correlations Among Exogenous Measures: Longitudinal Path Model

Variable	1	2	3	4	5	6
1. Alcohol use	—					
2. Knowledge of effects	−.06*	—				
3. Health information–prevalence knowledge	−.18***	ns[a]	—			
4. Friends' alcohol use	.65***	−.05*	−.17***	—		
5. Friends' alcohol attitudes	.51***	ns[a]	−.10**	.53***	—	
6. Peer normative expectations	.41***	−.06*	−.11**	.55***	.40***	—

[a]Constrained to zero in the final path model.
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$ (one-tailed, $z = 1.64$).

mediate the effects of social influences and alcohol knowledge on both concurrent and subsequent alcohol use.

The results of this study confirm that expectancies play an important and key intervening role in the promotion of adolescent alcohol use. In the cross-sectional model, four of the five social influence measures had significant indirect effects on alcohol expectancies, and two of these measures, perceived friends' alcohol use and friends' attitudes toward alcohol use, had significant direct effects on alcohol consumption. Likewise, peer normative expectations had only a contemporaneous direct effect on alcohol use, suggesting that during this early part of adolescent development perception of peer norms for alcohol use was not an essential ingredient in the construction of alcohol-related expectancies.

In the longitudinal model, four of the five social influence measures were significantly mediated through expectancies (but not normative expectations) after control for early levels of alcohol use, reinforcing the importance of internal cognitive processes in the early stages of alcohol use. In addition to the indirect paths, perceived friends' alcohol use had a small but significant direct effect on later alcohol use. Net of the effect of social influences, expectancies also significantly predicted later drinking. These findings paint a more detailed picture regarding the cognitive processes by which peer social relations influence the development of both expectancies and later alcohol use. What these findings highlight is that both early-stage and later (and more pronounced) drinking are strongly predicated on social influences but that later drinking is also instrumentally tied to

cognitive memory processes that reflect internal reward systems.

In contrast to the findings of this study, Ennett and Bauman (1991) reported that social influences still maintained a relatively large direct effect on alcohol use even when expectancies were specified in the same model (as mediators). Because they included parental alcohol use as a measure of social influence, and because many youth may not vicariously observe their parents' drinking behavior, this may prevent direct comparison with the current findings. Our results point more conclusively toward the necessity of a cognitive mechanism in the elaboration of social influence processes and alcohol use. Given the absence of convergent findings between these studies, further research is warranted that can replicate the current findings and clarify the mediational role of expectancies.

The current study also extended the time interval over which the effects of social influences and expectancies on alcohol use were examined, a period corresponding to the critical years during which adolescents are most likely to initiate and consolidate these behaviors. This is an important component of developmental research and highlights the importance of varying time intervals to establish empirically whether causal relations are bound by time. The findings from the cross-sectional model were extended by the longitudinal model, which spanned 3 years, and underscored the finding that the perception of immediate social facilitation from drinking remains predictive of alcohol use 1 year later. The increased mean levels of self-reported drinking in this sample also support the increasing variability and growing

consolidation of behavior over time. In 10th-grade self-reports, as compared with 8th-grade reports, more youth had experienced alcohol, and mean levels of alcohol use (including drunkenness) were significantly elevated for both male and female students. These increases were not limited to behavioral measures but also included elevated levels of alcohol expectancies and social influences.

Limitations

There are several limitations to the current study worth noting. First, the sample we analyzed represents a broad mixture of experimental alcohol use patterns, including youth reporting no alcohol use and youth reporting frequent (if not abusive) use. As others have noted, differences in relevant alcohol experiences can moderate the expectancy–behavior relationship (Cooper et al., 1995), and this relationship may also be reciprocal (e.g., Smith, Goldman, Greenbaum, & Christiansen, 1995). In a related vein, path analysis is helpful in elucidating the simultaneous relations among multiple indicators of social influence and providing estimates for unique effects over time. The processes that are highlighted by the path model reflect group-level, rather than individual-level, behavioral tendencies, and future analyses may want to examine individual variation in expectancies (high vs. low) or alcohol use (nonuse vs. use) and the manner in which these risk mechanisms influence future consumption.

Second, the expectancies we examined in the current study tap perceived social facilitation and do not emphasize physical or cognitive expectancies (i.e., tension reduction), the latter of which are also influenced by social and environmental cues (e.g., Christiansen, Goldman, & Inn, 1982; Fromme & Dunn, 1992). Thus, future research may want to draw from a broader pool of expectancy items and determine whether the current findings are specific to social reinforcement motivations for alcohol use at this early age. It is quite possible, however, that in the early stages of alcohol use, social reinforcement expectancies are prominent and that with continued and exacerbated alcohol use, linkages of behavior to physiological arousal, tension reduction, and emotional regulation become more salient (e.g., Labouvie, 1986).

Related to this problem is that our model excluded any consideration of the role of negative expectancies. In light of the biphasic properties of alcohol and the immediacy of positive responses to drinking (i.e., fostering enhanced retrieval), we are inclined to support a model that hypothesizes a dominance of positive social reinforcement expectancies at the earliest stages of drinking. However, Stacy and his colleagues have provided both conceptual arguments and empirical support for the inclusion of negative expectancies, which, among older and more experienced drinking populations, may be equally potent in predicting consumption (Stacy, MacKinnon, & Pentz, 1993; Stacy, Newcomb, & Bentler, 1991) and should be included in models that seek to elaborate a more complete understanding of expectancy–behavior relations.

Third, in the interest of parsimony, the external variables in the longitudinal model were limited to those tapping social influences, which represent only a limited set of the total array of psychosocial influences that may affect alcohol use (e.g., Hawkins, Catalano, & Miller, 1992). Among the many indexes of model fit, the overall R^2 values for both the cross-sectional and longitudinal models underscore that alternative models with increased numbers of predictors might enhance prediction (48% in the cross-sectional model and 31% in the longitudinal model). Future studies that specify expectancies as mediators of psychosocial influences may want to include additional personality, intrapersonal, demographic, and interpersonal measures that are part of the network of influences causally related to alcohol use. Unfortunately, we were unable to include many of these measures, principally because robust estimation with path analysis is severely constrained with moderately small sample sizes (Tanaka, 1987). Expanding the size of our model to include elements of any of these important domains of risk might have been conceptually accurate; however, it would have strained the robustness of the analytic methods we used to examine the data.

Implications for Prevention

This study failed to find any consistent pattern of relations among peer normative expectations,

alcohol expectancies, and alcohol use. In the cross-sectional model, normative expectations had a small but significant effect on alcohol use, whereas, in the longitudinal model, the same measure did not significantly influence either expectancies or later alcohol use. Peer normative expectations for alcohol use were moderately related to friends' alcohol use and alcohol attitudes and less related to health information–prevalence knowledge. Because one of the strengths of path analysis is that it provides unique parameter estimates, it is possible that the moderate overlap between peer norms and peer models for drinking prevents both of these measures from uniquely predicting expectancies and consumption. The absence of unique effects associated with peer norms does not diminish the importance of correcting erroneous normative expectations regarding both peer and adult alcohol use and maintaining this key focus of prevention (Botvin & Botvin, 1992; Graham, Marks, & Hansen, 1991).

It is also important to understand that peers will always exert a strong developmental influence, particularly because peer social relations are essentially the means by which youth test, establish, and refine their psychological identity (e.g., Seltzer, 1989). Ideally, peer relations should represent a positive medium for identity development; in certain situations, however, peers may represent a safe haven for fallout from family problems and personal identity crises and may provide opportunities for escapism through excessive alcohol and drug use. In these extreme situations, expectancies may represent a microscope that helps focus on the source of discontent beneath the emotion-focused coping that alcohol represents.

Finally, the consistent negative pattern of relations among both facets of alcohol knowledge (effects and health information–prevalence), expectancies, and social influences represents an important vehicle for the effective conductance of prevention. Factual information remains an effective deterrent against alcohol use and should be included as a component of prevention programs. Botvin (1995) has argued that, to be effective, information-based prevention programs need to emphasize the adverse consequences of drug use, and information should be developmentally appropriate and consider the needs of youth (specifically their

rational capabilities and personal interests). Included in these recommendations is a concern that adolescents may not respond to specific exhortations regarding drug abuse as addictive, particularly because many young people maintain an illusion of invulnerability. In light of these concerns, the measures of alcohol knowledge that we included assess near-term health consequences (e.g., "Switching drinks will make you drunker than staying with the same kind of alcoholic beverage") and health information–prevalence (e.g., "Alcohol is the cause of the majority of fatal car accidents"), measures that should have immediate relevance to adolescent concerns. Health information–prevalence knowledge was a stronger predictor of expectancies and, in the longitudinal model, had a small but significant negative effect on later alcohol use. Accordingly, exclusion of alcohol information from current prevention efforts on the sole basis that previous information-based prevention approaches have not been able to show marked reductions in target behaviors or demonstrate significant statistical relationships between knowledge and alcohol use may be erroneous (e.g., Schaps, Moskowitz, Condon, & Malvin, 1982). It is quite possible that the information component of prevention programs serves as a foundation to the "cognitive" facet of attitude formation and that, if there is sufficient time for a linking with other developmental facets of expectancies, greater success will be achieved in deterring alcohol use. In general, expectancies may represent a dynamic window through which a confluence of social and intrapersonal forces actively operate to promote a variety of health-related and health-compromising behaviors.

References

Abrams, D. B., & Niaura, R. S. (1987). Social learning theory. In H. T. Blane & K. E. Leonard (Eds.), *Psychological theories of drinking and alcoholism* (pp. 131–178). New York: Guilford Press.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173–1181.

Bauman, K. E., & Chenoweth, R. L. (1984). The relationship between the consequences adolescents

expect from smoking and their behavior: A factor analysis with panel data. *Journal of Applied Social Psychology, 14,* 28–41.

Bauman, K. E., Fisher, L. A., & Koch, G. G. (1989). External variables, subjective expected utility, and adolescent behavior with alcohol and cigarettes. *Journal of Applied Social Psychology, 19,* 789–804.

Bentler, P. M. (1989). *EQS structural equations program manual.* Los Angeles: BMDP Statistical Software.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107,* 238–246.

Bollen, K. A. (1989). *Structural equations with latent variables.* New York: Wiley.

Botvin, G. J. (1993). *Reducing drug abuse and AIDS risk: Final report.* Rockville, MD: National Institute on Drug Abuse.

Botvin, G. J. (1995). Drug abuse prevention in school settings. In G. J. Botvin & M. A. Orlandi (Eds.), *Drug abuse prevention with multiethnic youth* (pp. 169–192). Thousand Oaks, CA: Sage.

Botvin, G. J., Baker, E., Dusenbury, L., Botvin, E., & Diaz, T. (1995). Long-term follow-up of a randomized drug abuse prevention trial in a White middle-class population. *Journal of the American Medical Association, 273,* 1106–1112.

Botvin, G. J., & Botvin, E. M. (1992). School-based and community-based prevention approaches. In J. H. Lowinson, P. Ruiz, & R. B. Millman (Eds.), *Substance abuse: A comprehensive textbook* (2nd ed., pp. 910–927). Baltimore: Williams & Wilkins.

Brown, S. A. (1985). Expectancies versus background in the prediction of college drinking patterns. *Journal of Consulting and Clinical Psychology, 53,* 123–130.

Brown, S. A., Creamer, V. A., & Stetson, B. A. (1987). Adolescent alcohol expectancies in relation to personal and parental drinking patterns. *Journal of Abnormal Psychology, 96,* 117–121.

Chen, M.-J., Grube, J. W., & Madden, P. A. (1994). Alcohol expectancies and adolescent drinking: Differential prediction of frequency, quantity, and intoxication. *Addictive Behaviors, 19,* 521–529.

Christiansen, B. A., & Goldman, M. S. (1983). Alcohol-related expectancies versus demographic/background variables in the prediction of adolescent drinking. *Journal of Consulting and Clinical Psychology, 51,* 249–257.

Christiansen, B. A., Goldman, M. S., & Inn, A. (1982). Development of alcohol-related expectancies in adolescents: Separating pharmacological from social-learning influences. *Journal of Consulting and Clinical Psychology, 50,* 336–344.

Christiansen, B. A., Smith, G. T., Roehling, P. V., & Goldman, M. S. (1989). Using alcohol expectancies to predict adolescent drinking behavior after one

year. *Journal of Consulting and Clinical Psychology, 57,* 93–99.

Connors, G. J., Maisto, S. A., & Derman, K. H. (1992). Alcohol-related expectancies and their applications to treatment. In R. R. Watson (Ed.), *Drug and alcohol abuse reviews: Vol. 3. Alcohol abuse treatment* (pp. 203–231). Totowa, NJ: Humana Press.

Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology, 69,* 990–1005.

Douglass, F. M., & Khavari, K. A. (1982). A major limitation of the percentile index of overall drug use indulgence. *International Journal of the Addictions, 17,* 283–294.

Ennett, S. T., & Bauman, K. E. (1991). Mediators in the relationship between parental and peer characteristics and beer drinking by early adolescents. *Journal of Applied Social Psychology, 21,* 1699–1711.

Fromme, K., & Dunn, M. E. (1992). Alcohol expectancies, social and environmental cues as determinants of drinking and perceived reinforcement. *Addictive Behaviors, 17,* 167–177.

Fromme, K., Kivlahan, D. R., & Marlatt, G. A. (1986). Alcohol expectancies, risk identification, and secondary prevention with problem drinkers. *Advances in Behavioral Research and Therapy, 8,* 237–251.

Gfroerer, J. (1985). Influence of privacy on self-reported drug use by youths. In B. A. Rouse, N. J. Kozel, & L. G. Richards (Eds.), *Self-report methods of estimating drug use: Current challenges to validity* (DHHS Publication No. ADM 85-1402, pp. 22–30). Washington, DC: U.S. Government Printing Office.

Goldman, M. S., Brown, S. A., & Christiansen, B. A. (1987). Expectancy theory: Thinking about drinking. In H. T. Blane & K. E. Leonard (Eds.), *Psychological theories of drinking and alcoholism* (pp. 181–226). New York: Guilford Press.

Goldman, M. S., Brown, S. A., Christiansen, B. A., & Smith, G. T. (1991). Alcoholism and memory: Broadening the scope of alcohol-expectancy research. *Psychological Bulletin, 110,* 137–146.

Goldman, M. S., & Rather, B. C. (1993). Substance abuse: Cognitive models and architecture. In P. C. Kendall & K. Dobson (Eds.), *Psychopathology and cognition* (pp. 245–292). New York: Academic Press.

Graham, J. W., Marks, G., & Hansen, W. B. (1991). Social influence processes affecting adolescent substance use. *Journal of Applied Psychology, 76,* 291–298.

Greenbaum, P. E., Brown, E. C., & Friedman, R. M.

(1995). Alcohol expectancies among adolescents with conduct disorder: Prediction and mediation of drinking. *Addictive Behaviors, 20,* 321–333.

Hansen, W. B., Collins, L. M., Malotte, C. K., Johnson, C. A., & Fielding, J. E. (1985). Attrition in prevention research. *Journal of Behavioral Medicine, 8,* 261–275.

Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin, 112,* 64–105.

Henderson, M. J., Goldman, M. S., Coovert, M. D., & Carnevalla, N. (1994). Covariance structure models of expectancy. *Journal of Studies on Alcohol, 55,* 315–326.

Jessor, R., & Jessor, S. L. (1977). *Problem behavior and psychosocial development: A longitudinal study of youth.* New York: Academic Press.

Kandel, D. B. (1980). Drug and drinking behavior among youth. *Annual Review of Sociology, 6,* 235–285.

Kandel, D. B., & Logan, J. A. (1984). Patterns of drug use from adolescence to young adulthood: I. Periods of risk for initiation, continued use, and discontinuation. *American Journal of Public Health, 74,* 660–666.

Kaplan, H. B., Martin, S. S., & Robbins, C. (1984). Pathways to adolescent drug use: Self-derogation, peer influence, weakening of social controls, and early substance use. *Journal of Health and Social Behavior, 25,* 270–289.

Labouvie, E. (1986). The coping function of adolescent alcohol and drug use. In R. K. Silbereisen, K. Eyferth, & G. Rudinger (Eds.), *Development as action in context* (pp. 229–240). New York: Springer-Verlag.

Lang, A. R., & Michalec, E. M. (1990). Expectancy effects in reinforcement from alcohol. In W. M. Cox (Ed.), *Why people drink: Parameters of alcohol as a reinforcer* (pp. 193–232). New York: Guilford Press.

Leigh, B. C., & Stacy, A. W. (1991). On the scope of alcohol expectancy research: Remaining issues of measurement and meaning. *Psychological Bulletin, 110,* 147–154.

MacKinnon, D. P. (1994). Analysis of mediating variables in prevention and intervention research. In A. Cázares & L. A. Beatty (Eds.), *Scientific methods for prevention intervention research* (NIDA Research Monograph 139, NIH Publication No. ADM 94-3631, pp. 127–153). Washington, DC: U.S. Government Printing Office.

MacKinnon, D. P., Warsi, G., & Dwyer, J. H. (1995). A simulation study of mediated effect measures. *Multivariate Behavioral Research, 30,* 41–62.

Marsh, H. W., Balla, J. W., & McDonald, R. P. (1988).

Goodness-of-fit indices in confirmatory factor analysis: Effects of sample size. *Psychological Bulletin, 103,* 391–411.

Moskowitz, J. M., Schaps, E., Schaeffer, G. A., & Malvin, J. H. (1984). Evaluation of a substance abuse prevention program for junior high school students. *International Journal of the Addictions, 19,* 419–430.

Newcomb, M. D., & Bentler, P. M. (1986). Frequency and sequence of drug use: A longitudinal study from early adolescence to young adulthood. *Journal of Drug Education, 16,* 101–120.

O'Connor, J., & Saunders, B. (1992). Drug education: An appraisal of a popular preventive. *International Journal of the Addictions, 27,* 165–185.

Oetting, E. R., & Beauvais, F. (1986). Peer cluster theory: Drugs and the adolescent. *Journal of Counseling and Development, 65,* 17–22.

Pentz, M. A. (1985). Social skills and self-efficacy as determinants of substance abuse in adolescence. In T. A. Willis & S. Shiffman (Eds.), *Coping and substance use* (pp. 117–142). San Diego, CA: Academic Press.

Rohsenow, D. J. (1983). Drinking habits and expectancies about alcohol's effects for self versus others. *Journal of Consulting and Clinical Psychology, 51,* 752–756.

Schaps, E., Moskowitz, J. M., Condon, J., & Malvin, J. H. (1982). Process and outcome evaluation of a drug education course. *Journal of Drug Education, 12,* 353–364.

Schaps, E., Moskowitz, J. M., Malvin, J. H., & Schaeffer, G. A. (1986). Evaluation of seven school-based prevention programs: A final report on the Napa Project. *International Journal of the Addictions, 21,* 1081–1112.

Scheier, L. M., & Botvin, G. J. (1995). Effects of early adolescent drug use on cognitive efficacy in early-late adolescence: A developmental structural model. *Journal of Substance Abuse, 7,* 379–404.

Seltzer, V. C. (1989). *The psychosocial worlds of the adolescent: Public and private.* New York: Wiley.

Sher, K. J., Walitzer, K. S., Wood, P. K., & Brent, E. E. (1991). Characteristics of children of alcoholics: Putative risk factors, substance use and abuse, and psychopathology. *Journal of Abnormal Psychology, 100,* 427–448.

Smith, G. T., Goldman, M. S., Greenbaum, P. E., & Christiansen, B. A. (1995). Expectancy for social facilitation from drinking: The divergent paths of high-expectancy and low-expectancy adolescents. *Journal of Abnormal Psychology, 104,* 32–40.

Snow, D. L., Tebes, J. K., & Arthur, M. W. (1992). Panel attrition and external validity in adolescent substance use research. *Journal of Consulting and Clinical Psychology, 60,* 804–807.

Sobel, M. E. (1987). Direct and indirect effects in

linear structural equation models. *Sociological Methods and Research, 16,* 155–175.

Stacy, A. W., Bentler, P. M., & Flay, B. R. (1994). Attitudes and health behavior in diverse populations: Drunk driving, alcohol use, binge eating, marijuana use, and cigarette use. *Health Psychology, 13,* 73–85.

Stacy, A. W., Leigh, B. C., & Weingardt, K. R. (1994). Memory accessibility and association of alcohol use and its positive outcomes. *Experimental and Clinical Psychopharmacology, 2,* 1–14.

Stacy, A. W., MacKinnon, D. P., & Pentz, M. A. (1993). Generality and specificity in health behavior: Application to warning-label and social influence expectancies. *Journal of Applied Psychology, 78,* 611–627.

Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1991). Cognitive motivation and drug use: A 9-year longitudinal study. *Journal of Abnormal Psychology, 100,* 502–515.

Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1992). Interactive and higher-order effects of social influences on drug use. *Journal of Health and Social Behavior, 33,* 226–241.

Stacy, A. W., Widaman, K. F., Hays, R., & DiMatteo, M. R. (1985). Validity of self-reports of alcohol and other drug use: A multitrait-multimethod assessment. *Journal of Personality and Social Psychology, 49,* 219–232.

Stacy, A. W., Widaman, K. F., & Marlatt, G. A. (1990). Expectancy models of alcohol use. *Journal of Personality and Social Psychology, 58,* 918–928.

Tanaka, J. S. (1987). "How big is big enough?": Sample size and goodness of fit in structural equation models with latent variables. *Child Development, 58,* 134–146.

Webb, J. A., Baer, P. E., Francis, D. J., & Caid, C. D. (1993). Relationship among social and intrapersonal risk, alcohol expectancies, and alcohol usage among early adolescents. *Addictive Behaviors, 18,* 127–134.